MAKING CULTURES: POLITICS OF INCLUSION, ACCESSIBILITY, AND EMPOWERMENT AT THE MARGINS OF THE MAKER MOVEMENT

By

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ABSTRACT

Historically an elite, formally-trained, and Western-centric population has dominated technology development, creating an inequity in who decides what roles technoscience will play, and how it will affect different publics. More recently, tactics to counter observed inequities have taken the form of citizen science, "civic science," science shops, science for the people, as well as Do It Yourself (DIY) movements such as the "Maker Movement." This dissertation joins the growing body of scholarly explorations into the development of such technoscientific practices and analyses of whether and how they might set the stage for "technological citizenship."

While it stands to be seen if these interests or shifts are permanent and what impact they might have, if the Maker Movement is poised to make any kind of change in the realms of democratizing technology innovation and production, re-industrializing the US, and changing educational practices, STS will be a helpful touchstone for critically-engaging and informing such transformations. In highlighting the sociocultural underpinnings of makerspaces and hackerspaces, STS scholarship will bring a reconstructivist edge to the maker landscape.

By examining the margins, I trouble the Maker Movement label, the people who hold sway over this categorization, and consider both proponents as well as dissenters from within and without its bounds. I question claims that its focus is beholden to re-industrialization and the fostering of a cadre of globally competitive engineers. I then focus on characterizing the root mechanisms behind groups trying to make visible the oft implicit barriers facing certain marginalized groups in the technological landscape.

CHAPTER ONE: INTRODUCTION

Historically an elite, formally-trained, and Western-centric population has dominated

technology development, creating an inequity in who decides what roles technoscience

will play, and how it will affect different publics.[1] In conversation with this narrative,

public engagement with and the democratization of technoscience are domains of study

that have become increasingly present within Science and Technology Studies (STS).

These fields of study include ways in which the public engages the acquisition of skills or

"tacit knowledge" used to develop the artifacts, practices, and tools that comprise the

built world. In so doing they can, and often do, disrupt or reconfigure different power

relations.[2] More recently, tactics to counter observed inequities have taken the form of

citizen science, "civic science," science shops, science for the people, as well as Do It

Yourself (DIY) movements such as the "Maker Movement."[3] This dissertation joins the

growing body of scholarly explorations into the development of such technoscientific

practices and analyses of whether and how they open up the stage for "technological

citizenship."[4]

 Each of my field sites is related to what some practitioners, scholars, and policy-

makers are calling the Maker Movement. Participants in this movement intend to enact

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[1] Noortje Marres, *Material Participation: Technology, the Environment and Everyday Publics* (New York: Palgrave Macmillan, 2012).; Kim Fortun and Mike Fortun. "Scientific Imaginaries and Ethical Plateaus in Contemporary U.S. Toxicology," *American Anthropologist* 107 no. 1 (2005): 43-54.; Nicole Farkas. "Matching Community Needs with University R&D," *Science Studies* 12 no. 2 (1999): 33–47.

[2] See Michael Polyani's and Kelly Joyce's work on tacit knowledge.

[3] Kelly Moore. *Disrupting Science: Social Movements, American Scientists, and the Politics of the Military, 1945-1975*. (Princeton NJ: Princeton University Press, 2008).; Moore *Disrupting Science* 2008; Farkas "Matching Community Needs" 1999.

[4] Philip J. Frankenfeld "Technological Citizenship: A Normative Framework for Risk Studies," *Science, Technology, & Human Values* 17 no. 4 (1992): 459-484.

hands-on empowerment strategies within science and technology development, creating a space for involvement beyond discursive policy engagements.[5] Outcomes of the Maker Movement often take the form of setting up of a physical community meeting and work space. With different labels such as makerspace, hackerspace, hacklab, and fab lab, these are places where like-minded individuals can gather to share tools, knowledges, and an interest in individual or collective fabrication, prototyping, and repair.[6] Those involved push for material empowerment through the acquisition of skills, technical literacy, and tool and facility accessibility. More so than hackerspaces, makerspace proponents have put forth rhetoric that argues for ultimate inclusivity, claiming everyone as a *maker* on at least some level in their everyday lives.

Anthropology, communication, information, and media studies scholarship is currently exploring the spaces, technological practices, gender dynamics and ethics involved in hacker, maker, and fixer communities.[7] But much of this work fails to look deeply at the technology transformation and educational practices animating these groups. Critics often dismiss the Maker Movement as techno-utopic or techno-optimistic, questioning its proponents' emancipatory claims.[8] This work notes how the Movement reinforces innovation and consumerist norms that contribute to systemic injustices, and

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[5] For an overview of avenues toward deliberative democracy, such as the consensus conference, see Patrick W. Hamlett. "Technology Theory and Deliberative Democracy," *Science, Technology, & Human Values* 28, no. 1 (2003): 112-140.

[6] See Maxigas, "Hacklabs and Hackerspaces – Tracing Two Genealogies," *Journal of Peer Production* 2 (2014), accessed August 15th, 2017. http://peerproduction.net/issues/issue-2/peer-reviewed-papers/hacklabs-and-hackerspaces/.

[7] See Silvia Lindtner and David Li, "Created in China," *Interactions* 19 (2012): 18 – 22.; Sabine Hielscher, Adrian Smith, and Mariano Fressoli, "WP4 Case Study Report: FabLabs," *Report for the TRANSIT FP7 Project*, University of Sussex, Brighton, 2015.

[8] See Evgeny Morozov, "Making it," *New York Times*, January 14, 2014, accessed February 28, 2014. http://www.newyorker.com/arts/critics/atlarge/2014/01/13/140113crat_atlargemorzov?currentPage=all.

questions the extent to which they can claim inclusion or accessibility.[9] Some of these critics do see some promise in maker cultures, but assert that no change will really occur without critical input toward querying technological production and innovation in regards to: for whom, by whom, and for what purpose.[10]

Critical design scholarship explores methodologies that broaden participation by instigating design practices which question expertise, the politics of design, approaches to enact technology design, the publics involved in design, how design problems are configured, and their outcomes. Thus, these research endeavors query the publics for whom a technology is designed and incorporate iterative reflexivity into their design narratives. This includes "critical-making," "critical technical practice," and "adversarial design."[11] In line with such interventions some researchers and participants within maker cultures hope to explore how artifacts, and the systems that produce and reproduce those artefacts, do indeed have politics.[12]

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[9] See Debbie Chachra, "Why I'm Not a Maker," *Atlantic*, January 23, 2015, accessed on January 30, 2015. http://www.theatlantic.com/technology/archive/2015/01/why-i-am-not-a-maker/38767/ and Daniela K. Rosner, Sarah E. Fox and Rachel Rose Ulgado, "Hacking Culture, Not Devices: Access and Recognition in Feminist Hackerspaces," in *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing*, location, 2015, 56-68. New York: ACM Press.

[10] See Susana Nascimento, "Critical Notions of Technology and Promises of Empowerment in Shared Machine Shops," *Journal of Peer Production* 5 (2014), accessed August 15th, 2017. http://peerproduction.net/issues/issue-5-shared-machine-shops/editorial-section/critical-notions-of-technology-and-the-promises-of-empowerment-in-shared-machine-shops/.

[11] Matt Ratto, "Critical Making: Conceptual and Material Studies in Technology and Social Life," *The Information Society* 27 no. 4 (2011): 252-260.; Philip E. Agre, "Toward a Critical Technical Practice: Lessons Learned in Trying to Reform AI," in *Bridging the Great Divide: Social Science, Technical Systems, and Cooperative Work*, ed. Geoffrey C. Bowker et al. (New York: Erlbaum, 1997), 131-157.; Carl DiSalvo, *Adversarial Design* (Cambridge, MA: MIT Press, 2012).

[12] See Nascimento "Critical Notions" 2014; Sophie Toupin, "Feminist Hackerspaces as Safer Spaces?" in *Feminist Journal of Art and Digital Culture* 27 (2014); Peter Troxler and Maxigas, "Editorial Note: We Now Have the Means of Production, But Where is My Revolution." *Journal of Peer Production* 5 (2014), accessed August 15th, 2017. http://peerproduction.net/issues/issue-5-shared-machine-shops/editorial-section/editorial-note-we-now-have-the-means-of-production-but-where-is-my-revolution/.; Langdon Winner, "Do Artifacts Have Politics?" in *The Whale and the Reactor* (Chicago: University of Chicago Press, 1986).

At this historical moment, maker practices have been effecting greater cultural and economic narratives through General Motors' partnerships with TechShop, Maker Education programming in US public schools, makerspaces being established in higher education institutions, and countless makerspace entrepreneurial endeavors fostered through state, US governmental, and industry funding. While it stands to be seen if these interests or shifts are permanent and what impact they might have, if the Maker Movement is poised to make any kind of change in the realms of democratizing technology innovation and production, re-industrializing the US, and changing educational practices, STS will be a helpful touchstone for critically-engaging and informing such transformations. In highlighting the sociocultural underpinnings of makerspaces and hackerspaces, STS scholarship will bring a reconstructivist edge to the maker landscape.[13]

The empirical foundation of this dissertation includes participants' thoughts, actions, and discourses as collected through interviews and participant observation. Through iterative coding practices, I focus on the margins of the Maker Movement, a diverse set of communities employing collective actions in order to instigate change in technology development and knowledge dissemination. By examining the margins, I trouble the Maker Movement label, the people who hold sway over this categorization, and consider both proponents as well as dissenters from within and without its bounds. I question claims that the focus of the Maker Movement is beholden to re-industrialization and the fostering of a cadre of globally competitive engineers. I then focus on

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[13] See Edward Woodhouse et al., "Science Studies and Activism: Possibilities and Problems for Reconstructivist Agendas," *Social Studies of Science* 3 no. 2 (2002): 297-319.

characterizing the root mechanisms behind groups trying to make visible the oft implicit barriers facing certain marginalized groups in the technological landscape.

This dissertation contributes to efforts of diversifying maker and hacker cultures and STEM (Science, Technology, Engineering, and Mathematics) fields more broadly by providing in Clifford Geertz's terms a "thick description" of a diverse set of maker cultures and practices.[14] Critical examination of these cultures and practices engages with rethinking technological use and manipulation in the everyday and outside of established institutions. It also contributes to efforts of diversification by intentionally selecting marginalized narratives in relation to technology research and development. By empirically studying diverse groups – including feminist hacker collectives, library makerspaces, and fixing groups – that help to create counter-narratives of material manipulation, I critique the dominant discourse in relation to technological change, 'development,' education, and political transformation.

Through data collection and analysis, I provide an alternative story of how a subset of maker and hacker groups actually contends with the promise of democratization of making and their mechanisms for establishing inclusion, accessibility, and empowerment for diverse publics with diverse needs.[15] While dominant makerspace discourse and current scholarly understandings of maker cultures command a univocal focus on technical knowledge use as the ultimate goal, my findings suggest that the field is much more diverse, with possibilities toward cultivating different knowledges for differentiated communities with particular values and intentions. Thus, my inquiry and

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[14] For more on thick description see Clifford Geertz, "Thick Description: Toward an Interpretive Theory of Culture," in *The Interpretation of Cultures: Selected Essays* (New York: Basic Books, 1973).

[15] For more on publics see John Dewey, *The Public and Its Problems,* (Cleveland: Ohio University Press, Swallow Press, 1954).

findings have implications for steps toward recognizing and working with the politics of care involved in relation to technological material participation within communities for a more social justice oriented movement at the margins of the greater Maker Movement.

DIY Cultures and the Rise of the Maker Movement

"Making" is often defined as the creative use or re-use of technologies and artifacts to accomplish small or large-scale projects, although it is a loose term that can mean a myriad of things. Cultures of making incorporate many different movements, histories, and ideologies, but their unifying and overarching rhetoric is to claim that everyone has the capacity to "make" − that is manipulate or create − technologies. This assumes general interest in the practice of 'Doing It Yourself' (DIY), which is focused on grassroots empowerment through consumer-conscious acts of making material goods as opposed to purchasing them. Another facet of DIY revolves around subcultural trends such as running one's own tape label, small run publication distribution, or collectively run venues/arts spaces/print-shops.[16] A more recent iteration of DIY is 'Doing It Together' (DIT) − which refers to a communal melding of expertise and tools to further combat costs and satisfy the personal labor politics of making.[17] DIY and DIT practices are rooted in the narratives of hobbyists, tinkerers, ham radio enthusiasts, mechanics' institutes, the arts and crafts movement, new communalism, and Free and Open Source Software (F/OSS) hackers.[18]

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[16] Blake Stimson and Gregory Sholette, eds., *Collectivism After Modernism: The Art of Social Imagination After 1945* (Minneapolis: University of Minnesota Press, 2007).

[17] See for example Chris Anderson, *Makers: The New Industrial Revolution* (New York City, NY: Random House Inc., 2012).

[18] See for example Linnda R. Caporael, Gabriella Panichkul, and Dennis R. Harris, "Tinkering with Gender," in *Research in Philosophy and Technology: Technology and Feminism*, ed. J. Rothschild, 73-99 (Greenwich, CT: JAI Press, 1993) and Gabriella Coleman, "CODE IS SPEECH: Legal Tinkering,

Normalized constructs of Maker Movement practices are deeply rooted in hacker and hackerspace cultures, more related to software manipulation and coding, communities of which have been examined by Gabriella Coleman, Lawrence Lessig, and Chris Kelty. [19] From its beginnings "[t]he global hackerspace movement has helped proliferate a 'maker culture' that revolves around both technological and social practices of creative play, peer production, a commitment to open source principles and a curiosity about the inner workings of technology" both digital and physical. [20] In their work on F/OSS developer communities, Coleman and Lessig characterize a hacker ethic based not just on individualism and meritocracy, but on communalism. This value of the hacker ethic is based on the understanding that in order to achieve the most forward-thinking innovations in code, it needs to be collectively developed. In some senses, this produces a double-bind wherein the expectation to be self-sufficient, self-made, and productive (individualism) might typically prevent collective collaboration or any drive to help in collective endeavors. And yet, proponents of the communalist ideology in the hacker community assert that source code should be open and free for all to see, manipulate, and develop – that many minds collectively think and solve problems better than one. This is reflected in the open source and free software movements that have pushed programs and hardware such as Debian, Linux, openBSD, Arduino, and the original MakerBot 3D printer. All were developed openly, and not copyrighted, so that anyone, developer or not, had legal access to the code and hardware schematics. According to those developing

Expertise, and Protest Among Free and Open Source Software Developers" *Cultural Anthropology* 24 (2009): 420–454.

[19] See for example Coleman, "CODE IS SPEECH" 2009.; Lawrence Lessig, *Code* (New York: Basic Books, 2006).; Christopher M. Kelty, *Two Bits: The Cultural Significance of Free Software* (Durham, NC: Duke University Press, 2008).

[20] Lindtner and Li, "Created in China" 2012, 18.

the code, anyone could recreate, copy, make, tweak, and distribute the technologies as they saw fit.

Maker culture converges with open source in claiming that all skills, tools, and schematics should be open for all and that all are invited to join in on technological play and development. The Maker Movement's initial focus on end-product and efficiency-driven computing has been aptly pointed out by Erika Halversham and Edith Ackermann during a recent panel at the 2017 FabLearn conference in Stanford.[21] Ackermann traced the roots of those who initially branded the Maker Movement as an object of practice. As she describes it, the Maker Movement label itself grew out of the establishment of *Make*: Magazine and Make Media, which is tied to the O'Reilly corporation and other for-profit endeavors. These powerful groups have strategically co-opted hobbyist communities and other maker cultures as they created Maker Movement rhetoric that was subsequently used for branding. This has led many scholars to write off maker culture as just another commercialist and consumerist trend.[22] Yet small, localized maker groups continue to enact their practices, claiming empowerment and joy from their projects over which these critiques often gloss.

However, this unchecked culture of "openness" may reproduce the inequities of power in technology-based cultures. Maker practices have moved from fringe to mainstream as technically-minded communities gained authority and popularity. On June 18th, 2014, the White House held its first Makers Faire and declared a "National Day of

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[21] From the FabLearn website, "FabLearn Conferences bring together key influencers and thought-leaders from around the world in education, policy-making, academia, design, research, and maker communities to learn, present, and discuss digital fabrication in education, the maker culture, hands-on learning, and instructional tools." Fablearn.org/conferences/.

[22] Morozov, "Making it."

Making," contributing political legitimacy to dominant Maker Movement rhetoric that the possibilities for inclusion and technological empowerment are endless and the benefits to be gained through participation accessible to all.[23] As it turns out, these explicit policies of openness often empower stereotypically technically savvy groups, more often white, educated men, and create implicit barriers to access for those already marginalized by the broader technological culture.

The Maker Movement has been lauded, critiqued, validated, trivialized, and aggrandized on various levels by scholars, social critics, practitioners, makers, hackers, librarians, and technologists. Yet beyond the totalizing claims of both fervent positive attitudes that laud every aspect of "making" and dismissively skeptical ones that downplay these practices as just a passing and inconsequential trend, there is little empirical work that explores the specific mechanisms of skill-sharing and educational practices within these spaces and their impact on questions of access, inclusion, and empowerment. There have been some explorations, such as Sophie Toupin and Daniela K Rosner et al., that engage implicit and explicit technological biases in terms of gender, race, (dis)ability, and socio-economic class.[24] Meanwhile, Steven Jackson et al., Daniela K. Rosner and Fred Turner, and Martin Charter and Scott Keiller look at repair cultures and Repair Cafés invested in advocating circular economies – which focus on establishing standards that enable the reuse and recycling of material goods, thus circular or cyclical, as opposed to on new material extraction and production.[25] Charter and

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[23] Caleb Kraft, "White House Maker Faire Attendee List Released," *Make: Magazine*, June 18th 2014, accessed July 1, 2015. http://makezine.com/2014/06/18/white-house-maker-faire-attendee-list released.

[24] See for example Sophie Toupin, "Feminist Hackerspaces as Safer Spaces?" in *Feminist Journal of Art and Digital Culture* 27 (2014) Accessed on December 8, 2014 http://dpi.studioxx.org/en/feminist-hackerspaces safer-spaces. And Rosner et al., "Hacking Culture Not Devices," 2015.

[25] See Steve Jackson, A. Pompe, and G. Krieshok. "Repair worlds: maintenance, repair, and ICT for development in rural Namibia," in *Proceedings of the ACM 2012 conference on Computer*

Keiller argue that "there is an urgent need to move toward a more Circular Economy, which is focused on 'closing material loops' through the more efficient use of materials and extending the life of products, thereby reducing the embodied materials at manufacture and energy use throughout the product lifecycle."[26] They believe that fixing and repair groups, as well as tangential possibilities within hackerspaces, can help to establish an EU agenda toward establishing a Circular Economy.

Charting different genealogies of the Maker Movement, several scholars are working to historicize its participants' actions regarding past movements and DIY practices – giving a richer explanation for why the Maker Movement is happening now, and where it might be headed. Adrian Smith points out precursors in the UK which were not able to survive a neoliberalization agenda within the government.[27] Meanwhile, Evgeny Morozov looks to the Arts and Crafts movement as well as the Silicon Valley Homebrew Computer Club for historical narratives documenting the push towards commercialization of DIY maker initiatives.[28] Fred Turner also explores DIY and subcultural connections to Silicon Valley high-technology development, looking at how the countercultural new communalist movement influenced cyber cultural trends.[29] Turner's work provides a strong basis for looking at how these different groups become,

Supported Cooperative Work, 107- 116 (New York: ACM Press, 2012).; Daniela K. Rosner and Fred Turner, "Theaters of Alternative Industry: Hobbyist Repair Collectives and the Legacy of the 1960s American Counterculture," in *Design Thinking Research*, ed. Hasso Plattner, Christoph Meinel, and Larry Leifer, 59–69 (Cham: Springer International Publishing, 2015).; Martin Charter and Scott Keiller, "Grassroots Innovation and the Circular Economy: A Global Survey of Repair Cafés and Hackerspaces," The Centre for Sustainable Design, University for the Creative Arts (July 2014), accessed August 14th, 2017. http://www.research.ucreative.ac.uk/2722/1/Survey-of-Repair-Cafes-and-Hackerspaces.pdf.

[26] Charter and Keiller, "Grassroots Innovation," 12-13.

[27] Adrian Smith, "Technology Networks for Socially Useful Production," *Journal of Peer Production*, 5 (2014), accessed August 15th, 2017. http://peerproduction.net/issues/issue-5-shared-machine-shops/peer-reviewed-articles/technology-networks-for-socially-useful-production/.

[28] Morozov, "Making It," 2014.

[29] Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, The Whole Earth Network, and the Rise of Digital Utopianism*, (Chicago: University of Chicago Press, 2006).

in Peter Galison's terminology, "trading zones," meeting places where different ideologies, disciplines, and cultures come together, therein shaping one another and transforming cultural values.[30] Within these trading zones, various individuals, communities, and institutions carry out "boundary work" to delineate what constitutes a hackerspace, and how one is recognized as a hacker, maker, crafter, feminist hacker, fixer, or otherwise.[31] Yet in Turner's account, which is helpful and follows a certain narrative centered on Stewart Brand, techno-elitism is highlighted and leads the story through. Mary Louise Pratt shifts the focus to the importance of sociocultural backgrounds and subsequent power relations within knowledge practices with what she calls "contact zones" – allowing for the challenging task of talking through diverse cultural backgrounds, not just different knowledge structures or practices.[32]

While this historical and ethnographic work on subversive hacker cultures is typically focused on computer hackers, scholars are starting to look at trends and practices among material hackers, fixers, fab labs, hacklabs, and hackerspaces.[33] Hacking of software and hardware alike is conducted at most hacking and making sites, although Fixers and Repair Cafés focus solely on hardware and object repair. Many participants within maker and fixer groups hope to disrupt capitalist alienation of labor and corporate

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[30] Thomas F. Gieryn, "Boundary-Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Scientists," *American Sociological Review* 48 no. 6 (1983), 781-795.

[31] Peter Galison, "Trading Zone: Coordinating Action and Belief," in *The Science Studies Reader* ed. Mario Biagioli, (New York: Routledge, 1999), 137–60.

[32] Mary Louise Pratt, "Transculturation and Autoethnography: Peru 1615/1980," in *Colonial Discourse/Postcolonial Theory* (1994): 24–46.

[33] For a focus on software and computing hacking see: Coleman, "CODE IS SPEECH," 2009; Kelty "Two Bits," 2008; and Lessig, "Code," 2006. For different narratives see: Rosner and Turner "Theaters of Alternative Industry," 2015; Boeva and Foster "On Making and Becoming," 2016.; Maxigas, "Hacklabs and Hackerspaces," 2014.; and Austin Toombs et al., "Becoming Makers: Hackerspaces Member Habits, Values, and Identities," *Journal of Peer Production* 5 (2014): 1-8.

tendencies to focus on profit rather than on making reliable, responsible, and customized products. Other groups on the margins – such as feminist hacker collectives and nascent library programs – reveal making activities that are overlooked in technoliberal and market-driven narratives more common to the Maker Movement.[34] Sophie Toupin and Christina Haralanova explore the rise of feminist hackerspaces, proponents of which point to both implicit and explicit barriers inherent in cultures of hacking and hackerspaces.

The makerspace phenomenon has created rich and sometimes contentious forces acting upon the local, national, and global terrain where democratization of technology is pursued. This dissertation reveals different facets of inclusion, accessibility, and empowerment within the Maker Movement. It complicates one-sided critiques of maker and hacker cultures by analyzing micro-interactions, tactics, affects, actions, and utterances. I parse out the Maker Movement's unintentional exclusions in the face of its overarching rhetoric of inclusion by examining activities that contradict the dominant rhetoric and attempt to reclaim the "maker" label as a banner through which to argue for the importance of care, differentiated knowledges, and alternative ways of taking part in world-making.

This study focuses on eight groups that actively reflect on accessibility, inclusion, empowerment, situated learning, and situated knowledges. The focus on and rhetoric of

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[34] In his book *Technoliberalism and the end of Participatory Culture in the United States,* Adam Fish describes technoliberalism as a political philosophy based on the belief that networked technologies placate the contradictions of a society (that of the US) which cherishes both free market economies (individualism), and social welfare (collectivism). With its focus on the liberatory potentials of access to technology, it ties into a certain technosolutionist ideal which downplays the politics involved in the building of systems and structures, predetermines what counts as "technology," and who holds the power to manipulate and control it. He also points to how technoliberalism is tied to the development of Silicon Valley as well as hacktivist ethics – two worlds that are entangled in unexpected ways.

openness predominantly applies to those already privileged with certain skill-sets and interests, inadvertently further excluding those already on the periphery of the technosocial landscape. Despite this, communities exist within the Maker Movement that are more critically engaged with technological practice. I have set out to examine how a sub-set of them position themselves within or on the margins of the Maker Movement and what culture-shaping practices they enact. These groups enact a distinct set of practices within the Maker Movement that deconstructs technocentric power hierarchies and the unchecked consumerism that is often thought to be at its core. At the same time, these subversive groups are still interested in the Movement's aspects of geeking out, tinkering, having fun, and learning by doing – of playfully intervening in technology making by opening up its 'black box.' This dissertation examines how these groups work with the dominant discourse, by pushing against it or tactically restructuring it.

Theoretical Framing

My theoretical framing is grounded in the sensitizing concepts I initially drew upon for my data collection, namely accessibility, inclusion, and empowerment. Prior to and during my research, I continually came across these concepts, first in the dominant rhetoric of the Maker Movement with its liberatory and democratizing claims, and later in written materials, articles, and tag-lines from field sites, and in open discussions with participants. Through both observations and interviews I found that each group is attuned to different ways of knowing as connected to materiality and technical practice. This affected the ways in which they defined and cultivated accessibility, inclusion, and empowerment and led me to explore collective situated knowledges as tied to my main framing of epistemic cultures and entangled politics of care. In exploring their tactics and

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practices to instantiate heterogeneity, I characterize the epistemic cultures of these

groups. As different modes for dealing with care, non-care, comfort, and discomfort

became apparent in my findings, I felt it would be important to do a deeper examination

of the politics of care involved when trying to foster inclusion, accessibility, and

empowerment in diverse ways, especially with practices that have social, material, and

technological repercussions.

The Politics of Care and Collective Situated Knowledges
In my work, I demonstrate the collective, and very social, formation of knowledge

practices, through what I see as different communities of practice within technology-

based cultures.[35] Instead of focusing on stratifications of expertise and the boundary-

work therein, I analyze how groups on the margins have established community,

collective practice, support, and diminished barriers, often by acknowledging different

forms of expertise. To reveal relations of power in the Maker Movement, I have attuned

my data to practices of *care.* I thus shed light on the ways in which attention to care is

important in thinking about technology-based practice, design, learning, and

development.

Moving beyond what society typically constitutes as labors of care (i.e.

motherhood, medical professions, maintenance), Maria Puig de la Bellacasa has

developed a "matters of care" framework for technoscientific practice in which "caring

[…] is both a doing and ethico-political commitment that affects the way we produce

knowledge about things."[36] According to Bellacasa, care involves "the affective remaking

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[35] Etienne Wenger, "Communities of Practice and Social Learning Systems," *Organization* 7, no. 2 (2000), 225-246.
[36] De la Bellacasa, "Matters of Care in Technoscience," 100.

of relationships with our objects."[37] In a recent article that is partly a response to Bellacasa's work, Michelle Murphy argues that being attuned to care should also mean acknowledging the power relations involved.[38] She explores the violence that actions done in the name of "care" can enable, and troubles the notion that care is always tied to good feelings and comfort. Instead, she points to the instantiations of discomfort, anger, unrest, and inequity that an attention to the politics of care may reveal – and the importance of unpacking such indicators, instead of turning a blind eye. I am interested in following her path to not fully give up on care, but attune a critical approach to its enactments, elucidating the embedded power dynamics therein.

Care is always already caught up in entangled relations, whether they be collective or interpersonal or inter-material. Thus, centering on how it is or is not instantiated sensitizes my work to the ways in which collectivities sustain and support certain demographics over others and the diverse ways the groups I study remake relations with objects, practices, organizations, publics, individuals, and institutions. Identifying how participants, organizations, infrastructures, and objects engage care within technological practice – through collective care, social learning, infrastructure, external communities, technologies, and local publics – showcases a relational mode of how these groups and their participants partake in, or disrupt technological citizenship. Thus, by focusing on different valuations and practices of care, certain patterns of inclusion, accessibility and empowerment come to light.

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[37] Ibid.
[38] Michelle Murphy. "Unsettling Care: Troubling Transnational Itineraries of Care in Feminist Health Practices." *Social Studies of Science* 45, no. 5 (2015): 717-737.

Since diverse ways of knowing and the effects of context, culture, and tools on knowledge practices are central to my field sites, Haraway's conceptual work regarding "situated knowledges" is important for my theoretical framing.[39] In the groups I study, knowledge is conceived as iteratively construed and collectively shared. It takes myriad forms, including embodied knowledge, technical knowledge, emotional knowledge, social knowledge, organizational knowledge, and scientific knowledge. With situated knowledges, Haraway places an importance on context and culture when producing, sharing, and using knowledge. In part, she establishes that there is not one truth or pure knowledge to acquire or share, but many ways of knowing the world which shape an issue or inform the solution to different problem spaces.

The development of situated knowledges and its form of objectivity is not only about the relationship between knowers, but that between the knower, what is known, and how – thus the context, objects, and instruments present in the environs where knowledge is produced. Both dimensions provide a richer technoscientific practice in that one acknowledges different people and forms of knowledge as relevant to such endeavors, and the other highlights the importance of the materiality and context, and of what these knowers are attempting to know, in the production of knowledge – thus acknowledging material agency as well as culture and context for a stronger objectivity. Situated knowledges reject the objective 'god-trick' or all-seeing view-from-nowhere so often preferred within technoscientific practice. Instead, such a form of objectivity is cast as disembodied, unhelpful, and reductionist, often invisibly enforcing a dominant narrative over subjugated others.

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[39] Haraway, "Situated Knowledges."

Epistemic Cultures and Tactics Toward Heterogeneous Narratives

Karin Knorr-Cetina's concept of epistemic cultures offers insight into how different maker and hacker communities develop and sustain their specific knowledges, practices, skills, and cultural values.[40] She defines epistemic cultures as "those amalgams of arrangements and mechanisms – bonded through affinity, necessity, and historical coincidence – which, in a given field, make up *how we know what we know*."[41] Such a conceptual frame reveals the material, discursive, and organizational forms that allow for diverse types of knowledge construction and practice. The concept of epistemic cultures is grounded in Knorr-Cetina's work in laboratory studies and originates from explorations of knowledge practices and cultures of science in the making. However, it has fruitful implications for the informal knowledge practices of maker and hacker collectives as well.

While not a lab setting, makerspaces and hackerspaces could be theorized as nascent nodes of experimentation technologically and socio-culturally. For instance, there are certain tacit knowledges involved in various realms of material praxis that must be experienced to be developed; they cannot be learned from step-by-step instructions.[42] Some social groups have more access to and comfort with specific tacit knowledges before entering technology-focused spaces. The hierarchical values that communities place upon some knowledges and technologies over others, in turn, form different boundaries of locally-constructed expertise that may result in a culture of inclusion and

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[40] Knorr-Cetina, *Epistemic Cultures,* 2009.

[41] Knorr-Cetina *Epistemic Cultures*, 1.

[42] For more on tacit knowledge See Michael Polanyi and Marjorie Glicksman Grene. *Knowing and Being Essays* (Chicago: University of Chicago Press, 1969).; Kelly Joyce, "Appealing Images: Magnetic Resonance Imaging and the Production of Authoritative Knowledge," *Social Studies of Science* 35, no. 3 (2005): 437–62.

often blatant exclusion. Narratives of inclusion and exclusion need to be fully explored in terms of how these groups uphold certain epistemic cultures as ideal, especially scientific and technical knowledge systems. This is reflected in which activities or tools are given what amount of space, who is welcomed or praised for having a specific skill-set, how knowledge is shared and documented, and the types of workshops that are run.

Often such dynamics tend toward the technoliberal or technocratic, meaning that those with the most technical knowledge and expertise are given the most power to shape the space, its cultures, and practices – with an emphasis on the good of individualism, the "natural" liberatory nature of technology, and free market entrepreneurial goals. However, a study of epistemic cultures leaves room for diverse and internal dynamics that break from such hegemonic framings. Knorr-Cetina points to how particular systems of knowledge can be self-referential, orienting "more to internal and previous system states than to the outside environment."[43] In my own work, I reveal how other epistemic cultures are being established, and what transformative possibilities this entails for technological "material participation."[44]

The maker groups I selected to study are advocating for a wider acknowledgement that diverse knowledges are necessary and already a part of the technology development process. They stake their claim by working to create a multiplicity of discourses, solutions, and tactics to influence formal structures or even create their own informal infrastructures. Michel De Certeau describes the possibility for citizens to act against dominant systems through everyday actions as "tactics" in

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[43] Karin Knorr Cetina, "Culture in Global Knowledge Societies: Knowledge Cultures and Epistemic Cultures," *Interdisciplinary Science Reviews* 32, no. 4 (2007): 368.
[44] Material participation is Nootjes Marres' term which is further described in the literature review, chapter two.

opposition to the "strategies" used by top-down mechanisms such as corporations and other large institutions.[45] While De Certeau was more pessimistic about the possibility for small every-day actions to make a difference, I tie his thoughts on tactics in with Gibson-Graham's theorizations and descriptions of disruptions to capitalism and Bernstein and Armstrong's work on a multi-institutional approach.[46] Gibson-Graham's work demonstrates that by identifying alternative mechanisms to structures that are deemed all-encompassing, fissures within these dominant structures can be further opened, populated, and actualized towards new states of becoming.[47]

Theories on tactics and heterogeneous narratives help me to identify projects and community development within maker and hacker groups on the margins that confront and disrupt dominant rhetoric and expectations from institutions and granting agencies regarding STEM education, interest, and entrepreneurship. Knorr-Cetina also argues that there is a diversity of knowledge societies and that "it would be wrong to understand knowledge societies as homogenous and one-dimensional, which they are not."[48] This argument contributes to the theoretical lens for this dissertation: that there are multiple experiences and appreciating these multiple experiences is required to understand the Maker Movement and its many moving parts. Such multiplicity is often overshadowed by Western cultural fascination with technocentrism.

Knorr-Cetina recognizes the social, the organizational, and the technical as intertwined in a way that helps to relate how particular social mechanisms manifest in

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[45] Marcel De Certeau. *The Politics of Everyday Life,* (Berkeley: University of California Press, 1984).
[46] While Gibson-Graham is the work of two collaborators, they write as a single author. In following this style choice, in the body of my dissertation I use grammar for a single author when referring to them.
[47] J. K. Gibson-Graham, "Imagining and Enacting a Postcapitalist Feminist Economic Politics," *Women's Studies Quarterly* 34, no. 1/2 (2006): 72–78.
[48] Ibid 8.

technical and scientific work. Her work also gives weight to the materials and tools within a space as possible "epistemic agents" that shape and transform knowledge claims as well as the sociotechnical cultures involved. This object-oriented work connects to the tradition of Andrew Pickering, Karen Barad, Adele Clarke, Bruno Latour, and others who explore negotiated agency between objects, animals, environments, practices, cultures, and humans in the world-making of scientific experimentation.[49] Knorr-Cetina recognizes that while practice is essential in culture and world-making, particular discourses, rituals, and imaginaries are embodied through the micro-interactions and practices with which this dissertation mainly contends – both among people and between people and objects. While I explore the content and creative endeavors that come out of my case studies, I derive my main analytical claims by identifying the imaginaries embodied by skill-sharing practices, socio-cultural dynamics, types of tools used, types of spaces used, materials used, and various organizational mechanisms.

Sensitizing to the politics of care I demonstrate how my case studies enact accessibility, inclusion, and empowerment toward a plurality of epistemic cultures amongst technological publics. This theoretical frame helps me to analyze material participation in relation to different values, sociocultural backgrounds, and knowledge-making commitments. In turn, I explicate how each group develops collective situated knowledges and various tactical measures to establish heterogeneous narratives of technology that relate to the dominant discourse in diverse ways.

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[49] Andrew Pickering, *The Mangle of Practice: Time, Agency, and Science,* (Chicago: The University of Chicago Press, 1995).; Karen Barad, "Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter," *Signs: Journal of Women in Culture and Society* 28, no. 3 (2003): 801–31.; Adele Clarke, *Situational Analysis: Grounded Theory after the Postmodern Turn*, (New York: Sage, 2005).; Bruno Latour, "On Actor-Network Theory: A Few Clarifications," *Soziale Welt* 47 (1996): 369–81.

Research Questions

My empirical chapters grapple with the question: *in what ways do groups on the margins of the Maker Movement formulate narratives about technology development and how do they position themselves in relation to the dominant discourse in technology-based cultures?* In this regard, I examine the shifting and repeated practices within a group, or epistemic culture, that eventually settles into its own internal rules and dealings – as Knorr-Cetina describes, how it "curls in on itself."[50] And while they are still in communication with and affected by externalities and greater institutional framings, I explicate how they create their own internal logics, movements, and framings – their own narratives in relation to these diverse epistemic cultures.

My second inquiry is the main question according to which my data is framed. It also incorporates the initial themes I have set forth to explore. Coming from the first question, in studying internal dynamics I am more narrowly interested in: *How do accessibility, inclusion, and empowerment manifest differently, from the dominant discourse as well as from each other, among alternative maker and hacker groups?* In answering this question, I examine the diverse ways in which collectives build their communities and address issues of accessibility, inclusion, and empowerment through technologies, material praxis, and skill-sharing while also hoping to maintain their own epistemic cultures. In my conclusion, I continue to weigh in with how such practices might inform or affect larger narratives or discourse. Thus, the findings from these questions inform how informal educational practices of maker communities that deal with an unsettling of care, its various valuations, and (dis)comfort, "curl in" but then also

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[50] Knorr-Cetina, *Epistemic Cultures,* 8.

radiate out to affect the formal structures of libraries, schools, technology production, and the realm of consumer electronics.

As the Maker Movement continues to be touted as a phenomenon that will transform industrial production and educational practices in K-12 as well as higher-education settings, it is important to examine what is happening at the margins to identify mechanisms toward more transformative and equitable technology practices. Scholars examining the democratization of science have called for greater inclusion in terms of what constitutes legitimate knowledge, how and what information ought to be disseminated, and how research ought to be focused, all to give further voice to differentiated publics.[51] STS scholarship on social movements and participatory cultures is beginning to look at on-the-ground public engagements with technology and their efficacy to instigate change in technology development and science educational policy – towards the inclusion of marginalized voices.[52] Seemingly in line with the goals and mindsets of investigations into civic science and citizen science actions, maker collectives as grassroots groups interested in manipulating and transforming technology on their own terms and with collectively shared space and tools are emerging in diverse communities around the world.[53] This dissertation contributes to an emerging scholarly field that looks at community design and making practices, while specifically querying how feminist, marginalized, and radical groups use technology-making and breaking as

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[51] Sheila Jasanoff, "A Mirror for Science," *Public Understanding of Science* 23, no. 1 (2014): 21-26.; Carl DiSalvo, "Design and the Construction of Publics," *Design Issues* 25 (2009): 48–64.

[52] Shannon Dosemagen et al., "Grassroots Mapping: Creating a Participatory Map-Making Process Centered on Discourse," *Journal of Aesthetics & Protest* 8 (2012), accessed April 20th, 2017, https://www.joaap.org/issue8/GrassrootsMapping.htm.

[53] See Maxigas, "hacklabs."; Lindtner and Li, "Made in China."; Hielscher et al., "WP4 Case Study."

an avenue for cultural transformation.[54] Instead of glossing over practices as identifying

with one mindset, this project characterizes the entangled subjectivities, material praxis,

and power dynamics at play in these collectivities.

Research Design: Crafting a Multi-sited and Multi-modal Ethnography
This dissertation employs multi-sited ethnography, which entails parallel investigation of

distinct but related field sites, to provide a snapshot of a cultural system, and further

interpret this ethnographic work with attention to the politics of care.[55] My research relied

on three primary methods: interviewing, participant observation, and archival research.

Interviews were conducted and recorded digitally with participants of varying

engagement levels and revolved around how they saw their groups as both successful and

unsuccessful at enacting accessibility, inclusion, and empowerment. Arising from these

discussions I also identified feelings and thoughts regarding care, comfort, discomfort,

knowledge, and expertise. For participant observation, I selected activities at my sites to

illustrate the complexities across diverse avenues of the Maker Movement and the

epistemic cultures therein. Field notes and photography documented organizational

meetings, workshops, fixing sessions, open hours, multi-day conferences, group

discussions, and tool trainings. While my field notes and pictures detailed many levels,

practices, and types of interactions, they were organized around accessibility, inclusion,

empowerment and social dynamics of comfort and discomfort to connect with interview

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[54] See Ratto, "Critical Making."; DiSalvo, "Design and Construction."; Toupin, "Feminist Hackerspaces.";
Nascimento "Critical Notions."; Eglash Ron, Jennifer L. Croissant, Giovanna Di Chiro and Rayvon.
Fouché, eds. *Appropriating Technology: Vernacular Science and Social Power* (Minneapolis: University
of Minnesota Press, 2004).

[55] George E. Marcus, "Ethnography in/of the World System: The Emergence of Multi-Sited Ethnography,"
Annual Review of Anthropology 24, no. 1 (1995): 95-117.

data. Participant observation and interviewing of selected groups began seriously during the fall of 2014 and extended through the fall of 2016. This involved multiple visits to each site to lead workshops, to help organize and run larger events, and to carry out participant observations for those groups that had open hours.

Archival data was gathered during a funded visit to the Charles Babbage Institute (CBI) in July of 2015 as well as through exploration and personal documentation of online databases, online forums, websites, and governmental documents. This data contributed to a characterization of the dominant discourse and technocentric rhetoric that set the tone for the establishment (or divergent practices) of the sites I studied. In particular, archival research from the CBI grounded this dissertation in a narrative that revealed the role of women and minorities in past technology development and use, as well as informal education centers and DIY technology movements.

I conducted research with eight critical and socially-engaged groups in maker and hacker cultures that were interested in employing their practices for explicitly inclusive actions that subverted the blanket claim of "openness" and technocentric dominant discourse. Included are three distinct types: feminist hacker collectives, library maker programs, and fixer or repair groups. For each type, I selected two to three specific sites with which to work, giving a wider set of data, but also allowing the possibility and time to do deeper descriptive work. I saw feminist hacker collectives as providing a critical stance in relation to gender bias and technical practice when considering exclusions and epistemic practice; library maker programs as attending to racial, socio-economic, geographical, and literacy barriers; and finally, the fixing and repair groups as

contributing critical commentary related to consumerism typically tied up with the Maker Movement.

Specific field sites were identified via explorations of the greater Maker Movement and hacker culture field. I was first introduced to the Femhack collective via a Troy-based scholar who knew of my research interests and encouraged me to reach out to them. My initial contact was taking part in an event they organized for the Httmles Festival during fall of 2014.[56] Located in Montreal, Quebec, they established practices in 2011 at the hackerspace Foulab. Their intent is to explore more politically-minded endeavors and cultivate a non-threatening environment in which women, minorities, and those on the margins of technology can creatively collaborate. Femhack members have met in parks, their homes, or at La Passe and helped to run the third TransHackFeminist! (THF!) convergence at the end of August 2016.[57] Through other interlocutors based in Washington, DC, I soon heard of the feminist hacker collective Spanning Tree. Established in 2014, Spanning Tree is also interested in creating a safe and comfortable environment for participants. While initially established for and by female-identifying people and women in technology initiatives, they are open to gender non-conforming people and other marginalized communities.

I spent about 81 hours conducting observations of Femhack related to workshops, organizing work, and running a conference, and I formally interviewed four participants, informally speaking to five others. Meanwhile, I spent fifteen hours observing the

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[56] This is a biannual feminist art and technology conference organized by Studio XX and held in Montreal, Quebec (QC).

[57] This convergence is a general gathering of feminist hackers, activists, artists, and those interested in critically engaging technology – discussions and groups involved have included Gynepunk, Maxigas, Femke, BolWerk, feminist servers, reverse engineering satellites, decolonizing technology among other diffuse but connected topics. Usually bi-lingual, THF! has been held in Calafou, Spain, Puebla, Mexico, and Montreal, QC.

practices of Spanning Tree related to organizational meetings and workshops and formally interviewed four participants, informally speaking to four others. Tangential interactions and events have included a feminist crypto-party at ESC gallery space in Graz Austria with one member of Femhack involved, organization and performance of a Crypto-dance at panke.gallery in Berlin, Germany with collaboration of Femhack, attendance of a Raspberry Pi workshop at a refugee camp in Vienna, Austria organized by Mz. Baltazaar (feminist hackerspace and collaborators with Femhack), and what serendipitously turned into a women's-only, feminist e-textile workshop at TVCOG.

While I visited many library maker programs, I focused on three specific programs. In the fall of 2015, the Albany Public Library established The Albany Made Creative Lab. They have a dedicated space with open hours and two staff hired internally to facilitate projects and oversee use of the space. The Albany Made Creative Lab resides in the main branch of the Albany public library system, and was inspired by the Fayetteville, New York library makerspace and previous programming geared toward helping local adults start small businesses. Meanwhile, the Philadelphia Maker Jawn initiative located in Philadelphia, PA was started in 2012 in order to set up educational programming based on learning-by-doing practices. Funded in part through the Maker Education Initiative and the Institute of Museum and Library Services (IMLS), this program serves six neighborhood libraries in Northeast Philadelphia. Maker Jawn is geared to work with the immediate communities, which encompass some of the most economically disenfranchised areas of the city. The MLK DCPL located in Washington, DC has a wide variety of programming to engage the underserved community in the area, including computer and music design labs. In line with these initiatives they built and

opened the DCPL Fab Lab in May of 2015. Focused on adult programming, the Fab Lab is equipped with various material fabrication tools, such as a laser cutter, multiple 3D printers, sewing machines, and a CNC router. They focus on tool sharing, but hope to provide more in-depth programming toward skill-development to help their patrons gain employment.

During two separate, several-day visits to MLK in January and September 2016, I formally interviewed thirteen staff members and two users and informally interviewed several additional users. I also observed four different one-hour long workshops conducted by staff, one organizational meeting, and about thirty hours of open space comings and goings. At the Philadelphia Maker Jawn I formally interviewed nine mentors, two managers (both previous and current), one LEAP instructor, one children's librarian, and informally spoke with students, librarians, and staff. I visited all four active Maker Jawn libraries at least twice, observing programs and leading one workshop and attended two organizational meetings. For the Albany Made Creative Lab, I interviewed the two main staff, one intern, and one community expert. Primarily for my research of this site I observed open hours, attended a 3D printer training, took part in making, and ran a workshop. Across all sites, I gathered thirty formal interviews with organizers, managers, staff, librarians, as well as six informal interviews with users of the programming. Meanwhile I conducted about 90 hours of participant observation during meetings, open hours, workshops, and in the leading of programming across the three spaces.

The Fixers Collective of New York City, New York started in 2008 out of the now defunct art gallery Proteus Gowanus. They are invested in capacity-building

workshops for technological literacy that teach community members how to fix their own appliances, while providing the tools to do so. At the time of my research, they were running sessions at Hack Manhattan and the Brooklyn Commons, often showing up at different Maker Faire events and at the Brooklyn Public Library. Parallel to Fixers Collectives in the US are European groups known as Repair Cafés that have the same politically-minded consciousness toward planned obsolescence as the Fixers Collective. Repair Cafés are part of a larger initiative, called the Repair Café Foundation, which Martine Postma started in 2009 in the Netherlands and which boasts over 1000 centers worldwide, in over twenty-four countries across six continents.

I formally interviewed four Fixers Collective members as well as one participant, and informally talked to many participants during their sessions. In conjunction, I conducted approximately twenty-two hours of participant observation over the course of two Maker Faires, five fixing sessions in Manhattan and a Club de Reparadores event held at Sure We Can in Brooklyn, New York. By living seven months in Austria through the Institute for Advanced Studies STS (IAS-STS) fellowship, I saw first-hand how Repair Cafés are run in Graz as well as Vienna, Austria. Between the two Austrian Repair Cafés I conducted four formal interviews, four informal interviews and conducted nineteen hours of participant observation during five fixing sessions and one organizational event.

The research that I conducted at these field sites was primarily ethnographic although it also involved collecting papers, objects, and following their website and social media presences. In total, and as my main data for analysis, I gathered formal interviews with fifty-two participants for the sampling of narratives in the various maker

and hacker communities. Included in this number are ethnographic interviews conducted primarily with organizers or deeply involved community members who ran these spaces. This has helped to give a more complete picture of intention and practices of those strongly associated with shaping the community. Additionally, informal interviews and discussions were also conducted with individuals who were weakly associated with the space as users or first-time participants. These interactions and discussions were important for understanding the social life and dynamics of these groups, and to see their efficacy in engaging the general public (whether or not this was their intention). Interview findings were triangulated with ethnographic data gathered via workshop and participant observation practices and are structured around questions stemming from the main research questions. Selection of interview participants was through personal interaction at workshops or open hours or via introduction through other interlocutors.

Participant observation is a research practice contingent on context and upon emergent interactions within the chosen field sites. This method has contributed to my project by allowing me to directly observe participant practices. Being physically present in these spaces also revealed the subtle messaging around what is valued and what is not in each context or among each participant group and subgroup. By matching up observations of key participants in these spaces with interviews, further analysis was enacted. These observations also helped to give a fuller picture of maker cultures in many forms such as informal meet-ups, Pods, junk-jams, workshops, hack-a-thons, Pecha-Kucha events, members meetings, organizational events, social nights, and trainings. As my work has progressed, particularly with the feminist hacker collectives, participants have become more akin to collaborators than informants – which often results in thinking

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and writing *with and through* rather than *about*. In this case, I need to be particularly aware of my own lenses, biases, and assumptions that I bring to this research, and I strive to be clear when arguments or beliefs are not my own – while still acknowledging my influence in the framing and further interpretation.

Although it has not made its way directly into this dissertation, my research is inflected by primary archival data in relation to women and amateur clubs in computing technology. Resources were gathered via online collections as well as at the CBI. While providing historical origins and contexts, this research also informed an analysis of how dominant framings regarding gender, race, class, and militaristic or corporate ideals have shifted or survived in current instantiations of tech innovation communities. It also provided background on how small communities or networks shared knowledge and created their own cultures in relation to or in opposition to greater cultural narratives. This included the creation of newsletters, support groups, and social gatherings associated with women in computing and homebrew computing clubs.

My coding system followed themes related to my research questions, but since coding was iterative throughout research, themes and hypotheses have shifted. Initially they included themes regarding accessibility, inclusion, empowerment, and resulting exclusions. Codes that were later used to explore themes which were revealed as important through iterative analysis include comfort, discomfort, care, and maintenance. Different dimensions affecting these themes included the analysis of physical space, language, types of knowledges taught, formats for skill-sharing, resources made available, community development, and ways in which these themes came up and were talked about in interviews. Following Adele Clarke, I strive to "[represent] the

multiplicity of perspectives in the situation" as a way towards disrupting "representational hegemony."[58] This means that my research was geared toward representing the perspectives and practices of communities and publics that are not the focus of dominant maker discourse.

Chapter Summaries

This dissertation is centered on four main empirical chapters, in addition to this introduction, a following literature review, and finally a conclusion. Chapter two reviews the literatures most relevant to my inquiry, including STS scholarship that attends to public engagements of technoscience, critical design studies attuned to different publics and cultures, pedagogies geared toward liberatory endeavors, and feminist technoscience that critically engages definitions of technology and the embedded values therein. After explicating the theoretical stakes at hand and the gaps in current literatures, the subsequent chapters will work towards addressing these identified gaps and bringing the literatures into deeper conversation with each other.

Chapter three sets the stage for the rest of my empirical work by characterizing the dominant discourse of technoliberalism within the Maker Movement. In it I grapple with multiple narratives around making, problematizing the lone inventor trope which often structures practices and rhetoric within maker and hacker cultures. I start to parse out the role of underrepresented populations in the story-telling and point to gaps of knowledge regarding their involvement in DIY cultures. This then sets the stage for the subsequent chapters to demonstrate how some collectives are working to fill gaps in the narrative, or trying to create new narratives for DIY technological cultures.

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[58] Adele Clarke, *Situational Analysis*, 59.

Chapter four focuses on self-proclaimed feminist hacker groups through interviews and participant observation. In relation to my first research question, this chapter focuses on how feminist hacker collectives frame their skill-sharing and community-building as set apart from the dominant discourse via exclusionary practices and various other tactics. In caring for the inclusion and empowerment of certain marginalized communities, they worked to exclude dominant groups and discourse. They were most interested in troubling definitions of technology, expertise, and knowledge. Thus, through their attention to experiential knowledge and different mechanisms of learning skills, they established an epistemic culture set apart from dominant framing. Their delineations of comfort and their interest in troubling care and labor practices regarding technology-based cultures affected practices of accessibility, inclusion, and empowerment.

Chapter five characterizes several library makerspaces and fabrication labs, or fab labs. Unlike the feminist hacker collectives, such programs position themselves as within and often directly aligned with the dominant discourse, being housed within bureaucratic organizations that have top-down funding mechanisms. At the same time, I parse out how they contribute to a heterogeneous narrative by employing tactics associated with on-the-ground practices toward establishing a public good. I explore accessibility, inclusion, and community empowerment, in relation to the public library system's greater reach and mission around resource allocation and accessibility measures. In this chapter, the politics of care in relation to technologies and the library user-base reveal deeply entrenched "digital divide" rhetoric and an often technoliberal register that staff reflect upon and often challenge with varying levels of success.

Chapter six explores Repair Cafés and Fixers Collectives, where I delineate their different practices and rhetoric that are similar to and divergent from hacker and maker innovation and economic-development driven registers. Since such groups are invested in repair as opposed to fabrication, the intention of their practices is set apart from the dominant discourse of "making." However, I reveal how they take part in, or really leverage, the dominant framing via public engagement at several Maker Faires, direct use of hackerspaces, and through similar tool practices. I examine how fixers and repair groups establish accessibility and inclusion by the widely available material of broken things and empowerment through skill-sharing workshops. I also demonstrate how knowledge is situated and collectively dispersed – leading to a rich community of practice. Care is primarily enacted in relation to objects, revealing a different facet of the politics of care, however it is employed with the mindset that this action of care is interconnected and establishes care for the owner, the community, and the environment as well.

The concluding seventh chapter summarizes my overarching argument and how it draws on each empirical chapter finding. I tie together how each case positions themselves in relation to the dominant discourse within the Maker Movement, demonstrating that their various tactics, disruptions, and epistemic cultures provide a set of heterogeneous narrative in opposition to a hegemonic understanding of what maker and hacker cultures entail. I also explicate how they disrupt or reproduce power relations within dominant narratives of technological production and use, often due to their attentions to care, comfort, and discomfort. Instead of establishing care as a best practice or an automatic positive value, I point to moments of discomfort and the negative sides of

care in technological practice. I argue how an attention to the politics of care can help to unfold, reveal, and leverage productive tensions that can establish more democratic technology endeavors through collective witnessing, accountability practices, and a pedagogy of discomfort.

This dissertation establishes that what might be characterized as the Maker Movement is made up of a diverse set of practices, objects, and peoples, regardless of how the dominant discourse attempts to reframe all actions in the technoliberal and technocentric register. Instead of putting forth most efforts to change the dominant frame, however, groups on the margins work to construct their own infrastructure, practices, and communities. They grapple with disparate claims of democratizing technological production, each establishing their own definitions or mechanisms for accessibility, inclusion, empowerment, care, equity, and comfort. Beyond a descriptive stance, I elucidate what it might mean to enact critical technological citizenship through material praxis and participation, examining the politics of care entangled in a play for the lowering of barriers to participation and the heterogeneous use of technoscience. By examining marginalized knowledges within tech, I explicate what this historical moment reveals in possibilities to think differently about how technological material participation is enacted through diverse publics, communities of practice, and epistemic cultures.

CHAPTER TWO: LITERATURE REVIEW

My dissertation draws on and contributes to three major literature groupings, including: critical design and social movements, feminist technoscience, and liberatory and engaged pedagogies. While scholarship in these fields allow for deeper analysis of making, repair, and hacking cultures toward answering my research questions, they also establish the conversations of STS to which my work contributes.

Critical design provides a basis for considering the sociopolitical consequences resulting from the material praxis of maker and hacker groups and the contributions of their work to social movement framings. It is also the scholarship through which I engage how a dominant discourse is framed, the registers involved, and what a technology-based social movement might look like which troubles dominant framings. Feminist technoscience adds a critical angle for attuning to marginalized voices while examining how knowledge is formed and used in the context of technoscientific production, use, and development. Attention to recent feminist critiques regarding technology and the politics of care helps to elucidate how different narratives effect accessibility, inclusion, and empowerment. Such critiques also provide a historical narrative for how technical practices have functioned in the past, and give weight to the implicit and explicit biases that iterate and often reproduce power dynamics and inequities – typically along delineations of gender, race, socio-economic class, age, disability, and sexuality. Meanwhile, liberatory and engaged pedagogies shift my analytic gaze to the practice of skill-sharing employed in these spaces, mechanisms through which power disruptions might occur, and demonstrate the reconstructivist possibilities involved in material praxis.

Critical Design and Social Movements

Critical design is a sub-section of design studies literature that informs my own analyses more directly than design studies. This scholarship explores and contributes to practices that are a caveat to typical hacking practices, including critical-making, critical technical practices, and critical technology design and movements. Often practitioners employing these methods seek to engage community members in the design process. Beyond this, they may work to mobilize communities to reflect on societal issues specific to their locale as well as on a larger scale. Participatory design is often referenced in these initiatives and is a form of design established by the field, in the avenue of appropriate design, co-design, inclusive design and so forth, which strives to include the user in the design process. It influences these other design approaches as it is rooted in changing the very practices of design while working on a system, in an iterative format and in relation to users, researchers, materials, and designers therein involved.[59] However, participatory design typically involves users in the process only after designers have established the problem space or assessed for which issues they want to design.

Paul Dourish calls upon Human Computer Interaction (HCI), the study of interactive computer systems in which efficacious human interaction is part of the system, and other participatory technology systems, to engage the political implications of design, querying the "design of politics."[60] Dourish problematizes the narrative of an individual user, instead acknowledging communities of users, a theme appropriate to makers working in collectivities. Critical technical practice scholarship is in conversation

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[59] Finn Kensing and Jeanette Blomberg, "Participatory Design: Issues and Concerns," *Computer Supported Cooperative Work (CSCW)* 7, no. 3-4 (1998): 167-185.

[60] Paul Dourish, "HCI and Environmental Sustainability: The Politics of Design and the Design of Politics," *ACM, Proceedings from DIS Conference,* Aarhus Denmark, August 16-20, 2010.

with participatory design and inclusive design scholarship, but takes issues with classic

delineations of expertise, knowledge, community, and empowerment.[61] This dissertation

joins in on critical design conversations initiated by Dourish and others that highlight the

implicit politics designed into interactive systems, since it explores the implicit discourse

and structure that is designed into making and hacking communities, as well as locally

contingent disruptions that shift or establish themselves apart from the dominant framing.

Through critical technical practice, participants gain experiential knowledge of

technology, while observing how their personal, situated knowledge can contribute to the

project. Individuals are invited to explore how their own expertise might be relevant to

the scientific community with regards to questioning policies and practices. Carl DiSalvo

and Jonathan Lukens utilize speculative design for exploring possibilities of critical

technological fluency, particularly in radio broadcasting design.[62] Through analysis of a

hands-on workshop, their participants demonstrated that design practice was not just

about the technical, but incorporated discussions of policy, legislation, and regulation.

> [T]hey exhibited an engagement with and a developing understanding of
> the social practices of technology development as a heterogeneous process
> involving multiple actors and skills.[63]

Demonstrating the importance of various actors to technology development shows how

flawed technocentric understandings of design processes are: that in order to participate

in technology development, one must develop the skills (or some semblance of the skills)

of an engineer or computer scientist. "First it leaves out those who do not want to develop

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[61] Darren Reed and Andrew Monk, "Inclusive Design: Beyond Capabilities towards Context of Use,"
Universal Access in the Information Society 10, no. 3 (2011): 295–305.
[62] Carl DiSalvo and Jonathan Lukens, "Towards a Critical Technological Fluency: The Confluence of
Speculative Design and Community Technology Programs," *Proceedings of the Digital Arts and Culture
Conference, 2009: After Media: Embodiment and Context*, 1–6. (Irvine, CA, 2009).
[63] Ibid, 5.

such skills but nonetheless desire to have a voice in shaping technology development and use. Second, it does not accurately reflect the ways in which technology development and application occurs 'in the real world'"[64]

The recognition that science and technology are not shaped alone by technical expertise is a key aspect of critical-making and critical-technical practice groups. As related by Matt Ratto, helping to change this thinking is a major objective of participatory design advocates.

> Our goal is therefore to use material forms of engagement with technologies to supplement and extend critical reflection and, in doing so, to reconnect our lived experiences with technologies to social and conceptual critique.[65]

Critical-making practices focus on an iterative reflection process, working through changes on the prototype to inform the process. This relies upon a co-constructive attitude toward technology. The creative iterative process of critical-making invokes Pickering's ideas of tuning and a "dance of agency" between the technology in its formative process, and the critical, reflective mindset of the people working to create said technology.[66] The manipulation inherent in these processes is often a nexus of diverse types of actants with various agencies and philosophies – it is relational. This includes the "epistemic subjects" and "epistemic agents" that Knorr-Cetina characterizes when describing different epistemic cultures.

Critical-making and critical technical practices are generative, taking not only user needs, but community-oriented and socially responsible aspects into account during design. This entails incorporating various users' knowledges into an iterative design

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[64] Ibid, 4.
[65] Matt Ratto, "Critical Making: Conceptual and Material Studies in Technology and Social Life," *The Information Society* 27, no. 4 (2011): 252-260.
[66] Pickering, *Mangle of Practice*.

process wherein the user becomes the maker and directly part of the design process. The intent of the designers is to foster the creation of end-technologies that grow out of collective and differentiated knowledges within a community. Other communities or publics can then take the resulting technology, further modifying it to fit new needs and situations.[67] In this framework there is room for citizen sensing and citizen scientific practice, based on local knowledges, cultures, and needs. In this sense, critical design practices often take on a plurality. Similarly, "[t]he ultimate aim of citizen-science deliberations is [therefore] not to reach the truth, or even agreement, on the common good. More important is to make explicit the plurality of reasons, culturally embedded assumptions and socially contingent knowledge ways that can inform collective action."[68]

This mentality may counter the idea of a collective democratic ideal, but gives way to the idea of many different nodes of communities, working on their own concerns regarding a specific technology – communities who can then take part and contribute to the greater network toward a greater global framework of technological accountability. As Dewey theorizes, "publics are situated and multiple, [and a] Deweyan public is not exclusive to a particular class or social milieu."[69] In this framing of technology design, all can take part in their own way; all can give voice to their concerns. Not just the elite, not just the scientists, not just the self-designated experts.

Political implications and implicit biases underlie the reality of who identifies as a maker or hacker and who has the right or comfort to do so – and really take part in this technology-shaping endeavors. Empowerment struggles regarding technology use,

[67] Dewey, *Public and its Problems*.
[68] Jasanoff, "A Mirror for Science."
[69] John Dewey *The Public and Its Problems* in Carl DiSalvo, "Design and Construction of Publics," 50.

consumption and production have often revolved around boundary work entangled with

expertise, and other relations of power. Issues of who can and does participate in

technology production and development have a deep history of further entrenching those

in power, while marginalizing myriad others. As cultural and social movements continue

to develop around science and technology issues, social movement framings and analyses

become further relevant for exploring empowerment strategies via such critical design

practices.

Studies that follow social movements in STS include Steven Epstein's work on

AIDS activists pushing for the reform of medical research protocols, Phil Brown's

research into popular epidemiology and toxics sensing by local communities, and Kelly

Moore's work on scientist activists during the Vietnam War.[70] These works reveal

complications for the political process model that focus on law and policy change,

demonstrating that the collective actions associated with social movements and science

can target institutions other than the state as well as work towards cultural shifts. In this

sense, they can cause effective change beyond policy and law and have had implications

for cultures of technoscientific practice. By analyzing the often technocentric phenomena

of the Maker Movement as a social movement, subversive tactics, actions, and

mobilizations garner further analysis as cultural and social disruptions to the "organized

moral order" of corporate technological control.[71]

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[70] Epstein, *Impure Science.*; Phil Brown, "Popular Epidemiology and Toxic Waste Contamination: Lay and Professional Ways of Knowing," *Journal of Health and Social Behavior* 33, no. 3 (1992): 267-281.; Kelly Moore, *Disrupting Science: Social Movements, American Scientists, and the Politics of the Military, 1945-1975* (Princeton NJ: Princeton University Press, 2008).
[71] Moore, *Disrupting Science*, 15.

The analytic approach utilized in particular by Epstein and Moore also recognizes actors that are within and without the institutions that they want to restructure, which is relevant to my own work, studying those on the margins of the Maker Movement who might want to shift its focus, as well as the practices of larger technology-based cultures. In Moore's work on activist scientists instigating institutional change during the Vietnam War, the challengers are squarely situated within the institutions and frameworks that they hope to change. Similarly, many of those within alternative maker communities and the Maker Movement are situated directly within the technoscientific landscape in which they desire to enact a cultural shift. Meanwhile, Epstein analyses the mechanisms through which those on the margins of scientific production, yet deeply affected by it, have enacted change through social movement work. This is often the case for other social movements entwined within and around technoscientific landscapes, such as environmentalist movements – which is the case of Phil Brown's work into popular epidemiology.

In social movement theory, the multi-institutional approach developed by Bernstein and Armstrong "views power as dispersed in a variety of institutions operating according to distinct logics."[72] Thus the participants of social movements may prioritize cultural and mobilization goals over policy change. In this theorization, Bernstein and Armstrong explain a variety of types of movements beyond models of political opportunity. As the ideology of movements are "reproduced through social practices, solidified in buildings, and embedded in systems for the allocation of rewards and punishments, culture becomes both formidably powerful" and, strangely, almost

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[72] Armstrong and Bernstein, "Culture, Power, and Institutions," 92.

invisible.[73] Looking at the built environments, social practices, and allocations of resources in different maker movements elucidates their epistemic cultures and the power relations therein. This approach also helps to highlight power relations and ideological frames involved in the very infrastructures and organizing mechanisms of production which are sometimes overlooked in critical design narratives.

Previous and current work on technology empowerment movements, such as Gabriella Coleman's work on Anonymous, Chris Kelty's work on the F/OSS movement, and Christina Dunbar-Hester's work on Low Power FM communities, characterize structural change – something that various groups within the Maker Movement are also striving to enact. Also relevant are efforts to increase the participation of women and minorities in science and engineering. While not explicitly designated as a social movement by its participants or those studying it, scholars, educators, and scientists have taken both informal and formal actions to change how women and minorities are able to participate in technoscientific research. Sue Rosser, for example, has drawn attention to biases against women and minorities in the scientific workplace.[74] Rosser also pushes to enact projects that enable infrastructural change within this regard, specifically programming which is aimed to create formal mentoring, networking, and laborer child-care initiatives amongst tenure-track female science professionals. Likewise, Amy Sue Bix's research into the history of the Association for Women in Computing and the Women's chapter of the AMC sheds light on the historical narrative of the growing push

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[73] Armstrong and Bernstein, "Culture, Power, and Institutions," 85.
[74] Sue V. Rosser, "Female Friendly Science: Including Women in Curricular Content and Pedagogy in Science," *The Journal of General Education* 42, no. 3 (1993), 191-220.

for infrastructural change in technoscientific education and the need for support of women and minorities.

This dissertation pushes social movement theory to further consider tactical and innovative mobilization strategies within critical design toward instituting inclusion, accessibility, empowerment as well as cultural and institutional change. Specifically, I am interested in how groups create movements at the margins which may be connected to a larger frame, but are doing different work. Through such praxis is an angle through which to realize material participation and a critical consciousness toward technology and its role in society. In his description of a technological citizenship, Philip J. Frankenfeld contends that "both human ideals involve volition and autonomy or the unique capacity of humans for conscious, calculated thought and action."[75] It is not just the mission of those who discern technology innovation to have critical consciousness, but those who are in the act of tool-making and innovation as well. Making as political act is further explored in design studies scholarship with research into "DIY Citizenship," which involves individuals and collective actors partaking in subversive political acts through material praxis.[76]

Various aspects of citizenship demand different kinds of knowledge and expertise. As demonstrated by DiSalvo and Lukens, diverse types of people can contribute their own expertise to a particular cause. In theorizing about politics, materiality, and different publics, Noortje Marres explicates a type of "material participation" in which citizenship involves decision-making and responsibility toward

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[75] Frankenfeld, "Technological Citizenship," 463.
[76] Megan Boler and Matt Ratto, eds., *DIY Citizenship: Critical Making and Social Media* (Boston: MIT Press, 2014).

real material consequences.[77] While she is more engaged with policy work, the

conversations that Marres enables have implications for identifying different types of

participation which makers enact. She also ties critical design to larger political

implications, which DiSalvo also works toward within his work on Adversarial Design.

This is important because, although critical design practices engage different publics,

many of the workshops enacted occur at conferences and at spaces that may already have

a technical foundation or a dominant group that upholds systemic norms. So while

critical-making is working toward inclusion, what informal or formal structural

mechanisms might be put in place to further ensure radical inclusion and engage

participants with different knowledges and skill levels? Much as Dewey's American

pragmatism is grounded in educational practices and the recognition that there are many

different publics, so too must thinkers in the realm of technology use delve back into

pedagogy, and critical skill-sharing tactics.

Liberatory and Engaged Pedagogy

Critical design practices and their potentials to enable social movement actions are

helpful to enable design practices in a more open, collaborative, and public sphere.

However, critical narratives need to further break apart the mechanisms that make up the

Maker Movement, not just in material praxis, but in its skill-sharing and educational

endeavors as well. Research into critical pedagogies that elucidate invisible power

dynamics within educational strategies and reveal ways to break apart dominant

discourse are relevant as the Maker Movement moves toward influencing STEM

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[77] Noortje Marres, *Material Participation: Technology, the Environment and Everyday Publics* (New York: Palgrave Macmillan, 2012).

initiatives and library systems. In her work on material participation, Marres rightly

points to the issue of barriers in language and meaning, as distinct groups have unique

needs and concerns, often with diverse ways of communicating such things.

By drawing from scholarship that explores how engaged, critical, and feminist

pedagogy works through cultural difference and discomforts, informal education and

skill-sharing within makerspaces could focus on a process of skill transformation that

works with difference instead of shutting it out. Stanley Aronowitz argues that current

educational practices reinforce systemic classifications and function for those in power,

shutting down attempts to be critical of current political, economic and social

trajectories.[78] Ellen Seiter further examines issues of reinforcing dominant norms while

silencing critique in education by explicating how the failings of educational technology

are systemic to cultural, economic and educational practices.[79] As a response to such

issues raised, bell hooks, Henry Giroux, Maxine Greene, Megan Boler, and Donna Riley

argue for a more engaged and critical pedagogy not only in K-12 classrooms, but in

higher education as well.

These educational narratives point to the importance of structure and power

relations in dominant educational practices. Lave and Wenger emphasize that the

language of learning affects how students engage with information, who engages more

than others, and the processing of information.[80] This social model of learning is helpful

for rethinking how those with different situated knowledges might be enrolled and

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[78] Stanley Aronowitz, "Against Schooling: Education and Social Class," *Social Text* 22, no. 2 (2004): 13-35.

[79] Ellen Seiter, "Practicing at Home: Computers, Pianos, and Cultural Capital," in *Digital Youth, Innovation, and the Unexpected*, 27-52, ed. Tara McPherson (Cambridge: The MIT Press, 2008).

[80] Jean Lave and Etienne Wenger, *Situated Learning: Legitimate Peripheral Participation* (Cambridge: Cambridge University Press, 1991).

supported in peer-production situations. "A person's intentions to learn are engaged and the meaning of learning is configured through the process of becoming a full participant in a sociocultural practice. This social process includes, indeed it subsumes, the learning of knowledgeable skills."[81] Similarly, Dewey's writings in *School and Society* are both relevant and helpful in thinking through the dynamic possibilities within maker programming.[82] He points to the tension between individualism and socialism within the education system that I have noted in maker cultures. He does not see them as mutually exclusive, however, but as possibly informing and being read through one another, as an entanglement of values that sustain each other in that tension. "Here individualism and socialism are at one. Only by being true to the growth of all individuals who make it up, can society by any chance be true to itself."[83]

This sentiment might seem to match directly the Maker Movement interest in the lone inventor and individualistic tendencies. But this would be a misinterpretation of Dewey. He is focused on the communal doings of education and society building, and speaks to group work as an ideal in how to learn. "Helping others, instead of being a form of charity which impoverishes the recipient, is simply an aid in setting free the powers and furthering the impulse of the one helped. A spirit of free communication, of interchange of ideas, suggestions, results, both successes and failures of previous experiences, becomes the dominating note of the recitation."[84] Thus, Dewey argues that education should be situated in everyday practice as well as community needs and dynamics in a collaborative sense.

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[81] Ibid, 29.
[82] John Dewey, *The School and Society* (Chicago: University of Chicago Press, 1915).
[83] Dewey, *School and Society*, 3-4.
[84] Ibid, 13.

In her work on engaged pedagogy, bell hooks theoretically pushes this need for communities to transgress boundaries and work across difference in educational settings. Recognizing that no education is politically neutral, hooks plays up the need to critically examine learning practices in an iterative and reflexive process, that at times might be uncomfortable. This connects to Murphy's work which takes issue with care and points to the meaningful politics revealed by different evocations of discomfort in technoscientific research and practice – to give voice to concerns and not gloss over the violence that might be enacted in the name of care. By making space for discomfort and difficult subject-matters, hooks takes a different approach to creating community and understanding. "Rather than focusing on safety, I think that a feeling of community creates a sense that there is shared commitment and a common good that binds us."[85] The implication is to confront the awkwardness, discomfort, and issues of marginalization head on, or no progress will be made. This is tricky to enact constructively and respectfully. Particularly when many practitioners, artists, activists, and scholars of gender studies and race studies have come to recognize that sometimes setting boundaries and playing with forms of separatism in the realm of identity politics can be fruitful for empowerment of marginalized groups. Hooks even suggests this possibility as an initial tactic for breaking with dominant rhetoric.[86]

Historicizing the power and possibilities for emotion in education, in *Feeling Power: Emotions and Education,* Boler explores discomfort and unease in the classroom. She destabilizes assumptions and resituates practices on an intimate scale, instead of recapitulating dominant assumptions and norms. Boler emphasizes "'collective

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85 hooks, *Teaching to Transgress,* 40.
86 Toupin, "Feminist Hackerspaces," 2014.

witnessing' as opposed to individualized self-reflection" as a way of creating communities that speak to each other through difference and acknowledgment and mutual responsibility.[87] Instead of individuated consciousness-raising, the group dynamic brings participants into action with one another, and if one brings material practices and technological agency into the mix, accountability in regards to material publics and their effects could push fruitful pedagogical practices into the realm of productive critique.

For Boler, the act of 'becoming' that education so often proffers is collective and social, much as Lave and Wenger explicate in their work on situated learning. "A pedagogy of discomfort, then, aims to invite students and educators to examine how our modes of seeing have been shaped specifically by the dominant culture of the historical moment."[88] Henri Giroux also highlights the importance of responsibility regarding pedagogy and participatory cultures. Political pedagogy connects understanding with the issue of social responsibility and what it would mean to educate students not only to engage the world critically but also to be responsible enough to fight for those political and economic conditions that make its democratic possibilities viable.[89]

Taking critical pedagogical practices into the material realm of making, hacking, and fabricating has foundations in the work of Seymour Papert, who was influenced by Jean Piaget's "constructivism." Constructivism focused on the different developmental stages of children and considered their individual directions and means for world-making and description – it is grounded in the belief of their agency and resistances to education. Paolo Freire played on these themes extensively through his work on consciousness-

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[87] Boler, *Feeling Power* 176.
[88] Ibid, 179.
[89] Henry Giroux, "Cultural Studies, Public Pedagogy, and the Responsibility of Intellectuals," *Communication and Critical/Cultural Studies* 1, no. 1 (March 2004), 59-79.

raising with adults, and the importance of entering into educational settings as subjects, not objects.[90] According to Freire, students must instantiate their consciousness through praxis. "Freire has had to remind readers that he never spoke of conscientization as an end itself, but always as it is joined by meaningful praxis," where praxis is action and reflection upon the world in order to transform it.[91] Through praxis, people can confirm what they know in consciousness.

Feminist and engaged pedagogy raise questions concerning skill-sharing and knowledge production standards – particularly in terms of the ideologies and power relations embedded and reproduced in different educational forms. They typically focus on formal institutional practices and do not look deeply or question material practices and tacit knowledge production. Hooks and Freire alike assert that consciousness must follow through to praxis, or reflexive action, but instantiations of praxis within technical material development is not further explored. Instead, action is explored in the form of protest, speech-acts, and informed every day tactics, which are invaluable, but do not get to the root of the maker or hacker practices explored in this dissertation. Important work within the realm of feminist technoscience critique adds an important facet of criticality to bear on material and design practices, particularly in technology development. Such theories regarding the practice of technology design are under-examined, thus, the process of technology development and use needs to be further explored through a feminist lens.

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[90] Freire, Paulo, *Pedagogy of the Oppressed* (New York: Herder and Herder, 1970).
[91] Hooks, *Teaching to Transgress,* 47.

Feminist Technoscience and Design

Dominant trends within feminist design literature have focused on gendered uses of technology in the home and within fashion, particularly on advertisements and consumer goods geared towards women, rather than any creative shaping process women might have had in the mechanism of design.[92] Feminist design narratives have also focused on architectural design and spatiality, particularly in the context of the home and the "man-made" environment.[93] However, some compelling accounts are explored by feminist historians, who focus on alternative historical trajectories in the shaping of gender and various technologies.

Both Michelle Martin and Miriam Glucksman write about the often hidden role of women in shaping technology design – Martin through a deep analysis of the role that female operators had in shaping the Bell Telephone System and Glucksman in looking at women assembly line production practices during WWII in Great Britain.[94] Meanwhile, Ruth Schwartz Cowan reveals the alternative narrative of how household appliances created more work for women in the home and delves into the issues of household labor.[95] These works provide alternative histories and accounts of design, but still focus primarily on women as consumers.

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[92] See Nigel Whitely, *Design for Society* (London: Reaktion Books Ltd, 1993).; Adrian Forty, *Objects of Desire* (New York: Thames & Hudson, 1986).

[93] For spatiality see Joan Rothschild ed. *Design and Feminism: Re-Visioning Spaces, Places, and Everyday Things* (Rutgers, NJ: Rutgers University Press, 1999).; For home and the "man-made" environment see Leslie Weisman Kanes, *Descrimination by Design: A Feminist Critique of Man-Made Environment* (Urbana-Champaign: University of Illinois, 1994).

[94] Michele Martin, *Hello, Central? Gender, Technology, and Culture in the Formation of Telephone Systems* (Montreal: McGill-Queen's University Press, 1991).; Miriam Glucksman, *Women Assemble: Women Workers and the New Industries in Inter-war Britain* (New York: Routledge, 1990).

[95] Ruth Schwartz Cowan, *More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave* (New York: Basic Books, 1983).

Departing from these historical accounts are literatures that explore women's direct involvement in design processes – or their difficulties in establishing themselves in that process. In *Gender and Technology in the Making,* Cynthia Cockburn and Susan Ormrod follow the artifact – in this instance the microwave oven – to illustrate gender formation and gendered divisions of labor.[96] They demonstrate that the technology is informed by the social – and the interactions and structures therein – while also maintaining that technical practice and design narratives end up reinforcing gender stratifications. In order to do this, Cockburn and Ormrod examine the gender dynamics within creation, design, selling, and use of a product. While both women and men played important roles in microwave development, men were labelled "engineers" and women were categorized as "home economists" in an atmosphere where men's work was upheld as more important due to its technical "rigor." Cockburn and Ormond brought a feminist perspective to women's roles in product design prior to artifact use and consumer practices.

As articulated by Liz Henry, this gendered structuring or division of labor plays out heavily in hacker culture in terms of what is considered technical or important knowledge:

> When we [women] know something deeply technical about materials and invention, then it gets gendered as something women do and therefore as not "counting," as trivial. When we demonstrate knowledge about domains that are male-dominated, we are treated as intruders or impostors.[97]

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[96] Cynthia Cockburn and Susan Ormrod, *Gender and Technology in the Making* (Thousand Oaks, CA: Publications Ltd, 1993).

[97] Liz Henry, "The Rise of Feminist Hackerspaces and How to Make Your Own," *Model View Culture,* February 3 2014, accessed July 1, 2015, https://modelviewculture.com/pieces/the-rise-of feminist-hackerspaces-and-how-to-make-your-own.

Women and minorities have played (often forgotten) roles in technology design processes, imparting useful knowledge and skills for creating the built world.

Some design literatures look at alternative design practices and education for rethinking how design happens in the context of gender (and other) inequities. Randi Markussen delves into current cooperative design methods and practice, emphasizing alternative ways of understanding the political nature of design.[98] Through recognition of multiple perspectives, she demonstrates their potentials for both developing the technology and for deepening an understanding of the politics of intervention in design.

Linda Layne and Frances Bronet's chapter, "Teaching Feminist Technology Design," in the *Feminist Technologies* anthology helps to situate interventionist feminist hacking and design practices.[99] They seek not just to look at the technologies, but also at the methods and practices of design at the table. "We do not want to sit back and offer post facto critiques of new technologies but want to intervene proactively to influence design."[100] Feminist lenses can shed light on pathways for how formal engineering and technology-based design infrastructures may be reformulated to increase inclusion and accessibility. What exactly does designing for gender (and class and race, etc.) equity mean? In an homage to Langdon Winner's *Do Artifacts have Politics,* Layne calls upon design capacities for "figuring out 'how we can design artifacts to change gender'" and practices around gender equity. Feminist methodologies are starting to find their way into design practices such as Shaowen Bardzell's work on Feminist HCI, Markussen's

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[98] Randi Markussen, "Politics of Intervention in Design: Feminist Reflections on the Scandinavian Tradition," *AI & Society* 10 (1996): 127-141.

[99] Linda Layne, L, Sharra Louise Vostral and Kate Boyer, ed., *Feminist Technology* (Urbana-Champaign: University of Illinois Press, 2010).

[100] Ibid, 179.

interventionist analysis, and even in Layne and Bronet's work on design education interventions.[101]

Feminist critiques of technoscience advocate for and with populations that have been trivialized by technoliberalist accounts in the making of knowledge societies. Interested in building an incisive Feminist Science Studies (FSS), Kirsten Campbell reasons that social scientists must push deeper and in more nuanced ways to enact critique and reconstructivist engagements of technoscientific practice. Attention to these aspects of knowledge creation, dissemination, and transformation complement Haraway's situated knowledges. More recent feminist technoscientific critiques, such as those from Michelle Murphy, as well as Aryn Martin, Natasha Myers, and Ana Viseu, can also shed light on the politics of comforts, discomforts, boundaries of expertise, empowerment activities, and care involved in the development and use of technoscience and attempts at equity.[102]

While the exploration of care in feminist scholarship is contentious due to previous simplifications and theorizations of caring as "feminine," Murphy, Martin, Myers, Viseu, de la Bellacasa, and other feminist technoscience scholars are working to change this narrative. In particular, they are interested in exploring the politics behind care practices, with the recognition that care can enact violence. Precursors to this work include Virginia Held and Joan C. Tronto, who first grappled with debates about justice versus care and implications for morality. While care practices have been long attributed

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[101] Layne and Bronet, "Feminist Technology," 191.; Shaowen Bardzell, "Feminist HCI: Taking Stock and Outlining an Agenda for Design," in *Conference Proceedings for CHI 2010: HCI For All*, Atlanta, Georgia, April 10-15 2010.

[102] Michelle Murphy, "Politics of Care."; Aryn Martin, Natasha Myers, and Ana Viseu, "The Politics of Care in Technoscience," *Social Studies of Science* 45, no. 5 (2015): 625-641.

to labor involved in parenting, medicine, teaching, and hospitality industries, Held

proposed it should be taken up in other realms where practices of care and its different

forms had serious implications, but were made invisible. One such sector is that of

technoscience and technology-based design, within which Murphy and de la Bellacasa

have demonstrated it has an important role for unpacking politics, different types of

comfort, discomfort, and the violence research can enact in the name of "care."

Other political implications, stratifications, and marginalization have been

examined through explorations of the reproduction of power relations that technology

might enable. Feminist scholars, such as Virginia Eubanks and Donna Riley, have

revealed that it is not the digital divide that prevents diversity in design practices, but the

very way in which technology development is systematized in preference of specific

initiatives, methods, and outcomes. Eubanks explores these issues in her work to create a

technology center at a YWCA chapter, where she is met with the realization that

minorities, the poor, and women have access to technology and technical knowledge, but

it presents itself in ways that are inhibiting and controlling.[103] In her work on critical

engineering studies, Riley explicitly incorporates feminist theory with engineering

education, bringing this work to bear on liberatory pedagogy, but in a formal setting.[104]

She explicates the need to completely rework the system of pedagogy in order to create a

classroom setting that questions dominant frameworks within the engineering field,

presenting her students with alternative histories, and real-world applications of their

knowledge towards sustainable and socially-conscious engineering. While Riley's work

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[103] Virginia Eubanks, *Digital Dead End: Fighting for Social Justice in the Information Age* (Cambridge: MIT Press, 2012).

[104] Donna Riley, "Employing Liberative Pedagogies in Engineering Education," *Journal of Women and Minorities in Science and Engineering* 9, no. 2 (2003): 137-158.

might have also been grouped in liberatory pedagogies, I have included it here as her

work is in the feminist mindset of disrupting hierarchical power relations and particularly

in the realm of technoscience.

The ways in which my case studies focus on localized knowledge, collective skill-

sharing strategies, immediate community values, and different ways of engaging

technologies – such as story-telling and embodied practice – have connections to feminist

epistemologies, alternative pedagogies, and "situated knowledges."[105] My interest in and

engagement with the conceptual work that Boler has done on a pedagogy of discomfort

as well as situated genealogies of experience, Murphy has done on the politics of care,

and Haraway has done with situated knowledges and diffraction helps to clarify the

critically-engaged nature of my field sites. Such theory is especially pertinent for parsing

out knowledge-making practices, cultures, and designs which enable different forms of

inclusion, accessibility, and empowerment.[106]

Literature Review Conclusion

Against the backdrop of these three groups of literature, this research project contributes

to questions in STS regarding how knowledge is shared, the politics involved in

technoscientific practice and dominant discourse framing, politics of care practices, and

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[105] For feminist epistemologies see: Donna J. Haraway, "Situated Knowledges" in *Simians, Cyborgs, and Women: The Reinvention of Nature* (New York: Routledge, 1991).; Sandra Harding, "Rethinking Standpoint Epistemology: What Is 'Strong Objectivity'?" In *Feminist Epistemologies*, eds. Linda Alcoff and Elizabeth Potter (New York: Routledge Press, 1993).; For alternative pedagogies see: bell hooks, "Engaged Pedagogy," in *Teaching to Transgress* (New York: Routledge, 1994).; Megan Boler, *Feeling Power: Emotions and Education*, (New York: Routledge, 1999).

[106] For diffraction see: Donna Harway. *Modest_Witness@Second_Millennium* (New York: Routledge Press, 1997).; Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Durham: Duke University Press, 2007). For genealogies of experience see: Boler, *Feeling Power,* 1999. For hetereogenous narratives see: J.K. Gibson-Graham, *The End of Capitalism As We Knew It* (Minneapolis: University of Minnesota Press, 2005).

how comfort and discomfort shape epistemic cultures. These texts will help to look deeper into practices employed by critically engaged groups, while giving a sociocultural mapping of the physical as well as theoretical, methodological, and mental space they take. These literatures frame the tactics and cultivation of heterogenous technology-based cultures on the margins of the Maker Movement. They also form a basis through which to assess and problematize maker claims of inclusivity, accessibility, and empowerment. In researching the practices of marginal groups within the Maker Movement, I extend and push these literatures to develop an analysis that gives greater context to what sustains these cultures, and how they might eventually effect formal policy and infrastructure.

CHAPTER THREE: DOMINANT DISCOURE AND THE TECHNOCENTRIC
REGISTER

"It's 2026 and the Maker Movement has failed. Why?" In October of 2016 this question

was posed to the keynote panel at the FabLearn conference at Stanford University in San

Francisco, California. Comprised of educators Erica Halverson, Rich Halverson, as well

as Piaget and LOGO collaborator Edith Ackermann, the panelists took aim at the very

formation and underlying frame of Maker Movement rhetoric and programming. In their

answers, both Erica Halverson and Ackermann critiqued the dominant frame of STEM-

centric educational programming. Ackermann argued that the basis of the Maker

Movement, and subsequent funding and programming development practices, are at their

very root techno-liberal and problematic – the crux of the matter being with those who

branded the Maker Movement.

> The people who started the Maker Movement, started it as if the act of
> making had not existed before. As if tinkering, hands on activities, active
> learning, the art of tinkering, […] had no precedence even in the fields of
> education and psychology. […] It came in, orchestrated by a series of people
> who actually come from a very specific tradition of Computer Science […]
>
> And I think one of the reasons why the movement fails […], is it is a very
> limited view of what is going on in the creative process. […] Debugging is
> a word that comes from [Computer Science]. It means trial and error.
> Debugging is: if what I get is different from what I expected, […] I have to
> debug, I have to fix it and get better. And what I believe, is that there are
> many different ways, very different ways in which people engage in these
> activities of making, that are not at all […] based only on this computer
> science and engineering version of how you engage in the process of getting
> to know more about what you don't know yet.[107]

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[107] Edith Ackerman, FabLearn Conference, Stanford, San Francisco, California, October 12th, 2016,
author's own transcription, accessed May 3rd, 2017,
https://edstream.stanford.edu/Video/Play/a33992cc9fb2496488c1afa9b6204a571d.

As the very nature of the overarching culture involved in the FabLearn conference signified, the 'maker' concept is increasingly being applied in educational settings such as schools, libraries, and youth projects. Maker groups often hope to instantiate a 'community of practice' by highlighting the social and communal dynamics to learning.[108] However, despite this potential for community-centered education through making, as Ackermann problematizes, many maker education initiatives have an instrumentalist approach which focuses on individualistic, results-based, and techno-centric measures.

The problematic that Ackermann identifies, and that I have further observed, is particularly apparent in the Manufacturing Experimentation and Outreach (MENTOR) program, funded by The Defense Advanced Research Projects Agency (DARPA). In an enthusiastic blog post to the *Make: Magazine* website on January 19th, 2012, Dale Dougherty explains how the program will establish makerspaces in a pilot program of ten classrooms in California, with the hope to expand to hundreds across the US.[109] Certainly, the access to hands-on tools and fabrication processes is exciting for schools that might not have many material resources otherwise. Yet, project-based assignments were focused on competition, and a militaristic-mindset toward technological knowledge and efficiency, which included making robots that could launch projectiles.[110] It shapes the creativity and interests of the students in a technoglobal register that does not speak to their immediate, local communities' needs. Specifically, it shuts down the unfoldingness of the problem-space by fore-fronting a competition-based and militaristic project needs

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[108] Lave and Wenger *Situated Learning*.

[109] Dale Dougherty, "DARPA Mentor Award to Bring Making to Education | Make:" *Make: DIY Projects and Ideas for Makers*, accessed May 25th, 2017, January 19, 2012. http://makezine.com/2012/01/19/darpa-mentor-award-to-bring-making-to-education/.

[110] "Manufacturing Experimentation and Outreach," accessed May 15th, 2013, http://www.darpa.mil/program/manufacturing-experimentation-and-outreach.

– shutting out diverse possibilities with different value systems. The MENTOR program

implies that the US military, government, and corporate entities are interested to engage

the Maker Movement as a way to recruit an upcoming cadre of globally competitive

innovation and weapons development engineers. This is really nothing new and not

surprising given the promise of creativity within the Maker Movement. But the way in

which "making" is characterized in this program goes beyond a lack of community

engagement.

I would like to add to this argument that maker culture, in its dominant frame, is

also based upon the culturally reinforced, and oft misleading, mythology of the lone

genius inventor or scientist, which is further solidified by educational initiatives such as

the MENTOR program, magazine covers of *Make*: Magazine, and visual depictions of

DIY projects on the RadioShack website and within the *Instructables* online community.

This cultural myth often gives exclusive preference to technically-savvy demographics

and reinforces cultural norms around who can take part. This is also the case with

invitations to the White House Maker Faire, which are often geared to reward individuals

with the digital-tech and engineering drives and skills instead of opening up new interests

or collective attitudes toward change and technology-based development. Historically,

while science fairs and contests have been based upon rhetoric of individualism, in

practice there is a widely networked and strong community effort pushing and helping

individuals.[111]

Such a rhetoric also shows up in the promise of the Maker Movement to create

individualistic, tech-oriented entrepreneurs and STEM laborers. In a 2011 presentation,

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[111] Ruth Oldenziel, "Boys and Their Toys: The Fisher Body Craftsman's Guild, 1930-1968, and the Making of a Male Technical Domain," *Technology and Culture* 38, no. 1 (1997): 60-96.

Jim St. Leger of Intel's Embedded and Communications Group outlined the importance of makerspaces and cultures. He described corporate presence at Maker Faire: "The corporate world is taking notice, Google is there, HP is there, Microchip, one of our semi-conductor competitors in embedded is there, guess who is not there [?] … Intel, and that is unfortunate."[112] In the drive to increase STEM literacies, according to Jim St. Leger, makerspaces diffuse the skill-sets and incubate the bottom-up innovations that employers need in a globally networked world.

One place where the dominant discourse of corporatization in the Maker Movement propagate the lone genius and narrowing mindset of technoliberalism is *Instructables.* According to their website, the social networking site "is a place that lets you explore, document, and share your creations" with other individuals.[113] This scale of creating traverses the expanse of home repair, pet needs, baking, cooking, circuitry, toys, dress-making, and so on ad infinitum. While I have done a more comprehensive discursive analysis of *Instructuables* in unpublished materials, in the interest of my main empirical work, I am using this brief chapter to merely set the stage and give a small snapshot into the reproduction of cultural norms that I have seen across many different media outlets and technoliberal discourse.

As Ackermann argues, baseline instigators of the Maker Movement are always debugging towards the "best end" instead of focusing on the journey, letting things develop and unwind in the creative process. Following this line of argument, I will point to how mainstream Maker Movement discourse downplays the role and possibility for a

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[112] Jim St. Leger, speech, "Intel and the Maker Movement," transcription author's own, accessed May 15th, 2013, https://www.youtube.com/watch?v=jwHcMpEZVGg.

[113] "About Us," *Instructables,* accessed April 14, 2013, http://www.instructables.com/about.

more socially engaged and truly collective enactment of technological expertise. I would

also like to point to the liberatory technosolutionism they place upon equipment such as

3D printers and otherwise to enact dimensions of accessibility, inclusion, and

empowerment, while downplaying the sociocultural underpinnings and politics therein.

Instructables: The Great Make

Image 3. 1. *Instructables* homepage with search bar.

The homepage of the *Instructables* website itself is telling — of an implicit structure and

dominant discourse which has appropriated the appropriators, bringing the subversive

back into the hegemonic fold from which it may not have strayed far in the first place.

RadioShack component parts are strewn about. A set of young, white, possibly male

hands are hard at work discerning and tinkering with key components toward innovation

and invention. S/he is alone. Here, we glimpse that moment of action where the idea

becomes real, the virtual plan becomes the physical object. Here is the moment of

'making.'

Meanwhile, an advertisement for a competition held by RadioShack heralds,

"Piece by piece we are making a movement." This is the battle cry of *Instructables*. It

speaks to Freire's own conception of praxis toward revolution as relying not only on

action but on a critical mindset.[114] In this instance the critical, consciousness-raising aspect of the revolution is not there. Making is revolutionary. It is a movement, establishing that the act of making is liberatory and everyone should join. Yet what are people typically making? How does empowerment manifest within these objects and physical projects, and what form of empowerment is it? In this corporate framing, it becomes a grand marketing scheme of what was once DIY empowerment.

It is relevant to consider these issues when examining the meta-structure of the *Instructables* website and how it illustrates a particular register of the dominant discourse, while at the same time trying to create a façade of a subversive act. It is selling and catering to a crowd that considers itself outside of the normative framework, but through analysis one can see how neatly it folds back into the dominant registers of capitalism, consumer culture and male-dominated technical tinkering. *Instructables* as an object is an indicator of a major discursive shift that reveals a tension within hacker and maker communities. This is the desire to be open-source and anti-authoritarian and to value community over and above underlying (and sometimes blatant) capitalist desires channeled into innovation and entrepreneurship. Within the rhetoric or register of DIY and 'maker' culture is a myriad of discursive repertoires that ebb and flow, coexisting at some moments and at odds in others. *Instructables* lies at a nexus of various repertoires, and may well indicate tension or change within the DIY register.

From its inception, Maker Movement branding has refocused what 'making' and 'hacking' means on the terms of the dominant narrative. RadioShack's involvement in the Maker Movement reflects this as well as DARPA's explicit funding of the MENTOR

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[114] From Freire's *Pedagogy of the Oppressed* which talks about the importance not only of action in revolution, but critique and thought. Without the two, the revolution/movement is null.

programming in high schools.[115] By embracing the movement, these powerful entities

have a say in what the movement can mean and do. They have a stake and control in

what comes out, what is innovated, what is hacked into new ways of being, what is

printed at low cost and crowd-sourced. Thus, these issues take a colonial or post-colonial

turn in that the manufacturers want to envision or recreate the Makers and maker

communities in their own image. This is promoted through RadioShack, the MENTOR

program, and the *Instructables* website itself, which runs promotions and competitions

through RadioShack and TechShop.[116] By reconsidering and defining the "other" in terms

of themselves, businesses and product manufacturers are in turn being heavily influenced

by the Maker Movement and culture. They are in a sense transforming their self-image to

follow along with what the consumers as 'makers' want and desire. This results in a

general focus on the global economy and the fostering of innovations that are competitive

on the macro scale, as opposed to being helpful within local communities. This is an

issue as it leaves out marginalized groups that are often negatively affected by and left

out of technoscientific practice. Yet, there is a push against this tendency as local makers

and crafters work to create local technologies and entrepreneurship within their own

communities.

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[115] This is the initial solicitation by DARPA for the MENTOR program. Note, the emphasis on creating a "cadre" of next generation engineers who are attuned to a prize-based system. https://www.fbo.gov/index?s=opportunity&mode=form&id=0248c338123e8b6f51d4dcf743196464&tab =core&_cview=1.

[116] TechShops are considered the private gyms of Makerspaces. They are a chain started in Melon Park, California with a focus on fabrication that is less about subversion and hacking than about visualizing a small business or further building out an invention. http://www.techshop.ws/. On the Instructables website there are various competitions open to the community that promote innovation through a prize structure, much like one that DARPA wants to promote in their MENTOR program, which has interesting connotations. http://www.instructables.com.

Corroborative with this image are similar discursive narratives found in US government documents, Maker Faire promotion and website, in the makerspace playbook library edition, and maker educational programming that focus on a particular mindset for engaging the learning subject. At the same time, it implicates and elucidates the reality that 'makers,' 'hackers,' and DIY enthusiasts have always had to be part of the dominant discourse – they cannot exist from without it as it affects their actions and intentions. Even in trying to break from it, they define their actions in the terms of those setting the frame and producing the dominant discourse, which gives further power to its existence. Even as 'makers' struggle to establish themselves as agential entities taking hold of their own labor, that work is quickly subsumed into the corporate register which reinscribes their work in the form of advertising and the promise of a DIY entrepreneurial dream.

So, what does it mean to take part in the Maker Movement, especially from the margins? In her answer to the Maker Movement fail provocation with which this chapter opens, Halverson points to the telling of marginalized doings, knowledges, and relations – of erased or hidden narratives.

> The Maker Movement has failed because we have not acknowledged the big tent under which it exists. And we have failed by continuing to promote the idea that making is something that is very specific, that involves specific forms of technology, specific ways of producing, and specific ideas of about what counts as innovative. And I think there are certainly people within this community, and certainly the theme of this conference is around making the tent bigger, or acknowledging that the big tent is already there.
>
> Making the tent bigger implies that we have to create ways to be more inclusive -- rather than acknowledge that inclusivity is possible because this

range of ways of doing and being and valuing and seeing that encompass the Maker Movement, already exist.[117]

Like Halverson, I agree that there are different "ways of doing and being and valuing and seeing" that are already part and parcel of what is involved in maker spaces, practices, and the epistemic cultures therein – that create a heterogeneity rather than a hegemonic narrative. What I further argue is that such practices are systematically marginalized due to a technocentric and technoliberal register within the dominant discourse which harbors deeply entrenched inequity, and the mechanisms of marginalization need to be corrected before they can be merely recognized. The rest of the work in this dissertation is intended to establish and recognize ways in which to disrupt such marginalization and cultivate heterogeneous narratives with attention to the politics of care taken on by obscured registers. I reveal other dimensions and cultures that exist within or at the margins of this "big tent," and how they establish their own epistemic cultures toward alternative pathways.

The technocentric and technoliberal registers in the dominant discourse, as I have described, structure a Maker Movement which focuses on liberatory tools and technologies to enable accessibility, inclusion, and empowerment toward a democratization of technology. The reality is that such discourse is a mechanism of exclusion, attuning us to see certain practices as fitting in and others as non-relevant. In a way, they mask non-aligning practices, hence marginalizing them. However, an analysis attuned to care, as well as associated comforts, discomforts, and the politics of care, reveals a more nuanced narrative for the cultivation of accessibility, inclusion, and

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[117] Erica Halverson, FabLearn Conference, Stanford, San Francisco, California, October 12th, 2016, accessed May 3rd, 2017, author's own transcription.
https://edstream.stanford.edu/Video/Play/a33992cc9fb2496488c1afa9b6204a571d.

empowerment. It sensitises the concepts to relations of care rooted in relationships, networks, collectivity, and dispersed expertise; in support systems and mechanisms that are developed iteratively and in conversation with the communities which they serve or with which they are trying to shape, grow, and sustain. In what follows, I will parse through my empirical work on the organizational structure, micro-interactions and personal dynamics of the groups and spaces with attention to the politics behind different instantiations of care, comfort, and discomfort – while keeping in mind the dominant discourse with which they contend.

CHAPTER FOUR: FEMINIST HACKER COLLECTIVES

Introduction: "What do I have to do to feel legitimate in this space?"

While the subtitle of this section of the chapter could have easily come from an

experience that any one of my feminist hacker interlocutors had in a more male-

dominated hackerspace or in technology-based industry, it did not. Instead, this utterance

came from one of the staff members at the Washington, DC Public Library Fab Lab,

which is attuned to inequities and centers their practices on providing accessibility across

gender, race, and socio-economic class.[118] They are not a male-dominated hackerspace in

the classical sense, and have their own space within the library – equipped with digital

fabrication tools, hand tools, sewing machines, and space set aside from the otherwise

quiet nature of the library.[119]

Her story reveals a glimpse of pervasive and deep-rooted biases regarding gender,

diverse types of expertise, and women's roles and knowledges; of female-identifying

people being understood as non-specialized or unimportant – thus undervalued and

underpaid. These issues within the librarian profession are taken on directly by Roma M.

Harris and tangentially by Martin, Glucksman, and Light who have researched the roles

that women have had in shaping the telephone system, working on WWII assembly lines,

and as analog human computers.[120] In these cases, the influential role of women within

technology shaping is erased, and so these critical historical analyses make visible

[118] As one of my field sites for the next chapter, I will introduce and explain the DCPL Fab Lab in more detail later.

[119] This space, its location within the library, and issues of inclusion, accessibility, and empowerment will be more fully tackled in the proceeding chapter on library makerspaces.

[120] Harris, Roma M. "Gender, Power, and the Dangerous Pursuit of Professionalism." *American Libraries* 24, no. 9 (1993): 874–76.; Martin, *Hello, Central?;* Glucksman, *Women Assemble*; Light "When Computers Were Women."

alternate accounts by reframing technology production narratives. This is still an issue

within dominant technology and design narratives, as revealed by Weisman's work on

the "man-made" environment – an issue of gendered built environments that has

relevance when considering the infrastructural design of maker and hackerspaces. In

response to such structures that reproduce power relations, feminist hacker collectives

have created an alternative narrative. This involves a different epistemic culture with

practices, intentions, innovations, and connected networks that are focused on collective

care as opposed to the lone inventor trope. In this chapter, I establish the ways in which a

frame of caring relations in technology-based practice creates different patterns of

accessibility, inclusion, and empowerment.

Mel, who made the comment, had overheard an interview I was conducting with a

male-identifying staff-member at the DCPL Fab Lab. She was particularly affected by the

way in which her colleague, Andrew, talked about gender within the space.[121] He was

reflective and certainly critical of overarching bureaucracy and practices within the Fab

Lab, but there were certain aspects of it for which his understandings of the situation

came from a very particular positionality. He related that gender was pretty much a non-

issue – that there was general equity and parity in relation to gender dynamics and

distribution within the space. He also related that he was able to amicably diffuse any

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[121] Although some of the interviews I conducted were able to take place in more private basement rooms, the staff generally needed to be in the Fab Lab for work, and it had made sense during my observations and research to interview them there while they worked on other projects or supervised the space. It was not ideal, but it was the best outcome for the current circumstances. More often than not, no one else was in the Fab Lab, but this time Mel had also been scheduled to be off desk and get work done in the Fab Lab, so overlap occurred. I had been nervous about this – I did not want Andrew to feel like he couldn't speak openly about his own experiences or thoughts. I found that he had no trouble in that regard and neither did Mel.

tensions in relation to sexist attitudes among patrons before they progressed or went beyond small misunderstandings.

After overhearing her male colleague talk about the gender equity and dynamics in the space, Mel felt the need to step in and make her own experiences of belittlement and frustration known. Within Andrew's micro-interactions or handlings of certain patrons, she felt that another experience of the story was being made invisible. With a background in organizing and social work, Mel did not have much in the way of technical expertise when she started, and felt self-conscious in the heavily technical Fab Lab. It was intimidating. Mel told me that she worked hard to hone her skills, though, and to establish herself within the space, building her own confidence, knowledges, and skills so as to better lead information sessions and workshops. It had worked to her benefit since she was now an expert on the laser-cutter and ran most of the laser-cutting jobs for the library, designing many things for their store as well as for her own Etsy business.

Mel related to me the committed work she had gone through to get to this level of confidence – only to have it questioned time and time again by several male patrons, one in particular. During, a more recent introductory workshop that Mel led on the laser cutter, this particular patron was using the space in parallel. He decided to jump in and offer supporting information, but in a way that insinuated Mel was leaving things out. It was deeply frustrating for Mel, because the information he kept interjecting with were points she was prepared to present in the next part of her lesson. He was not giving her the time and the space to teach on her own terms. Not only did she feel that he was making assumptions about her ability to teach, but also about her knowledge of the subject-matter at hand.

In order to build the confidence to feel comfortable about her role in the Fab Lab,

Mel had faced her own personal barriers of intimidation and *imposter syndrome*, only to

be brought down by someone else who refused to acknowledge her own authority or

expertise on the subject matter. She has since observed a gender-bias within this

interaction. Mel was present when that patron watched Andrew give the same laser cutter

workshop with no interruptions – a telling outcome since his presentation used the exact

same slides and information as hers. "I guess it's because I look young," she related in

half resignation, half frustration. In final indignation she exclaimed, "I mean, what do I

have to do to feel legitimate in this space?" Her exclamation speaks to how the dominant

culture regarding technology and gender biases finds its way into dispersed local cultures

where there are not mechanisms to actively prevent it. While Mel felt she had to

empower herself to then empower others in the space, tech-oriented staff – typically men

such as Andrew and another staff member Dan – felt they only had to work to empower

patrons.

In solidarity and to help Mel know that she is not alone, I proceeded to relate a

similar story during a soldering workshop I led at the Tech Valley Center of Gravity

(TVCOG), a makerspace in downtown Troy, New York. A male member of the space,

who was present but not part of the skill-sharing session was perturbed by how I was

running the course. Whereas I talked about diverse practices of soldering and the

numerous ways of joining circuits for different situations, he related that there were very

clear best practices and only one right way to do it – the way that he proceeded to share.

While at first frustrated and intimidated by this interjection, I decided to engage the

member to share his expertise. It was my way of defusing the situation, and also factored

into the practice that I had of asking everyone to share their previous, situated expertise on the subject. I was worried he might create an atmosphere of intimidation, preventing others from deeper exploration and sharing of the different knowledges and experiences they had, but we worked through the interjections as a group. We proceeded to have an open discussion while making, a playful and light-hearted workshop.

In both situations, issues regarding gender dynamics in terms of particular forms of expertise play a role – problematic phenomena long recognized in the fields of engineering and technology development. According to Riley, Light, Layne and Bronet, as well as many other scholars looking at the co-construction and interplay of gender and technology, methods of intimidation are common in science, engineering, and technical practice.[122] This boundary-making and intimidation often enables the erasure of how minorities have helped to shape technology-based design and the weeding out of diverse ways of thinking and knowledge practices. In part, these methods of asserting power demarcate dominant boundaries of technical expertise, boundaries that have been contested by social scientists studying the influence and complexities of public engagements of science and technology.[123] The ways in which dominant culture bounds expertise preferences some knowledges over others, and thus technoscientific cultures often cut out and downplay the influence of different perspectives and standpoints. The power exercised in the examples above entailed illegitimate exclusions of non-dominant but still legitimate forms of expertise. The objecting individuals tried to normalize and shape technology-based practice to fit the dominant frame, because otherwise would

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[122] Riley, "Employing Liberative Pedagogies."; Light, "When Computers Were Women."; Layne et al., eds., *Feminist Technology*.
[123] Gieryn, "Boundary-Work."

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entail a shift in power. This brings me to the *difference* between these two scenarios. I somewhat defused the situation by asserting that this other way could exist, along with the many other scenarios we were discussing. Thus, the acknowledgement that there might be best practices for different contexts, scenarios, communities, and so forth. This led to an opening up versus a narrowing due to the way I designed the workshop. However, I was not having to lead a pre-developed slideshow.

The reactions of both men in these two situations contributes to the reproduction of larger sexist, exclusionary practices. These two moments demonstrate a perpetuating problem within much of technoscientific development and STEM educational experiences, supporting Ackermann's problematic of the narrow framing of making. It also invokes a harsh reality that comes up time and again for women and minorities in tech-oriented spaces who often fill roles in specialized fields that are taken for granted, typically in the realm of maintenance – of systems, of information, of infrastructure, and of the home. It is in the very culture and framing around women as having to legitimize their contributions and work against dominant narratives which casts their roles as unimportant, undervalued, or unknowledgeable. The problem of "what do I need to do to *feel* legitimate" is in the feeling – in the being made to feel othered, to feel cast as not holding important knowledge unless it is of the traditionally technical sort, unless it is the *right* technical knowledge.

According to my interlocutors, and my own research, this dominant cultural framing—in which femininity, alternative knowledges, and diverse ways of thinking or doing are unimportant--is a main driving force behind the formation of feminist hacker collectives. For many years, women in the technology industry have played by the rules

of corporate feminism to try to get ahead in a system that is often culturally stacked against them. Catherine Rottenberg argues that this has culminated in the rise of rampant "neoliberal feminism," where *neoliberalism* is defined as "a dominant political rationality that moves to and from the management of the state to the inner workings of the subject, normatively constructing and interpellating individuals as entrepreneurial actors."[124] Through this analytical frame, neoliberalism could also be seen as the basis for many makerspaces and cultures writ large, where knowledge acquisition and projects are often individualized. But this is a tendency that feminist hacker groups, as well as many other maker cultures, are hoping to dismantle through a "Do-It-Together" practice of knowledge acquisition and sharing.

The marriage of feminism and capitalism is exemplified in Sandberg's *New York Times* Bestseller *Lean In* – a text brought up by two of my interlocutors as an example of the corporate feminist ideal from which their particular women-oriented hacker collectives and spaces try to distance themselves. While neoliberal or corporate feminism could be considered a lesser evil to the toxic masculinist cultures reflected in phenomena such as Gamergate, it stands to become a part of the problem as it enables and normalizes an underlying patriarchal system which women must take it upon themselves to endure.[125] And while Gamergate could be explained away as the voices of a small subset

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[124] Catherine Rottenberg, "The Rise of Neoliberal Feminism," *Cultural Studies* 28, no. 3 (May 4, 2014): 418–37. doi:10.1080/09502386.2013.857361.

[125] The Gamergate controversy involves a harassment campaign that targeted several women in the video game industry as well as a feminist media critic who decided to take on blatant sexism that is prevalent in video games. Many supporters of Gamergate were opposing what they viewed as an increasing influence of feminism on video game culture and were adamantly opposed to cultural diversification and social criticism that they viewed as part of this. Katie McDonough, "Jian Ghomeshi to #Gamergate: Our Culture's Toxic Masculinity Crisis on Display," *Salon*, October 27th, 2014, accessed November 6, 2016. http://www.salon.com/2014/10/27/jian_ghomeshi_to_gamergate_americas_toxic_masculinity_crisis_on_display/.

of technology-based culture, toxic masculinity and its apologists have had and will continue to have serious influence on greater cultural understandings of technology, who makes it, and for whom it is developed.

Hoping to move beyond the downfalls of masculinist cultures and the neoliberal, corporate feminist response that tells women to "lean in" and make the changes within themselves instead of to the systems of power, female-oriented hacker collectives are pushing for their own structuring of technology production, skill-sharing, and use. Thus, they are creating alternative spaces, practices, and pathways. Following critiques of gendered organizational values, such as Kathy E. Ferguson's *Feminist Case Against Bureaucracy*, the creation of these spaces recognize and know all too well that the supposed openness of technology cultures is still often male-dominated and wrought with implicit power structures that preference dominant knowledge and belief-systems.[126] Instead, they call for a different way of designing, structuring, learning, engaging with, and creating technology through their own epistemic cultures. From my research sensitized to inclusion, accessibility, and empowerment, I have found that feminist hacker collectives considered, instead of downplayed, humanistic or social dynamics of technology-based endeavors, particularly enacted through different valuations of care toward reworking relationship to technologies, others, and selves.[127] Such practices regarding relations and care are not always positive. These groups also grappled with the discomforts of dominant power relations, systematically challenging them to enable new ways of technical and material engagements. They were also heavily invested in

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[126] Kathy E Ferguson, *The Feminist Case Against Bureaucracy* (Philadelphia: Temple University Press, 1985).

[127] Joan C. Tronto, "Care as a Basis for Radical Political Judgments," *Hypatia* 10, no. 2 (1995): 141–49.

technology use as an empowering practice and are attuned to the co-constructions of

culture, gender, technology, and social dynamics.

The Rise of Feminist Hackerspaces in North America[128]

The Silicon Valley start-up culture located in and around the Bay Area of California has

been recognized by scholars as one of the foundational threads of what hackerspace

cultures in the US and the Maker Movement have now become.[129] It is also a reflection

of how marginalization with regards to gender, race, and class within the maker and

hacker cultural milieu has been a long-standing issue. Certain biases are built into the

dominant framing and registers of these spaces via dominant technology cultures, which

not only shapes the practices, policies, and sociocultural dynamics therein, but the

outcomes and technologies that are produced. In Silicon Valley, the technology start-up

culture crosses heavily over to dominant hacker and maker cultures, as exemplified by

Mitch Altman's work within O'Reilly Media, *Make*: Magazine and Maker Faire while

also being the co-founder of Noisebridge – one of the first hackerspaces in the United

States.[130] These influences made it easy for dominant narratives and biases regarding

gender, race, and class from the masculinist technology cultures to become normalized

within the hackerspace and makerspace scenes. Under the veil of progressive and liberal

attitudes about technology use, democratization, accessibility, and development, systemic

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[128] This history is North American-centric, and does not fully incorporate a deeper history of feminist hacker practices in Western and Eastern Europe going back to the mid-1990s. In talking with an Austrian-based interlocutor, and via my involvement with the TransHackFeminist convergence, I found an alternate thread that involves a festival titled the Electric Technology Carnival (ETC) run by the Gender Changers group and which was a women-run and women-only event done prior to THF! In conversation, RH, she noted that ETC was not quite a precursor to THF! Per-say, but that THF! Was splintering off -- a creation of pluralities and alternative pathways. ETC may still happen once again.
[129] Turner, *From Counterculture to Cyberculture*.
[130] "Noisebridge," accessed May 15th, 2017, https://www.noisebridge.net/wiki/Noisebridge.

power issues have never been fully addressed in these settings and thus have been allowed to reproduce within bottom-up organizations that claim openness and a libertarian take on freedom – the structure of no structure referenced above.

To female-identifying members of technology start-up culture, this was nothing new. But as biases and discrimination shifted from their career landscape into the more personal and social dynamics of openly and communally organized accessible spaces, tensions finally broke. Female-identifying members began to join forces and formulate what Toupin categorizes as "safe space" via exclusionary practices – resulting in the creation of female-oriented and women-only hackerspaces, the histories of which have been delineated in various articles and blog-posts from participants and theorists alike.[131] Due to a lack of any serious institutional movement toward holding misogynistic actions in the tech scene or hackerspaces accountable, female-identifying tinkerers, makers, crafters, and hackers were realizing they needed to take matters into their own hands to establish spaces of mutual support.[132] They decided to establish spaces where they could fail freely without judgment and set an alternative culture apart from the masculinist cultures that they were facing in the multiple realms of their lives.[133]

Acknowledging the systemic privilege and dominant structures of innovation that are often reproduced via claims of 'no politics,' feminist hackerspaces claim to take a

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[131] Toupin, "Feminist Hackerspaces."; Henry, "How to Make Your Own Feminist Hackerspace."; Kayla Shultz, "Is the Maker Movement About Hacking Society—Or Just Hardware?" February 18th, 2015, accessed August 14th, 2017. http://www.yesmagazine.org/people-power/is-the-maker-movement-about-hacking-society-just-hardware.

[132] Personal correspondence with members of Femhack and Spanning Tree and article by Liz Henry; Toupin speaks in this video: https://vimeo.com/107441293 about the unfortunate lack of positive response when she tried to talk through issues of oppression at Foulab.

[133] Daniela K. Rosner and Sarah E. Fox, "Legacies of Craft and the Centrality of Failure in a Mother-Operated Hackerspace," *New Media & Society* 18, no. 4 (2016): 558–80. doi:10.1177/1461444816629468.

political stance caught up in the power of boundary-making and demarcations of what counts as knowledge and technical skill.[134] Their focus is still on experiential learning of tacit knowledge. However, alongside this interest in technology and fabrication, they question norms of technology-centric skill-sharing and cultivate a particular politics as important for instantiating a constructively critical realm. The possibility in this framework is to recognize these acts as exploratory and subversive, hoping to delineate which acts are reproducing cultural norms or breaking their bounds by producing new practices, discourses, and actions.

Precedents of tactics employed by feminist hacker collectives trace back to the consciousness-raising groups of the 1960s, stitch-n-bitch sharing circles, and the riot grrrl movement of the 1990s. These groups used the concept of 'safe space' to create an exclusive setting that allowed for open exploration of ideas, failures, skills, and knowledges. They were seeking to build community and trust among particular subject-formations in order to create their own cultures and alternative routes for subverting what dominant cultural practices and beliefs were telling them: that they did not have the capacity to do certain things and that their particular standpoints and knowledges were irrelevant in the greater cultural context. In response, these previous movements and groups created their own cultures of belonging – something that feminist hacker collectives also seek to do in the face of a technology-based culture that is predominantly white, male, and upper-class dominated – typically in an overtly masculinist manner. I relate these different groups as enacting alternative *epistemic cultures* because, in their

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[134] Femhack participants are explicitly clear about this as seen through my own research as well as described in Schultz's article on feminist hackerspaces: http://www.yesmagazine.org/people-power/is-the-maker-movement-about-hacking-society-just-hardware.

practices, they reframe how technical knowledges are made and engaged – through the lens of differentiated standpoints that often focus on the politics of care practices, responsible relationalities, and collective action toward instantiating shifts in sub-cultures that they have experienced as hierarchical, oppressive, and patriarchal. By building their own institutional and organizational frame, feminist hackerspaces seem to be employing Armstrong and Bernstein's theory on multi-institutional disruptions, but on a smaller scale – and in a way towards creating alternatives instead of shifting the greater institutions at work.

Feminist hacker collectives are operationalizing politics and inclusionary or exclusionary tactics in order to open up complex discussions regarding technology industries, empowerment, knowledges, pedagogy, accessibility, and inclusion. Not all are enacting the same critique, though, and some are more tech, white, and upper-class oriented with empowerment helping one marginalized community and often excluding others.[135] Their intention is to question notions of accessibility and inclusion within technology use and development, but they still often struggle with how to enact other forms of inclusion regarding race, class, and mobility – even as they are aware of and try to enact intersectional practices.[136]

Inspired by the Seattle Attic, which started a feminist hackerspace in 2012, and through conversations started at the AdaCamp feminist unconference in 2013, Double Union was founded by previous members of Noisebridge in direct response to continuing micro-aggressions and blatant comments and actions of molestation or belittlement from

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[135] Rosner and Fox, "Legacies of Craft."

[136] For definition and work on intersectionality, see: Kimberle Crenshaw, "Mapping the Margins: Intersectionality, Identity Politics, and Violence Against Women of Color," *Stanford Law Review* 43 (1991): 1241-1299.; Rosner and Fox, "Legacies of Craft."

male members.[137] Shortly thereafter, the discourse around feminist hackerspaces in the US greatly increased, and through documentation, support, and the sharing of ideas, similarly oriented groups started forming in Montreal and DC, with multiple groups having taken root in San Francisco and Oakland, including Double Union, Mothership Hacker Moms, and Liberating Ourselves Locally (LOL). An article in *Model View Culture* written by the founder of the Seattle Attic gives an encouraging basic step-by-step for establishing a feminist hackerspace.[138] Social science scholars have also taken note, Toupin included, leading to the examination of how feminism is actually enacted in these spaces. Researching feminist hackerspaces on the west coast, Rosner, Fox, and Ulgado explore how these spaces are less concerned with hacking technologies, than they are with hacking ideas and the very underpinnings of what technology entails:

> More specifically, by tracing the often-explicit interweaving of hacking things with hacking the self, we show how feminist hackerspaces reorient our concern for women in technology from ideas of access to an ongoing working through of definitions, acknowledging the breadth of technical work that women already do. Hacking thus becomes a technological imaginary, a set of deeply held ideas and norms subject to failures and partial readings that shape the work of technology cultures.[139]

Reclaiming hacking to talk about culture becomes an emancipatory tactic to reconstruct cultural norms regarding technology. In this reframing of technology, and the creation of new cultures surrounding technology development, feminist hacker collectives also demonstrate a cognitive praxis approach to enacting change and working towards shifts in power relations therein.

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[137] "Double Union | A Hacker/maker Space for Women in San Francisco," accessed November 6, 2016. https://www.doubleunion.org/about.

[138] Henry, "The Rise of Feminist Hackerspaces."

[139] Daniela K. Rosner, Sarah E. Fox and Rachel Rose Ulgado. "Hacking Culture, Not Devices: Access and Recognition in Feminist Hackerspaces" *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing*, 56-68, (ACM Press, 2015): 1.; See also Fox et al "Hacking Culture," referenced by me above.

The discourse and excitement around feminist and women-oriented hacker collectives is both laudatory and dismissive.[140] As previously related, claims of inclusion or radical accessibility practices may be just as prone to bias in women-oriented hackerspaces as in traditional spaces, an issue already raised by queer and non-binary identifying people who remain excluded from women-in-technology initiatives and groups. Race and economic class are also still sensitive topics.

Reacting to the increased attention, one of my interlocutors from Femhack reflected on how they are described versus how they really exist and enact their practices.

> I had the feeling that there were more people interested in Femhack than there were involved in Femhack. People doing interviews with us, and we were like 'yea yea yea, we're not doing much.' But we are well known. So, there is something like fitting the imaginary of what we are doing maybe more than [just doing what we are doing].[141]

In this chapter, I examine ways in which they challenge the power structures that exist for more diverse technology-based and informal knowledge exploration. Fox and Rosner argue that feminist hacker collectives challenge power through a complete restructuring of informal knowledge production practices and cultures while also establishing the acceptance and recognition of how women already take part in technology. I have found it also involves different methods for skill-sharing or pedagogical engagement while reframing technology via care and collaborative development. It is these dynamics that I further delineate in my own study of two feminist hacker collectives situated on the east coast of the US and Canada. The bulk of my research and work is in the entangled and tightly woven personal interactions that shape experiences of the actualized world and

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[140] Rosner and Fox. "Legacies of Craft."
[141] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016.

technology. Thus, I am interested in the "becoming of process" that unfolds in the narratives and practices I observed.[142]

Field Site One: Spanning Tree

Organized by a small team of women in tech, writing, and non-profit social justice work, Spanning Tree is a self-proclaimed feminist hacker group founded in the winter of 2014 and based in the Washington, DC area. Similar to Silicon Valley, although on a smaller scale and with different cultural underpinnings, DC is home to a decently-sized technological and start-up scene that spreads across a fairly wide geographic area including Arlington, Virginia, Washington, DC, and the surrounding suburbs of Bethesda and Silver Spring, Maryland. Part and parcel with this is a density of hacker and maker groups including a TechShop in Arlington, Virginia, the Fab Lab at the MLK branch in DC, HacDC hackerspace in downtown Washington, DC, the Catylator makerspace in downtown Silver Spring, Maryland, and the Greenbelt Makerspace in Greenbelt, Maryland. Connected to, yet separate from, these groups, Spanning Tree was in part initiated by Kelli, a 30-something genderqueer aeronautical engineer who previously was involved in various women-in-technology groups as a member of the DC chapter of the Ada Initiative and as the main organizer for the LinuxChix chapter in DC.

Kelli had also been part of the local hackerspace, HacDC, since their inception in 2008. When they first opened, Kelli was hanging around their space since she was excited to interact with many different people who had different skills from her, for the possibility of mixing and trading knowledges – an empirical instantiation of Galison's

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[142] Manning, *The Minor Gesture* (Chapel Hill: Duke University Press, 2016).

"trading zones."[143] She was curious "To have something sort of concrete that I could make. It seemed like a whole different set of skills that hackerspaces were especially encouraging people to do including learning soldering and circuitry."[144] This particular set of skills, as Kelli described, was typical of hackerspaces or makerspaces in general, which as an overarching community have established their own kind of "epistemic culture" to fit into or from which to feel alienated.[145] While not directly situated in the professional sphere, different hackerspaces or makerspaces have established a "community of practice" that fits into the overarching epistemic culture which leans toward a scientific or technical set of practices. Foray and Hargreaves describe,

> [C]ommunities of practice, or sections of them, reflect what Knorr-Cetina (1999) calls epistemic cultures that produce and warrant knowledge. All communities of practice have a positive orientation to 'best practice'—which may be something preserved in the community's traditions as a standard to which practitioners aspire, or something yet to be identified. The methodology a community adopts to determine best practice within its domain will reflect its dominant epistemic culture. An epistemic culture can thus be defined as a means of identifying best practice.[146]

Having a background in aeronautical engineering, Kelli felt comfortable in a place rooted in a technology-based and individualistically-oriented epistemic culture and register. She ended up on the board of HacDC for several years. Yet her excitement and interest in these groups became strained as Kelli's politics grew increasingly more radically queer and feminist, beyond the thinly political corporate feminism she had experienced in the women-in-technology groups with which she was involved and partly helped to cultivate – and certainly not on par with what projects or connections were fostered at HacDC.

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[143] Galison, Peter. "Trading with the Enemy." *Trading Zones and Interactional Expertise. Creating New Kinds of Collaboration* (MIT Press: Cambridge, 2010).

[144] KB, interview by author, Skype interview, United States, April 5th, 2016.

[145] Knorr-Cetina, *Epistemic Cultures.*

[146] Dominique Foray and David Hargreaves, "The Production of Knowledge in Different Sectors: a model and some hypotheses," *London Review of Education* 1 no. 1 (2003): 10-11.

A few months after Kelli returned from a year of travel in Japan in 2013, the Ada Initiative, which is now defunct, held a Washington, DC based AdaCamp.[147] The Ada Initiative was in part founded by a few coordinators of the LinuxChix group, but they were more explicitly feminist in their values. Their goal was to make social change happen for women-in-tech and culture, and Kelli was excited to establish an on-going community of feminists and technical people through their network. Double Union and the Seattle Attic had been established and word was starting to spread in the geek feminist community about their success and the stand they were taking against masculinist technology cultures on the west coast. Kelli knew some of the founders of these two groups, and wanted to make a feminist technology group happen in DC if possible.

> I liked the idea of hackerspaces and makerspaces and I liked the idea of feminism and combining those two, so that's what made me want to start what we ended up calling Spanning Tree.[148]

Kelli was not alone in this desire, and she found like-minded individuals at the AdaCamp where an informal meeting happened for those interested in starting a feminist hackerspace. An email list was formed and online conversations sparked the creation of a virtual group through the online organizing platform *Meet-up* and a newsletter mailing list, with the future goal of eventually finding and sustaining a space.

For about a year, Spanning Tree was solely an online discussion around the imaginary of what it could be with a few tabling sessions to further find interested

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[147] The AdaCamps, two-day mini-conferences specifically for feminists in technology and open culture, occurred in multiple cities, much like Maker Faire. The events were run in an unconference format. The website for the community can be found here: http://geekfeminism.wikia.com/wiki/Timeline_of_incidents. This page of the community website gives a historical timeline of misogynist incidents and transgressions against women in technology cultures.
[148] KB, interview by author, Skype interview, United States, April 5th, 2016.

members at technology conferences, such as Robotfest at the USA Science &

Engineering Festival in April of 2014. It became a more concrete group in July of 2014,

when they had their first workshop on knitting.

Image 4. 1. Knitting demonstration from Spanning Tree's first workshop.[149]

As they ramped up public engagements and word-of-mouth efforts, within a year the

group grew to 193 members on *Meet-up*, which as of November 2016 has over 306

members. More active members related that these groups were low commitment and

sign-ups might be due to general interest in accordance with the nature of the *Meet-up*

website. This past January the low-traffic newsletter had a total of 200+ people signed up,

which is more telling of traffic to their website, and the effectiveness of their efforts to

table at local technology and maker interest conferences such as Maker Faire, at the

Science & Engineering Festival, and women-in-tech conferences. The number of core

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[149] Erica Stratton, *Untitled,* 2014, "Our first-ever class was pretty great," *Spanning Tree,* July 21, 2014,
accessed October 3rd, 2016, http://spanningtreedc.org/.

organizers, has ebbed and flowed but typically stays at around 10 people and is managed through an email list for decision-making and coordination.

One interlocutor, Emily, found the group through her initial interest in joining a hackerspace, and subsequent issues with the way the HacDC community dealt with homophobic and xenophobic comments made to the mailing list by other members. For her, instead of challenging what was being said she wanted to know, "why is this guy even in the group?"[150] Another member, Celia, who found Spanning Tree about a year after its inception expressed her non-care in HacDC in comparison to her excitement about Spanning Tree: "It's really more that I wasn't that motivated or excited to get very involved until I heard about Spanning Tree. So, it's not that I was rejecting what they were doing, I just didn't care enough to get very involved."[151] In this sense both the culture and practices and the ways in which HacDC was engaging technology was not of interest to these two interlocutors.

Due to HacDC's open nature and the structure of its bureaucracy, any kind of response to the blatant bigotry that Emily observed was slow and unstructured, and no major repercussions (as in the member being asked to leave the group) occurred. In reaction to this, Spanning Tree has made clear through their own website language, in the communities that they reach out to, and via internal dialogue that they have values of tolerance for difference in cultural background and intolerance for dominant masculinist technology cultures. Mostly they did this through responsiveness and fostering care for different variables of need in relation to comfort and discomfort. They avoided defining

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[150] ES, interview by author, Skype interview, United States, August 15, 2015.
[151] CD, interview by author, phone interview, United States, December 14th, 2015.

their group as exclusive of men and focused on the demographics who they intended to include. The first readable post on their website states their inclusionary practices: "We welcome people of color, trans women, genderqueer/gender-neutral people, and people with disabilities."[152] Some of this wording was a response to initial tensions within the group about gender-identity, exclusion, and comfort, particularly regarding 'women-only' terminology clashing or upsetting members who identified as genderqueer. This was a continuing issue in the women-in-tech scene more generally, which had also met problems regarding racial and economic diversity – something that may in part have led to the dissolution of the Ada Initiative.[153]

In order to deal with these tricky situations, Spanning Tree looked to predecessors like Double Union, as well as groups from which they wanted to differentiate themselves. "I think the Double Union website has a statement of values displayed fairly prominently, and just reading that – I agree so so much with all of them."[154] Spanning Tree not only aligned with Double Union's values, but was in conversation with them and other feminist hackerspaces via a feminist hackerspace listserv and through personal contacts. Spanning Tree received solidarity and support by gaining information on what had worked or had not for the formation of other groups. At the beginning of their endeavors, an organizer at Double Union sent them a 5-page email detailing the best practices and processes by which they might acquire a permanent space and how to make it sustainable. As Celia related they helped with "just little things that make a huge difference when you're kind of walking into it blind."[155] At the same time, Spanning Tree

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[152] "Spanning Tree – DC's Feminist Hackerspace," accessed October 25, 2016. http://spanningtreedc.org/.
[153] Personal conversation with researcher who is studying the Ada Initiative.
[154] KB, interview by author, Skype interview, United States, April 5th, 2016.
[155] CD, interview by author, phone interview, United States, December 14th, 2015.

has struggled to find local alliances with whom they share the same values. This fragility has made it difficult to enact accessibility, inclusion, and empowerment in a fully accountable manner.

Field Site Two: Femhack

Founded loosely in 2010 in Montreal, the seeds of Femhack came from a collective interest by two core members in cultivating their knowledge of F/OSS, specifically through mutual aid workshops. The workshops focused on aiding each other in the maintenance and installation of Linux and other F/OSS software – giving each other support, solidarity, and advice, learning together along the way. The groups' practices and mechanisms were very free-form, but built on feminist methodologies of care, respect, support, and empathy – similar to consciousness-raising groups. They met regularly at a computer lab on the Universite du Quebec a Montreal campus, but when kicked out due to a change of lab management, they started meeting in cafes, homes, and eventually established themselves at foulab, a hackerspace also located in Montreal.

Femhack has a similar story to Double Union and in part Spanning Tree in that they grew somewhat out of and tangent to a more male-dominated hackerspace. While at first the loosely-organized group of people who became Femhack tried to hold meetings at foulab, there were tensions with some of the regular foulab members regarding the women-only aspect of 'foufem' (the original name of Femhack). Foulab members felt that any meetings happening within their space needed to be free and fully open to the membership, especially since foulab members were paying the rent and maintaining the space, and since foulab was also organized according to an open, non-hierarchical, and non-exclusive framework. This tension speaks to a recurring theme, within research done

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in this study and in data from other scholars, that involves the reasoning behind safe

space and feminist hacker collectives extracting themselves fully from groups with

different ideologies or politics.[156]

Often more established hackerspaces or makerspaces have a facade of openness

and acceptance of different ideologies, values, backgrounds, and cultures. This veil of

"openness" is itself a rule to abide by, and one in which dominant voices or those that are

loudest often go unchecked, and thus dominate the culture of a space. Critical reflection

does not always factor into these practices, but there certainly is a politics involved in the

types of technologies they use and develop, how they share skills, how the space is

designed, and so on. In reaction to this, some feminist hackerspaces, and other more

politically-oriented groups, are engaged in exploring the issues around the "politics of no

politics" and are explicit about the politics they want to impart within their practices,

spatial design, and skill cultivations. With the phrase "politics of no politics" I am

invoking Haraway to think about Kelty and Coleman's work into issues of openness

among hacker groups – both of whom explicate that in the stead of such openness, certain

dominant voices and structures often tend to assert themselves.[157] This is also based

upon Traweek's explanation of a "culture of no culture" within her sociocultural study of

a Japanese high-energy physics laboratory.[158] In this profession where there is high

demand to be objective, any kind of cultural values or norms are considered timeless

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[156] Toupin, "Feminist Hackerspaces."

[157] Kelty, *Two Bits*.; Gabriella Coleman, *Coding Freedom. The Ethics and Aesthetics of Hacking*, (Princeton: Oxford, 2013).

[158] Sharon Traweek. *Beamtimes and Lifetimes: The World of high Energy Physicists*. (Cambridge: Harvard University Press, 1992).

scientific truths. Such a shared conviction resulted in an erasure or glossing over of the politics and cultural values deeply embedded in daily scientific practices.

Haraway has theorized how a "politics of no politics," wherein claims are made about the objective and political neutrality of scientific research, is in and of itself a mechanism through which powerful forces assert their authority.[159] In the end, the dominant, male voices of foulab controlled the scenario which resulted in the discomfort and exclusion of others. I also observed this control scenario with the externally-imposed 'Ladies Night' at TVCOG in downtown Troy, New York. Even with the best intentions, the cultures and dynamics of a women-only night still needed to be defined, monitored, or formulated by the dominant voices within the space. From what I have observed, more male-dominated hackerspaces either want to silo female-identifying groups on the dominant groups' terms, or are in direct opposition to them creating exclusive groups for safe space concerns.[160] While these are two very different scenarios, they are tied by the fact that both (the cultivation of and the dissent to) were led by main organizers of the hackerspace – and the dominant culture of the space was masculinist. This is not to say that the intentionality by the latter was not well-meant, but it seems in this case that everything had to be done on the dominant culture's terms. Realizing the culture of foulab would not change to accommodate their needs for meeting, Femhack members felt unwanted in the space. Some Femhack members also noted that there had even been a shift within foulab to be less radical, political, and supportive of what might be considered feminist goals or standpoints.

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[159] Donna Haraway, *Modest_Witness@Second_Millennium*, (New York: Routledge Press, 1997).
[160] Opposition and dissent to feminist hackerspaces has been voiced in blogposts, emails, personal interactions, and organizational discussions according to the organizers of Mothership Maker Moms, Double Union, and Femhack.

In the fall of 2014, I participated in my first Femhack event, which happened to be the second Femhack hack-a-thon during Httmles.[161] I applied to lead a discussion and a workshop about soldering practices and how gender is co-constructed with soldering expertise and practices. When I arrived at the event, I was anxious from having gotten horribly lost, turning myself round and round in the downtown, cobblestoned tourist section of Montreal. This resulted in me being an hour and half late to E-space Fibre – a fabric art studio where the event was being held.

A volunteer for the event sat at a table at the top of the stairs right at the entrance to the event and with a calm, helpful attitude. She signed me in, and put me at ease as we walked into the open-floor-plan space, furnished with comfortable seating, huge windows for natural light, and hanging fabric art. As it turned out, the whole event was running behind anyway, and I had ample time to catch my breath. Kim, the volunteer, showed me where coffee and breakfast items were, as well as where I could set up a discussion group, PowerPoint presentation, or a hands-on workshop. My feelings of anxiety melted away in the relaxed and welcoming atmosphere that Femhack had set up. After getting over my initial nervousness over being late, I felt at home – a sentiment that several participants shared at one point or another during the event. Many of them did not know anyone, or had weak connections, but everyone felt willing to share their stories and sentiments, wanting to learn together. This was likely a combination of the small group setting of nineteen attendants and the relaxed atmosphere cultivated by the organizers.

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[161] Httmles is a bi-annual festival focusing on run by feminist arts organization and gallery Studio XX. The event focuses on technology, cyberfeminism, afro-futurism, queer identities, and various other themes highlighting different marginalized voices within the tech-art world.

After brief introductions, presentations and workshops began. The first presenter, Leonard, talked about his dissertation project studying foulab as a community of practice, and the barriers he ran up against while working on a more politically-oriented technological intervention in the space. He had not intended it, but his project quickly became a critical analysis of gender dynamics in the space. He observed how foulab transformed from a community skill-sharing site, to one with a "man-cave" mentality that did not foster an environment of communal learning and care. During discussion after his presentation, others who had used foulab weighed in with their own experiences. It became clear that the dominant technology-based stereotypes regarding gender dynamics had become dominant at foulab because politics had *not* been discussed explicitly in the space. In a parallel session to this first discussion, two engineering and arts professors taught a workshop about building circuits for a transportable and solar-powered cellphone charger – an example of politically engaged technology development and use in relation to sustainability and care for the environment.

For my own presentation, I started with my own story about myself and my research, as well as my personal story of learning to solder. I then opened up the discussion. Several participants shared various stories of learning to solder: one with her mother in the context of stained glass crafting; another during the barn-raising of a radio station through the Prometheus Radio Project; yet another in the context of coursework for Electrical Engineering at Columbia University.[162] All stories demonstrated a

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[162] Prometheus Radio Project is a community radio advocacy group based in Philadelphia, Pennsylvania. This discussion participant was involved in many "barn-raisings" in which Prometheus Radio Project helped Low Power FM (LPFM) stations in small communities across the US, as well as in South America, to build a fully functional radio station. For Sylvia, learning to solder in this context was an empowering act and deeply political since it was a skill through which community-organizing technologies were being realized.

multiplicity of reasons why and how to learn and enact soldering practices. Eventually, the group started to talk about yarn-bombing, what counts as technology, and who has the authority over what kinds of soldering and circuit-making. One woman noted the possibilities for other ways of soldering or creating circuits – be it by conductive thread, conductive ink, or otherwise. How are these practices not as skill-full or technical-seeming as soldering with an iron? Kim brought up how the mathematics of knitting is downplayed. She then brought up the issue of how women and minorities are often doing important undervalued labor on the margins of technology and data analysis – including spectral analysis of stars in astronomy which was not considered technical mainly because it was gendered as women's work.

The discussion then shifted toward dissecting educational practices and norms, and the need to step down from authority as a teacher – to teach an engaged pedagogy. Lydia shared her experiences as an engineering professor trying to get the students to think for themselves, to not believe everything she said, to be critical of where the facts are coming from. Issues of women in technology and technical educations were raised – particularly how, due to cultural norms, women may be wary of making mistakes or being ostracized for making mistakes more than their male-identifying counterparts. Lydia observed first-hand how this inhibited inquisitiveness and willingness of her female students to partake in discussions or active learning.

Via talking through alternative pedagogical methods, participants spoke on how a masculinist model typically dominates education, and that situated knowledges and different ways of thinking are not celebrated. Hence the understanding that there is one way of engaging a problem and reaching an answer, an approach preferred in most

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educational practices. By discussing various ways to solder as a jumping off point for touching on issues of technology-based stratification, feminist hacking practices and reflexive discussions highlighted power-dynamics embedded within different forms of skill-sharing. This example foregrounds how Femhack ran most of their events. It also touches on themes I will explore in the rest of this chapter including how feminist hacker collectives work to redefine technology cultures, creatively engage technologies for differentiated needs, and cultivate critical pedagogical practices within technoscientific education and skill-sharing.

In the next few sections I will describe their practices as well as my own readings of how the politics of care are entangled with how these two feminist hacker collectives engaged issues of accessibility, inclusivity, and empowerment. In doing so, I identify "uneven ground" that results in the reproduction of subjectivities and power relations.[163] In this sense, I keep attuned to moments where practices are not able to disrupt systemic issues of power. I should also note that I engage these groups often as an accomplice and participant – so I celebrate the steps they take toward demonstrating diverse epistemic cultures, rooted in a value of care, that remains in dialogue with the dominant discourse of maker and hacker cultures. In the following sections, I demonstrate how these groups have built an epistemic culture that attempts to deconstruct the individuating technoliberal register observed in the dominant discourse – specifically in how they deal with accessibility, inclusion, and empowerment. By enacting collective care work with and through technology, they attune technical practices to the inherent social nature of

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[163] Laurel C. Smith, "Decolonizing Hybridity: Indigenous Video, Knowledge, and Diffraction," *Cultural Geographies* 19, no. 3 (2012): 329-348.

technologies. Thus, through an entangled reading of feminist hacker collectives, I reveal

different intentions and ways in which to focus and interpret public engagements of

technology.

Accessibility: (Dis)comfort and Care

There are many variables involved in accessibility, as well as many different dimensions

that are obvious to some and not to others. These include physical space, physical

location, cultural barriers, base-technical knowledge as a possible barrier, and prior

knowledge of maker and hacker cultures. In hoping to be accessible to those with

feminist values in line with their own, Spanning Tree has been and will continue working

through what accessibility means for their organization. In relation to the feelings and

thoughts that members of Spanning Tree have about accessibility, it is viewed not as an

end goal or something to 'have,' but as a constant conversation and process to cultivate

with current members, potential members, and the greater technology, feminist, and

social justice communities that Spanning Tree wishes to engage. In this sense, they are

interested in the process of becoming more accessible – so designing how the process of

defining accessibility can be intentional, and building an epistemic culture that supports

that intention, specifically for marginalized groups. They reject the "anything goes" or

"anyone can join" statements made by other maker and hacker groups, which they know

– implicitly and through their own experiences – plays out as a fallacy. The attitude also

reflects an ethics of care in that it recognizes that accessibility is a relationality that must

be cultivated, cared for, and to which the collective (both participants and organizers)

must attend and be accountable. These sentiments are matched by Femhack. The ways in

which both groups have collectively engaged the design of their organization and its

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practices in a politically engaged manner reflects Dourish's call for a "design of politics" while critically engaging the "politics of design."[164] This unfolds in feminist hacker collectives' interest in caring relations and a different kind of engagement with technology.

Neither group has a strict written policy on accessibility – they are relational and in flux with the needs of whosoever is included and can take part in an event. Ludost, One of the core members of Femhack, relates that this is mostly due to the fact that they are focused on the practice of accessibility and creating "safe space" for engagement, checking in with one another, and reaching out to the greater community to address such needs and concerns. They also understand that some people may not yet know what "safe space" is and so they discuss what this looks like at the beginning of events.

> There is a discourse on safe spaces and every time we organize an event we talk to our participants about this. They are free to ask questions, they are free to not know answers. [...] I think we are talking about it and are very conscious about having everyone on board in being accessible to everybody. We don't want to push anyone away by [creating] an elitist culture.[165]

The three core organizers and members, Sylvie, Akhe and Ludost, were activists and technologists in one form or another. Each employed different methodologies for creating an emotionally safe space that felt accessible, unlike the cultural dynamics they had experienced in some other hacker realms. This included sharing circles, participatory action research, and safe space methodologies. Through these mechanism, they hoped to facilitate events and workshops with an atmosphere of accountability and vulnerability

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[164] Dourish, "HCI and Environmental Sustainability."
[165] CH, interview by author, Skype interview, Canada, October 17th, 2016.

toward careful engagements of technology – while also establishing a space to voice any discomforts.

Drew, one of the core members of Spanning Tree related that the problem around general claims of openness in maker and hacker cultures was not a lack of good intentions. She believed that these claims fell flat because there was a lack of more deeply understanding different experiences of technology and the power dynamics involved. Misunderstanding led to a lack of follow through and iteration on what accessibility might mean for different needs. Thus, there was in an inability to recognize when needs are not being met.

> So much of the time when people mess up it's not that they don't have good intentions, it's that they don't know what it looks like. […] I think I have more awareness of economic accessibility than most people because I have lived through extreme poverty. And there's just things you don't know [unless you've lived that].[166]

In the same sense that Harding and Haraway claim a need for *situated knowledges* and *standpoint epistemologies* toward the diversification of scientific understandings, thought, and knowledge production, Drew is claiming these needs for a greater ability to instantiate accessibility in grassroots technological cultures.

In support of Drew's observation, Akhe of Femhack admitted that it was hard for her to talk about different dimensions of accessibility unless she had been touched by that issue personally or through those with whom she was close. She expressed needing a personal connection in order to understand, build solidarity, and take different concerns into account that she might have not considered previously.

> I can become aware of other issues that I am in relation to, like I can talk about my friends because this is how my sensitivity grows. I have friends who are deaf, I have friends who are in wheelchairs, I have friends who are

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[166] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.

trans people. And […] I've seen and I've felt with them. I've felt with them what it was to be rejected or not even thought of as activist or objectified or used as the proof that we had "one." Like all this, which is very painful. Or not respected in need. This is how I can say I've become more aware of accessibility issues, and diversity and oppression.[167]

The issues around tokenism or needing to build exposure and diversification via intentional solidarity-building played heavily into Akhe's feelings, and thus Femhack's dealings, with accessibility, but more directly inclusion and exclusion. Her sentiment matched other conversations I have had in other feminist hacker gatherings where individuals admit the difficulties of identifying privilege and accounting for certain needs until in dialogue with others.[168]

Drew's comment and Akhe's experience of not recognizing dimensions of privilege and mischaracterizing needs until she knows someone intimately is in line with Eubanks' work on the digital divide and access to technology – where the good intentions of digital divide scholarship and programs for increasing computer access missed the point.[169] By not being attentive to understand what such technology might enable through care or recognizing the politics that come with different instantiations of "caring," the actual needs of the community were obscured or oft misunderstood. As Eubanks argues, the real concern was how digital technology systems and cultures were marginalizing – systemically oppressing and stratifying people according to gender, race, and particularly class. Through Participatory Action Research *with* the marginalized populations Eubanks was able to parse out the problems at hand, and what actions or interventions could be

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[167] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016.

[168] This came up again during a small feminist hacker and artist meeting held in early May 2017 in Graz. Participants included feminist artists and researchers in Graz and a member of Mz. Baltazaar. One of the participants related that they felt that if you have a certain privilege it is hard to recognize you are privileged until you see how others are treated, or until you are made conscious and aware of the problems that others face.

[169] Eubanks, *Digital Dead End.*

done to instigate change. It is not just a joining in, but a reframing of what technologies can do from a socio-economic and diverse standpoint. Coming from a different positionality allows for different framings of what the problems are to consider, and the causality therein.

Unlike other places that claimed openness and accessibility, by employing certain practices of care both groups acknowledged the difficulties and hard work needed to enact and keep attuned to accessibility issues. They knew of its flexible, collective, and iterative process as people, objects, practices, cultures, technologies, social dynamics, and environments shift. Drew spoke of the difficulty to sustain such practices in relation to resources and energy. "I think that the problems Spanning Tree has had for the most part that I have seen, since I have been involved, have been less about creating real accessibility and more about getting off the ground at all."[170] Once they have established themselves further, the issue of accessibility may be able to be more fully breached, "but then there's a question of how do we create the kind of permeabilities and organization and space for more people and new people."[171] Drew felt that by building a strong initial community-base and developing more human resources, members could focus on tactics to create a welcoming atmosphere – taking on the roles of setting structures and mechanisms for accessibility.

> We try. We try to be nice. We try to listen to people. We try to notice people. We try to be aware of when people need rides and those kinds of things. But this is one of the downfalls of having two people who both have substantial health problems who **are** the group. And also, one of the downfalls of having a group that isn't hierarchically organized with a [dedicated] person

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[170] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.
[171] Ibid.

who's the welcoming committee, is [that] there isn't a structure taking care of that.[172]

This reflexive statement about their organizational failings corroborates much of the sentiment that Drew and other organizers of women-oriented hackerspaces have shared as a reason for departing from openly structured and nonhierarchical spaces. The last part of Drew's statement also points to this being an issue of care. Her utterance *there isn't a structure taking care of that* demonstrates the importance of and need not only for human resources, but for a reflexive organizational structure which is accountable to and deals with such things.

Akhe described her own interest to enact care in the face of it not being a part of the dominant hacker culture: "I'm really attentive to caring for the people who are asking for help. When I say, "I'm caring," it's [because it is] very much despised in the hacker world to receive people asking for help."[173] Likewise the issue of welcoming during events was brought up during the Spanning Tree organizational meeting I attended in January 2016. Drew brought forward that she thought it would be important to have hosts who work on creating a nice, welcoming environment for each event – take charge in a more caring way. As she related from her experience organizing on her college campus, it was important for college organizing, and a simple way to get newcomers involved. So, she proposed that it might work best if there was one person who led the workshop, and then another person who took on welcoming others and warming the space – getting food, making sure people were oriented, and so forth. This structure would take the full

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[172] Ibid.
[173] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016.

burden of the person administering the workshop, demonstrating a collective mentality toward care, accountability, and responsibility.

Other barriers to achieving accessibility that connected care, comfort, and a spectrum of needs is in relation to locations and infrastructures used. Spanning Tree has held events in members' homes, at a co-working space in downtown Silver Spring, Maryland, and at the Iron Yard in downtown Washington, DC. Around Spanning Tree's inception, one deeply involved member helped to hold workshops and meetings at the MLK public library where they worked. To them, this meant greater accessibility for everyone since it was in a central location, and since the public library took accessibility issues into account for its own infrastructure. But caught up in the accessibility of MLK's location and the possibilities for wider visibility were variable feelings about comfort, which members felt were connected to accessibility for current membership. Several members related that the basement meeting rooms at the MLK public library had several dimensions of physical discomfort and inaccessibility. The rooms were free to use, but there was no natural light, the Wi-Fi was weak, and on-street parking was expensive. So, while it was fine for those using public transportation, for members with medical conditions that required them to drive it was not ideal. Due to many factors, the preferred place of meeting became Creative Colony, a co-working space located in the World Building in downtown Silver Spring, Maryland.[174]

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[174] "Shared Office Space in Silver Spring, Coworking in DC Area, Shared Workspace," accessed October 25, 2016. http://www.creativecolonyspaces.com/.

Image 4. 2. Room at Creative Colony.

Image 4. 3. Spanning Tree member working on project.

Those in Spanning Tree with greater economic stability were willing to pay the costs for access to a space they *felt* was more pleasant, welcoming, and accessible – particularly in location for some participants who lived closer to that area and in relation to parking availability. They also felt welcomed by the Creative Colony community to use the space in whichever way they saw fit. Femhack had similar reasons for establishing themselves at La Passe, an activist community center, bookstore, and library.[175]

> Like for example here at La Passe, they don't know much about hacking, but they are so positive about us. I just talk to them and they are like 'yes!' And even though they never come […] they understand the politics of it […] And it was so difficult to be in a hackerspace where we had to fight to do anything, like just to meet in another room […] would make things problematic.[176]

However, some members of Spanning Tree preferred the MLK library basement, and some members of Femhack enjoyed taking space and taking part in the foulab community. In these examples, there are different expectations around comfort and discomfort and some needs being met over others. The ability for these groups to stay together comes out of their capacity to talk through these diverse needs, comforts, discomforts, and the power relations or politics therein.

For Kelli, it was important for a space to not only feel comfortable but be legible – for the space itself to be cared for, maintained, and looked after. Disorderly spaces prevented tool use and legibility, thus increasing barriers of intimidation when first stepping into the space.

> It seems under-rated or under-mentioned maybe as a way to make a space accessible. For people, from the very first impression of walking in and

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[175] This space was shut down, unfortunately, in the past year. Supposedly this was due to mold and code violations, but the city of Montreal has apparently been trying to shut them down for quite some time. All initial workshops and organizing meetings I attended were at La Passe.
[176] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016.

assessing their ability to use it, once they've been there for a little while, is just so, *so* important.[177]

As I will show in the next chapter, legibility also factored into the accessibility of library maker programs for patrons unfamiliar with new technologies. Spanning Tree hoped to use legible spaces, but in the absence of having their own space, they had to make do with the established infrastructures. Along with revealing uneven power relations, physical and structural accessibility exposed the difficulties brought on by limited resources, something with which both groups had to deal.

When looking for a space to host the THF! during August of 2016, Akhe worked hard to locate an inexpensive, welcoming, and private space for meeting, since some discussions would deal with sensitive topics like consent. Due to many limitations, the final choice of space was not wheelchair accessible. Akhe felt awful about this outcome, but also helpless to change the scenario – she was also frustrated at the general inaccessibility of the built infrastructure in Montreal, a problem that was well-known within activist communities wanting greater accessibility for their events. One newer member, a queer computer science student originally from British Columbia, related that finding or establishing physically accessible spaces had been an on-going struggle for not only Femhack, but queer fundraisers, and other activist organizations.

In this instance, Akhe made the limitations of the space along many different spectrums explicitly known. She also organized events to happen in a park, and reserved space on the street for a mobile van-house, thus allowing some of the workshops to happen in places where people in wheelchairs could attend them. (Several workshops

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[177] KB, interview by author, Skype interview, United States, April 5th, 2016.

actually happened in the street, on the ground level, but no participant in wheelchairs

attended them). However, Akhe recognized the problematics around putting the burden

of negotiating this on them as individuals. This also highlights how accessibility and the

micro-interactions therein are an assemblage – they involve the built-environment,

objects, socio-cultural dynamics, and that with which we surround ourselves. Femhack

was interested in exploring these dynamics in how people related to technology and felt

comfort or discomfort with and through it.

These dimensions of feminist hacker collectives and the importance of spatial

dynamics and "safety" are explored in Fox's work on the built environment of feminist

hackerspaces on the west coast as well as in Toupin's work on the use of exclusionary

practices to instantiate safe space culturally.[178] Many design and technology scholars

have studied the built environment as biased along lines of mobility, gender, race, and

class, but still others, such as Markussen and Bardzell argue for feminist interventions

into design, which is at the root of feminist hackerspaces taking organizational,

pedagogical, and spatial design control by setting themselves apart from their normative

counterparts.[179] These possibilities for design intervention play out differently in the two

sites I am studying as they are "making do" without their own spaces, and working with

whatever resources they have available for meeting as comfortably as possible – whether

it be via holding meetings outside, creating a welcoming environment through food-

[178] Fox, Sarah. "Feminist Hackerspaces as Sites for Feminist Design." In *Proceedings of the 2015 ACM SIGCHI Conference on Creativity and Cognition,* Glasgow, United Kingdom, June 22nd – 25th 2015. 341–42. ACM Press, 2015. doi:10.1145/2757226.2764771.; Toupin, "Feminist Hackerspaces."

[179] Weisman, *Discrimination by Design*.; Winner "Do Artifacts Have Politics?"; Markussen, "Politics of Intervention in Design."; Shaowen Bardzell, "Feminist HCI: Taking Stock and Outlining an Agenda for Design." *Conference Proceedings for CHI 2010: HCI For All*, Atlanta, Georgia, April 10th -15th, 2010.

sharing, using name-tags with gender sensitive pronouns, starting with a sharing circle, or being attentive to the orientation of new-comers.

The *hacking with care* group, to which Akhe of Femhack belongs, has many methods toward collective care in activist and technology communities, and is heavily interested in examining the accessibility issues of different physical spaces.[180] First, they come up with a list of concerns that the members have towards feeling comfortable in different settings. When they find a space "we answer all of this language around need. [Such as]: the space was wheelchair accessible, but it was not chemical free, because there was a part of the space where there [had been] a lot of painters and it smelled like paints."[181] The *hacking with care* group is not directly part of Femhack, they took part in the third TransHackFeminist! Convergence that Femhack organized, and were indirectly effecting discourse regarding accessibility via Akhe.

Drew of Spanning Tree noted that it was not radical accessibility to tools for Doing-It-Together (DIT) or Doing-It-Yourself (DIY) technology production that was needed, but a cultural shift around who could take part.

> We live in an age where production is radically available – or the physical parts of production are radically available. And the things that are keeping people out of that are cultural [along with] other forms of accessibility. [N]ot that they don't have the physical thing [they] need to manufacture.[182]

Factored into technical knowledge, accessibility, and comfort also involved familiarity with and understanding of what maker or hacker cultures are, what the dominant discourse was, and what it would mean to work from the margins to create an alternative narrative of technology production and manipulation within the Maker Movement.

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[180] See: https://hackingwithcare.in/.
[181] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016.
[182] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.

When contemplating who might be prospective members or who they should

reach out to, Kelli was met with a quandary. She surmised that they appealed to people

who would "naturally" think of themselves as potential hackerspace or makerspace

members, which would mean they have technical careers or backgrounds. "[...] And

ideally I would like to think that that is *not* a criterion for being interested in the idea of a

hackerspace or a makerspace. But at this point I think it is, even just the familiarity with

those words."[183] As Spanning Tree has shifted with changes to the initial core

membership and participants, those currently involved are not so tech-oriented, including

Drew. She claimed some ease with technical concepts from college course work at St.

Johns, but had a long history of being the English major in a family of engineers.

> And even though I am in a place where I feel fairly comfortable with
> technical knowledge and skill, I have these two-decades […] of feeling like
> I was on the outside of that. […] The idea of creating a community where
> all those people who feel like they're on the outside of that, but really don't
> have to be, speaks very powerfully to me and I really wanted to be a part of
> it.[184]

Coming from this background, her personal hope was for Spanning Tree to continue to be

open to those who have been shut out of and left at the margins of technology-based

production and development. Thus, an intention was to both demystify and eradicate the

imposter syndrome that I described earlier in this chapter – to create a culture where

diverse backgrounds and skills are welcomed, where it is safe to try something out for the

first time without knowing anything – to muddle through.

Akhe of Femhack called this elitist cultural dynamic regarding other technology

groups the "intimidation barrier." It was something she also tried to diminish in the

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[183] KB, interview by author, Skype interview, United States, April 5th, 2016.
[184] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.

context of Femhack and saw it as a contributor to *imposter syndrome.* One issue that

Femhack organizers had observed is that "hacking" as a terminology in and of itself

could be intimidating, especially for individuals not well-versed in the technical. As an

implicit and intangible barrier, it was hard to define, and thus hard to dispel. Akhe

described their approach to dispel the boundary-work that such a term often helped to

solidify:

> When we talk about it, we like to deconstruct this and we often say that hacking is not about computing. And, no, we're not expecting any basic skill. To me hacking is much more an attitude, and feminist hacking is more an attitude of not being scared. So, making things less scary, making things and knowledge welcoming.[185]

This comes through in practice via Akhe's workshops on laptop autopsy, where

participants used the senses of smell, hearing, sight, and touch to explore and understand

their laptops better, while also opening them up delicately and looking inside. In these

workshops, she worked to create a pleasant atmosphere where questions and different

ways of feeling or thinking about technology were welcome. It was a care-ful

introduction to technological interventions. In talking about the workshop in relation to

accessibility Akhe related:

> I really like this idea of making revolution irresistible. I have not used irresistible before, but desirable – like something you want, something that is pleasant. So, it doesn't require any skill to start. This laptop autopsy, it was very sensitive, like smelling, listening to the laptop.[186]

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[185] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016.
[186] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016.

Image 4. 4. HP dissection, exploration for laptop autopsies. Hands-on, Karine Rathle, Barbara Loreck.[187]

Another project aimed at lowering the intimidation barrier was the crypto-dance – which was meant as a participatory event and embodied knowledge practice to foster discussion and understanding of the often intimidating, but increasingly important, world of cryptography and data security.[188]

In relation to the actual making and doing of things, when I last talked to Kelli and Drew they were hoping to take Spanning Tree in a new direction that was project-based. They wanted to open the black box of technical elitist cultures with a shift toward working in and creating a project as a political statement about systemic power structures – or as purposeful for the participants' lives. Through interest-driven collaboration, and a supportive collective learning environment, they wanted to foster accessibility for those not typically involved in technology culture.

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[187] Anne Goldenberg, Berlin, 2012.
[188] See: http://www.ooooo.be/cryptodance/where.html.

> Even if you're in this cafe in Bethesda that has a quiet room and you're just all there making jokes about the patriarchy while you do your stupid little "now it looks like a penguin" programming exercise -- that's so much more motivating. In the same way people do better […] in everything if you have a study group. If it's people you connect with. And so I think the combination of the social aspect of it and the purpose aspect of it will make the tech-knowledge more accessible.[189]

The importance that Spanning Tree puts on social learning, in that they supported and learned with and alongside one another, for a more accessible learning environment connects to Lave and Wenger's theorizations on situated and social learning.[190] Drew also admitted that a certain familiarity or desire to create technology was needed, but referenced humor as a way to downplay the difficulty, intimidation, or seriousness. She viewed these possibilities as a positive aspect for developing an overarching role for Spanning Tree, and that at the end of the day, it would not be intended for anyone coming in off the street. Or at least not in her future visioning of what the group would entail. Drew explained that they are "[...] looking for people who are sufficiently committed to the idea of the thing that we want to make – to just hack through a lot of difficult learning for it."[191]

The ability to laugh and "make jokes about the patriarchy" is a powerful tactical move for reframing how, why, and in which ways technical skills can be learned or engaged. Humor has not only been employed by other oppressed groups, but also comes up in conversations with Femhack. Participants in the collective have described one event in which tensions and discomforts arose. In one such event, they were hosting a workshop and an outsider to Femhack took what participants and Femhack members saw

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[189] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.
[190] Lave and Wenger, *Situated Learning*.
[191] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.

as a machismo attitude to teaching and skill-sharing. The outsider ended up telling people to just come to him with their problems because it was too complicated for them to understand, instead of setting up self-sustaining practices for the participants. In reflection and talking, the helper/outsider recognized the issue within himself and apologized – but things were not shifted, changed, or addressed in the moment. Femhack saw this as an issue within their own abilities to deal with such interactions in their programming. For the future, Femhack members wanted to set up a different way of reacting to these tensions in the moment and worked to conceptualize this later in the winter of 2015. Not wanting to react in an aggressive way that escalated the problematic interaction, the tactic they landed upon was that of *jouissance* – to take the belittlement or attempts of control as farcical, to bring levity and humor into the situation, to undercut acts of bravado or belittlement with laughter instead of rage or silence.

Rather than having self-proclaimed experts teaching courses and skills, participants in Femhack were interested in creating an atmosphere where it is permissible to learn together and have different styles to approaching a problem. In this sense, there is more than one way to solder a circuit. Everyone has some knowledge, whether it be technical, organizational, emotional, or otherwise to bring into the craft-work – and the feminist hacker and maker groups I have talked to want to foster that radical inclusiveness. This was also revealed by Rosner and Pasquait as a practice of Mothership Hacker Moms, when members were encouraged to bring ideas and projects to the table that they felt they would never be able to accomplish on their own. The hope being that members can garner advice and support from the others in the group who have different

expertise, knowledges, and experiences – and accomplish a project through the collectivity that they would not have been able to realize on their own.[192]

One such project in which Femhack members are involved and help to facilitate is the Anarchaserver project. Established in 2014, the AnarchaServer is a self-proclaimed feminist server group, working to establish and train female-identifying people as System Administrators (sys admins) – a classically male-dominated field in the realm of information technology and hacker cultures. Members in their network reach far and wide including Austria, Catalunya, Quebec, and Switzerland. Much of the physical infrastructure for the Anarchaserver is based in Calafou, a self-proclaimed "post-capitalist colony" housed in an abandoned textile colony outside of Valbona, Catalunya.[193] Femhack is invested in creating such alternate cultures and technological infrastructures to disrupt the use of larger structures, such as the large servers that typically host websites and meet data storage needs. By hosting their websites on the Anarchaserver, they can establish the data protection practices for themselves, and have a more personal connection to the technology-use.

In a sense they are doing something akin to the alternative economies that Gibson-Graham highlight as a way to create an economic alternative that destabilizes

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[192] Rosner and Fox, "Legacies of Craft."

[193] Calafou hosted the Trans Hack Feminist! Convergence of 2014, and is also home to the feminist healthcare hacker group Gynepunk. Gynepunk hopes to reclaim female health care practices for women, much in the way that the feminist consciousness-raising groups of the 1960s hoped to do -- but this time with the production of serious at home testing kits via the DIY Bio movement, and 3D printed speculums that they plan to make available freely to sex workers and the resource poor. There is a slight flip-side to this narrative as strains of neo-liberalization increasingly take hold of healthcare, often making the individual fully accountable and responsible for their own needs and cares. The possibility to take such health concerns into one's own hands assumes a lot in terms of labor, time, and affordance in many ways. In creating a collective around these DIY methods and sharing practices, experimentations, stories, tools, and failures there is hope to subvert neo-liberalization by establishing an alternative narrative through collective becoming and accountability.

capitalism.[194] Creating this autonomous and alternative data server infrastructure puts the

theory of alternative pathways and infrastructure into practice in a very real way, but it

also poses issues regarding the resource-intensive realities of running and maintaining a

reliable data server, especially in Calafou, an off the grid colony that has power outages

from time to time. Yet, it is the possibility to foster these multiplicities and differences

within the greater maker and hacker milieu that seem to cultivate feelings of utopia,

transgression, transformation, and change through pursuit of their practices. The field of

sys admins is heavily male-dominated. The project to tackle becoming one would not be

possible or culturally accessible to the members involved without collective and

aggregate care to maintain the server and experiment with its possibilities – and to

support each other's failures and learning curves in relation to sys admin tasks.

Spanning Tree has employed economic accessibility – by supporting mechanisms

of redistribution and caring for ways in which to include those who may be struggling

financially. This awareness comes from members having specific experience with

economic instability, and is supported by other members having greater economic means

– thus they hope to build care mechanisms and solidarity across differentiation of

economic class. Spanning Tree has membership dues, but they are on a sliding scale

according to economic means. This was a structure that Drew helped to establish and she

related: "I'm really proud of that. I think that that's essential to making things class-

accessible."[195] In Femhack the core members also struggle economically, and realize that

putting a price on something might limit who can participate or feel like they can

participate. To compensate they locate free space for use, and enroll participants to help

[194] Gibson-Graham, *End of Capitalism*.
[195] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.

with organizing. This includes helping to set up early, or partaking in the potlucks that they typically have at events. It not only helps Femhack members share responsibility of maintenance tasks, but is a collective way in which to create a welcoming and accessible atmosphere. "Meals are part of this, not only for accessibility, but also as a way to warm up space and the event. Technology is not an isolated thing. It could be very social, we could talk about a lot of things, but also we socialize together as friends. It's a friendly environment."[196] This focus on collective care, organizing, and working together to figure out the kinks is connected to the *hacking with care* group in which Akhe participates. It also speaks to how Femhack members view technology – and access to it – as inherently social, cultural, and political.

According to Drew, her experiences of economic instability early in life gave her a more critical perspective into the overarching issues at hand with the accessibility of technology and cultural divisions therein. This was particularly affected by seeing her mother struggle to find a job even after she had made her way through school into a technology-based field.

> I think what I see coming out of that experience, is […] the short-falls of the education to fight poverty system. There's a limited number of jobs on the other side anyway and there's an enormous amount of pruning people down that comes in that rise, in that economic rise. You need to fit in this box and you can't ask too many questions, and you need to be the person that they need you to be.[197]

But it also gave her a standpoint from which she felt she could develop a more accessible frame. "And so I do feel like the background I come from, [in] having much more

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[196] CH, interview by author, Skype interview, Canada, October 17th, 2016.
[197] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.

experience with poverty than most people who, say, went to St. Johns or who are working in technology, [will help to] bring an economic accessibility to this."[198]

Drew's concerns highlight a major issue within the Maker Movement and these "openly accessible" spaces. Mainly that they imply intention without deeply engaging cultural, economic, racial, and gendered barriers before stepping into the realm of technology-based development. Instead, they tend to focus on the building up the technologies and establishing infrastructure, instead of working with and co-constructing both sociocultural and technology design dimensions in a truly intentional way, as Lee Martin's article on maker education article demonstrates.[199] Get the space, get the tools, get the people in the space, *then* worry about accessibility, inclusion, and empowerment.

Instead, feminist hacker collectives demonstrate how accessibility is framed and dealt with as a becoming, as a conversation, and a constant state of flux in relation to materials, people, resources, infrastructure, shared cultural values, and external institutions. Regardless, there *will* be some for whom these groups are physically inaccessible or who do not feel the group is culturally accessible. There is no way these groups could provide resources for everyone in a local community. But by working explicitly to be accessible for those at the margins, groups like Spanning Tree, as with the people of color-led Liberating Ourselves Locally (LOL), are creating an alternative narrative for technology-based production, development, and interventions to create alternatives to the dominant framing of technology.

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[198] Ibid.
[199] Lee Martin, "The Promise of the Maker Movement for Education," *Journal of Pre-College Engineering Education Research (J-PEER)* 5, no. 1 (2015): 30-39.

Inclusion

As is clear in the previous example, Spanning Tree does not pretend to want everyone to

take part in their group. So, entangled with their inclusionary practices, are explicit

exclusionary tactics – which is a practice enacted by most feminist hacker collectives.

This is something I would like to call *tactical essentialism* – in taking from De Certeau's

work on tactics in his work *Practice of Everyday Life*, and Spivak's concept of "strategic

essentialism," tactical essentialism originates from grassroots activism and ground-up

practices.[200] While Spivak's concept of strategic essentialism and its misuse has been

critiqued for various problems such as that with essentializing diverse experiences and

glossing over intersectionality, even by Spivak herself, it is a helpful concept for

understanding the mechanisms and tactical interventions by which feminist hacker

collectives strive to shift the landscape of dominant technological imaginaries.[201] In the

particular case of feminist hacker collectives, tactical essentialism means employing safe

space mechanisms to shut out groups who dominate technology cultures so that they can

create and develop solidarity and support among marginalized others.

Of course, such tactics have run up against critiques of their own within

technology groups and regarding issues of gender identity – something of which

Spanning Tree members were aware.

> We're creating a space for us, but is that necessarily welcoming to other
> people? So we do try to have those conversations. And we try to make the
> language as inclusive as possible. […We] got a question from somebody
> who was like, "y'know I'm gender-queer and I don't necessarily identify as
> a woman. Am I welcome at your event?" And we were like 'Yea, of course!'
> […] We don't want to force you to decide on your identity. The point is to

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[200] De Certeau, *The Politics of Everyday Life.*; Gayatri Chakravorty Spivak and Sarah Harasym, *The Post-Colonial Critic: Interviews, Strategies, Dialogues* (New York: Psychology Press, 1990).

[201] Sara Danius, Stefan Jonsson and Gayarti Chakravorty Spivak, "An Interview with Gayarti Chakravorty Spivak," *Boundary 2,* 20, no. 2 (Summer 1993): 24-50.

be welcoming to anybody who feels like they may not fit or be welcomed in that traditional space.[202]

In opposition to exclusionary practices that harbor ill-will or discrimination in terms of ability or skill along different axes of experience or identity, Spanning Tree's intention behind exclusionary tactics is as part of the safe space mechanism. This grows out of both Emily's and Kelli's experiences within HacDC, and even Celia's own experiences as a computer science student wanting to learn on her own terms.

By establishing a culture of radical openness, both HacDC and foulab had no repercussions or accountability measures. When it was revealed that some members had sexist, racist, homophobic, or classist views and were negatively affecting other members, nothing changed. This is a problem that many women and minorities have noted in technology communities at large. Thus, they feel the need to make changes on their own terms – through safe space and tactical essentialism. It is also hard to separate trauma from a physical space, once discomfort or antagonism has occurred, which makes the need for a safe and separate space that much more pressing for some. This is not to say that Spanning Tree or Femhack are against openness or open cultures, but that they recognized it would not work for their particular community – in regards to comfort and vulnerability. As Kelli explained: "We like the value of openness, but we have to be able to keep and to create a safer space for each other by excluding some people."[203] Certain safe space practices had yet to be fully employed by Spanning Tree, but they had also considered members-only meet-ups or working groups as a tactic for ensuring they know of and can trust the values of the people taking part in certain activities.

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[202] CD, interview by author, phone interview, United States, December 14th, 2015.
[203] KB, interview by author, Skype interview, United States, April 5th, 2016.

In establishing certain mechanisms for inclusion and exclusion Femhack hoped to create a different culture set apart from the "openness" that functioned in foulab, and in other such spaces, which prevented deeper discussions on how to make things more welcoming, more inclusive, and more attentive to various needs, knowledges, and cultures. Ludost, who is fond of foulab, could at the same time recognized its faults and the reasons for which they had to stop meeting there.

> It's a chaotic place. Many have critiques [of it], and it's not inclusive, like every other hackerspace I guess. Even a little bit more because there are no rules for social inclusion. When we started meeting other like-minded folks and women, many of them just felt uncomfortable to stay in foulab. They felt that it was not their space.[204]

In recognizing foulab's unintentional exclusion of different genders and levels of expertise, particularly in the context of comfort, Femhack has made a point to focus on comfort and engage different valuations of care in relation to themselves and their participants. At times, this might mean gender exclusivity for creating safe space and emotional comfort for some participants.

They enacted safe space tactics through the language in their calls for participation in events, wherein they mentioned who was welcome, particularly around gender-inclusion. The intention was to alert marginalized others in the technology-based community that Femhack was committed to creating a safe space. Ludost explained:

> Most of the time we do emphasize that the event is open to queer people, transgender, and other types of gender -- diverse people are invited and are welcome. [We say] that this event will be very inclusive in terms of – for example – gender.[205]

[204] CH, interview by author, Skype interview, Canada, October 17th, 2016.
[205] CH, interview by author, Skype interview, Canada, October 17th, 2016.

She described their version of safe space as being in action, in the doing, and through conversation with participants:

> So I guess again it's in the practices but not in the theory, where we always try, at the beginning of a session, to say how we try to be inclusive to participants. […] Not specified in a precise way, but I think it's there.[206]

Even though it was hard for Corrine to articulate, in relation to "inclusion" per se, she indicated that in working to create safe space for exploration of these problems inclusion was folded into practice. It was involved in creating group solidarity through which participants could establish autonomy and talk through discomforts openly. In the practice of cultivating comfort regarding gender-dynamics, they strove to include those who would be intimidated otherwise.

Celia referenced issues of intersectionality when considering gender exclusion and racial-identity.

> As a man of color, you [may be] equally intimidated by these spaces. […] So we want to make [the] invitation explicit. That it's not just about being a woman, it's about being somebody who is identified […] with […] traditional stereotypes [regarding technical practice], but still likes to play with stuff."[207]

This sentiment is shared by other feminist hacker collectives, including the Seattle Attic which has a policy of male-identifying allies joining.[208] Being explicit about their flexibility of exclusionary practices and understanding of intersectional needs was reflected in in the language of Spanning Tree's website and in how they promoted events. This desire around *wanting* to be welcoming is caught up in Drew's own critique of other spaces as having the desire and the intention, but no follow through.

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[206] CH, interview by author, Skype interview, Canada, October 17th, 2016.
[207] CD, interview by author, phone interview, United States, December 14th, 2015.
[208] See: http://seattleattic.com/.

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Through intention-setting and reaching out to like-minded groups that are more diverse as well as interested in engaging technology in a political way, Spanning Tree members were hoping to expand the diversity of their group. But they also recognized their own privileges and the problems involved in the demographics of their core organizing members as being predominantly white, cis, and female-passing. They questioned the comfort that other marginalized groups would or would not have joining their membership. In speaking about issues of inclusion, Celia of Spanning Tree, who worked in the technology industry, voiced her concern with issues of cultural comfort and alienation.

> My concern would be if we built out a membership base and suddenly we're 150 members who are 150 white members. Then it's like […] 'how did we get here?' If I was black would I really want to show up to that group? I don't think I would feel necessarily all that welcome. […] I guess […] I look at it from that perspective.[209]

She goes on to reference her own experiences of discomfort when going to school and being in a predominantly male class – working to think carefully about the issues of being a token.

> In the same way that me being a female in a classroom that's 80 percent men […] [was not] always terribly comfortable. I guess I project that out and forward onto being an inclusionary group. […] By the same token if you can make a critical mass of whatever that thing is, then it no longer feels that […] you stick out or makes you feel weird.[210]

In *Teaching to Transgress,* hooks relates this as a problem of comfort and confidence development and references the positive value of her own up-bringing in a space where she was *not* a minority.[211] The mechanisms through which

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[209] Ibid.
[210] CD, interview by author, phone interview, United States, December 14th, 2015.
[211] bell hooks, "Engaged Pedagogy," in *Teaching to Transgress* (New York: Routledge, 1994).

Spanning Tree can become more culturally diverse have not been fully enacted,

but might come through their plans for inclusionary tactics that build alliances and

solidarities with different groups in the community, which Kelli and Drew

identified as a mutual goal.

Drew was hoping to use her background in non-profit and grassroots

activist organizing to think about groups that might make sense to engage with a

more sociocultural, radical, and diversification intent. This meant being careful

about the relations they built, and establishing caring relations of symbiosis and

respect. It entailed:

> Being careful about where we are recruiting from, and being very explicit
> about what we're trying to accomplish and going to the communities we
> wish to be inclusive of. [E]specially in the beginning, Spanning Tree was
> trying to exist by reaching out to Women in Technology groups and Women
> in Technology groups are ... I mean less than technology groups generally,
> but people have money. People are mostly white or Asian.[212]

Drew related how she hoped to meet with computer science groups at higher educational

institutions like Howard University, a historically black university. The intention would

be to find members who were often marginalized in technology cultures, while also

seeing if Spanning Tree could help the institution in some capacity. Through these

actions, Spanning Tree members wanted to follow through on their commitment to

diversification of ideas, backgrounds, and cultures in terms of technology development,

while recognizing their own blind spots and privilege.

> We still want to have a special outreach effort to the people who aren't like
> the people who are in the core group who are all white and who aren't
> necessarily all identifying as women but who would pass as women. […]
> [W]e're trying to welcome people who are diverse along axes that the core
> group itself is not.[213]

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[212] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.
[213] KB, interview by author, Skype interview, United States, April 5th, 2016.

They also wanted to move beyond their initial formation toward a different type of feminism – distancing themselves from corporate feminism. Having redirected their intention and efforts, Spanning Tree was trying to differentiate themselves from other women-in-technology groups. They saw the corporate feminist needs as met, and they wanted to work on diversification and technological interventions from a different angle.

The intention behind this outreach practice, however, has various issues that invoke the inability for male hackerspace colleagues to effectively organize a women's solidarity group for women.[214] This includes the problem of tokenism and making assumptions about why, if, or how diverse populations would want to take part in Spanning Tree's practices. According to Drew, Spanning Tree is hoping to mitigate that in some way by engaging groups that already have a strong presence and support system instead of singling out loosely associated individuals, toward building alliances and solidarity to create a larger and more enriched collective. They hope to conscientiously engage communities to think with and strengthen through. In his book *Street Science,* Jason Corburn describes the possibility for disparate, differentiated publics to collectively act and organize when connected by a sensitizing cause.[215] Spanning Tree is trying to enact a similar situation, organizing around a critically-engaged technology project and a cultural reframing for what it means to engage technology.

Femhack struggled to be a more inclusive space at times, and Akhe connected it to moments in which they have had low energy and resources. This is pointed to as a result

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[214] This is in reference to a situation or incident that I explain later, basically regarding the TVCOG LNN's good but ineffective intentions.

[215] Jason Corburn. *Street Science: Community Knowledge and Environmental Health Justice Urban and Industrial Environments* (Cambridge: MIT Press, 2005).

of fragility and as something that might change as Femhack deepens their solidarities with other groups, and further establishes their own values and dynamics. Akhe recalls a moment when one person in their collective needed more support and understanding about her level of involvement since she was a single mother. She recognizes now how they were clumsy in terms of care and solidarity. Reflecting, Akhe relates: "It's better [now]. […] I think that because of this fragility around us, at some point we were not good at being careful, or being inclusive about other people with other challenges."[216] The importance of feeling strong within oneself in order to effectively enact caring relations of inclusion is a dynamic also raised by the *hacking with care* group. Akhe notes that while they are trying and have awareness, they still need to learn how to make their space safer for people of color.

> It's a discussion we didn't have enough up until now. With our other groups [that we are part of] this is discussed more and we have more people of color around us and more anti-oppressive practices and skills that help us. But […] we haven't brought that yet into the group. […] And then the other thing, I feel, is that we need to make the space safer for us emotionally first.[217]

Again, she references the need to become established, to claim strength before these bridges can be built, something which also had also been a concern for Spanning Tree.

Similar issues were also raised during the organization of the 2016 THF! In July of 2016, Akhe and I met up to discuss what needed to be done, and how I might be able to help contribute organizationally. It made sense for us to meet in person beyond the January and April meetings and various online discussions regarding the CFP, promotion, finding a space, the online presence, and programming. I made my way from Troy to Val

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[216] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016.
[217] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016.

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David, Quebec, Akhe's sometimes place of residence, for a day-trip. Set in the hilly

resort country just north of Montreal, Akhe was living in the cabin of a family friend.

While rustic in décor, the cabin was very livable and well-equipped with two kitchens,

two bathrooms, a fire stove, and several rooms for sleeping. Akhe often held activist and

feminist retreats there, one of which was a Fix-It-Together weekend for Femhack that

included repairing clothes, and bags, jail-breaking phones, attempting to fix my sewing

machine, and many discussions about breaking down barriers within cultures of

oppression in relation to technology.

Image 4. 5. Fixing the sewing machine at the Fix-It-Together weekend.

Image 4. 6. Sewing machine repair and use.

As I arrived at the cabin, and we began to talk, it became clear that Akhe had many

concerns, including but not limited to: providing food, coordinating accommodations for

those coming from afar, solidifying publicity within Montreal, and program scheduling.

Most of all she was concerned with their inability to secure a wheelchair accessible

location for meeting, and the lack of people of color represented in the programming.

There were three thematic tracks as part of the event, one of which was about decolonial

infrastructures. Akhe wanted to follow through with the decolonization track, but felt it

was presumptuous to include this theme when the only people organizing and supposedly

involved in presenting for it at the moment were white, female-identifying women.

There were more diverse voices that Akhe had reached out to who were not able

to join, or others she had wanted to include with whom she was not able to get in contact.

In the moment, I suggested reaching out and intentionally inviting people she knew in the

community who were working on this topic and identified as people of color. Together,

we brainstormed people and networks that might make sense in relation to the subject matter, who were already working in that realm, and we made a concerted effort to go through the list – but it was pretty late in the planning stages. Any moves to get people involved who Akhe was really hoping for might prove to be difficult. She had other concerns: would this reaching out feel superficial to those invited since it was coming much later than it should have been, and thus be read as an act of tokenism in order to externally appear inclusive?

I thought back to the initial excitement and vigor that Akhe had for organizing the THF! Convergence. She had been clear about intentionality and inclusion earlier in the planning process, but originally it was also to be a concerted effort between three core members of Femhack and myself from afar. As the other two members slipped away, due to various personal life issues, it became difficult to manage all the moving parts for one person, and many original initiatives fell by the wayside. This fragility and the subsequent problems with being more intentionally inclusive demonstrates the difficulties of being intentional while trying to feel solid ground upon which to follow through with inclusive practices. While it was a hard lesson, this moment revealed that in order to enact care toward inclusion of diverse and inter-related voices, one must feel a collective care, strength, and support. It also spoke to the difficulties of breaking deeply entrenched and structural barriers of diversity.

In her articulation of the overarching goals of Spanning Tree, Kelli focused on inclusion not only of marginalized communities regarding gender, race, and class, but also in terms of alternative knowledges not typically highlighted as important, or worthy of the hacking label.

[We are trying to create] a welcoming and relatively safe community for people who have been marginalized in tech cultures. Or who might tend to be marginalized in tech [and] who are interested in pursuing activities in a general way, that might combine technology or geeky kinds of things with, I want to say, non-tech. Because it might be art, it might be a social or political statements to expand what 'hacking' means. And not just expand in the sense that [it includes] fiber-craft, but to expand it in the sense of what those things do other than just [be] a soldering activity for the action.[218]

For Femhack this entails using explicit language around not needing technical skills in order to take part:

We mention that no technical skills are really involved. I think this is a way to be inclusive in terms of technical skills. Or sometimes we emphasize that participants would need to have basic knowledge on the subject of the workshop. I think it's important for newcomers to know that if they didn't understand something, maybe they didn't have the base knowledge that was required.[219]

Being explicit on these terms is important so that newcomers can recognize that it is not their fault if they do not understand the activity. If there is misunderstanding Femhack work to treat it with care instead of through elitist attitudes that might make the participant feel at fault. This is done through solidarity and support – working to help people move beyond intimidation toward feeling comfortable and willing to try things out if they want to, giving them the space to explore.

Tied up in this is the acceptance of asking for help, or asking questions, which people are often degraded for doing in hacker cultures since much of the learning is often individualized and not collectively sustained. Akhe connects this to elitist technology culture attitudes.

The 'Read the Fucking Manual' practice is terrible. Or this fake practice: Don't ask about asking, just ask. As if that was an issue. It creates a barrier

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[218] KB, interview by author, Skype interview, United States, April 5th, 2016.
[219] CH, interview by author, Skype interview, Canada, October 17th, 2016.

if people say, "can I ask a question?" and then they are slapped for asking that question. Asking for help is difficult. That is how elistism is made.[220]

She goes on to relate how she dispels these embedded cultural stigmas around asking by being mindful of their negative effects and staying true to creating a caring environment.

Spanning Tree has their own tactics to demonstrate inclusion through the support of different knowledges and skills. With publicity and photography of events on their website, they highlight the different kinds of projects that members are doing in this regard. According to their members, they do this intentionally, wanting potential participants to see that it is possible to engage in a wide-range of activities without judgement. Drew related that this intention and consciousness within the development of Spanning Tree is a major reason why she got involved in the first place and has stayed within the group.

> [T]here's a real consciousness in the founding of Spanning Tree to be inclusive. Fiber arts and things that are traditionally not considered maker-y enough to be maker-y. That's one thing that drew me to Spanning Tree. When they talk about skills and making things, they believe in my artisanal pickles. And my crochet, my single crochet, entire blankets of a single crochet.[221]

It is this particular acceptance that made Drew feel at home, and has possibly helped others feel that they can take part and be involved in such a group. This is further supported by creating a collective "safe space" of exploration and encouragement. "It's made me feel the possibility of real inclusion, in the making of technology – that I don't have to fight tooth and nail on my own. That's very encouraging."[222] For Drew, "real inclusion" means the recognition of different skills, knowledges, technologies, and

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[220] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016.
[221] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.
[222] Ibid.

cultural backgrounds in relation to technology use and manipulation. The importance put on being able to shift the scope of technology, its very definition, fits into Fox and Rosner's argument about feminist hackerspaces as spaces for hacking culture, not just devices. Described as a social and collective endeavor, their conception of technology illustrates how Spanning Tree's practices can establish alternative epistemic cultures and narratives from dominant conceptions of technology cultures to establish a critically engaged technical practice.

Spanning Tree recognized their limitations and their inability to enact inter-generational programming – or that this is not their goal or a part of their practices. They do not have the resources to provide support for teaching young girls, and so they are explicit about that while tabling at Maker Faire. However, in an organizational meeting, Drew pointed out that it is important to garner interest of younger girls by pointing them to other resources or groups that may be able to provide them helpful resources. During her interview, Kelli also related her reasons for wanting to establish a service to adults, not to young children.

> The part I'm more interested in addressing is the women who are already in Tech. There is such a large drop-out rate of women in technology careers, who are leaving because for various reasons, but also it comes down to an environment that's just really unpleasant to be in.[223]

This sentiment was tied to figuring out their purpose, which has been an iterative process, and will continue to shift as their membership changes. It is even something that shifted during my observations of Spanning Tree as they went from a more women in technology-oriented group, to one that was hoping to be more radically inclusive of

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[223] KB, interview by author, Skype interview, United States, April 5th, 2016.

different genders and interested in stepping away from the corporate feminist world of women in tech.

While Drew was supportive of the decision to not provide inter-generational programming, she pointed out the importance of childcare – that it was important to not cut out mothers just because Spanning Tree members cannot teach the children or give them activities. As she related during the meeting, "motherhood is a feminist issue." Drew also suggested how, while tabling at events, they could be clear about who is their intended audience, while also encouraging the interest of young girls. This would involve having information on hand about other organizations through which they could learn to code, hack, and make. In a sense to make connections by opening up the conversation, identifying options available to them, and creating solidarity with the girls and their mothers. Mothers are often excluded from technological worlds, and so by inviting mothers and children to take part, even just by providing lists of resources they could find elsewhere, Spanning Tree might help to create a different kind of structure, tying together diffuse networks focused on different aspects of the same issue.

Empowerment

Talking about empowerment in relation to technical skill and technology use, I parse out ways these groups hope to disrupt power relations for both individuals and communities in relation to more dominant technology-based cultures in which they may feel marginalized or powerless. Empowerment is complicated, though, and often presumes uneven power already embedded within the situation of who is empowering whom. More so than the other groups I studied, feminist hacker collectives are engaged in both self

and collective empowerment – as they are in the position of creating their community in a 'for us by us' mentality.

Similar to other hacker and maker groups, empowerment within Spanning Tree and Femhack was partly based on individual skill acquisition, but it was also centered on collective support, encouragement, and a comfortable space in which to experiment – with no judgment or disapproving looks from over the shoulder. Celia described this importance of a comfortable and supportive environment for the first time she taught a workshop. "I taught a class on learning how to solder, and it just sort of opens up that door of, it's not that hard."[224] Celia went on to relate that tied into these skill-sharing practices was an empowerment that came from teaching and collective encouragement to do so. "It's also very empowering to the folks involved in teaching to be told by their peers 'Hey you should get up and teach a class about that.'"[225] As confidence was built by the collective to teach among each other, it could then be cultivated to take part in larger conversations with a wider community. Celia had observed this first-hand in the DC FemTech community.

> I come from the DC FemTech community and when people get used to standing up and claiming their expertise, they're more comfortable. They can do it in front of a very non-confrontational group and then they can go out and stand up and claim their expertise in sort of a wider community.[226]

She hoped that it would translate into Spanning Tree and then cycle back into DC FemTech and the DC community at large as a way in which to build solidarity and empower marginalized groups toward shifting power relations embedded within dominant technology cultures.

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[224] CD, interview by author, phone interview, United States, December 14th, 2015.
[225] Ibid.
[226] Ibid.

Building confidence in this way also becomes a reason to have a more exclusive group. As referenced earlier it is a tactic that hooks has described as the reason for her own confidence-development when young.[227] Other scholars, however, have argued that it is important for marginalized others, such as women in science and tech, to learn alongside their dominant counterparts – because when working in a career setting or in a different educational setting, this will be the norm. Within the groups I was studying, this latter argument was complicated by reports of continuing belittlement and disregard for different perspectives or needs. It would seem it is not as simple as putting these groups together without being very intentional and socioculturally sensitive, something the technoscientific classroom or makerspace typically is not. Such learning environments may call for more routine teaching of the power relations and dynamics often reproduced in technical skills and scientific knowledge practices. One way to enact this is through teaching different knowledge systems and production practices, which Riley has enacted in undergraduate engineering courses.[228]

It is not just the skills, acquisition of tacit knowledge, and claims of expertise that make such styles of learning associated with maker and hacker cultures empowering to these feminist groups. For many it is also the material practice which is classically seen as inaccessible or off limits to women due to cultural norms and stereotypes. This shows up in Drew's commentary about building a project from the ground-up, as a way to break down culturally-sustained or personal experiences regarding incapability and not being given the room for experimentation and failure in a safe space.

> I think for a lot of people, especially people who are coming from no technical background, building a technological device from the ground up,

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[227] hooks, "Engaged Pedagogy."
[228] Riley "Employing Liberative Pedagogies."

and building their own knowledge from the ground-up could be a transformative experience. In the future, that internalized exclusion of "I am not a person who can make the world in this way," can be a little bit more destroyed.[229]

This may then lead to the confidence of taking part in the dominant discourse, or, even more so, deconstructing and recreating the dominant narrative just slightly to put it on a divergent path.

There are others that are more interested in the development of hands-on and technical skills toward empowerment, like Ludost of Femhack. She associated the hacking enacted through Femhack as a personal and political act, and observed this within mutual aid workshop participants. "Sometimes I see participants feeling empowered because they learned something and are like 'oh now I can maintain my computer by myself. Now I can update this. I don't need to go to somebody who is very knowledgeable and I'm not.'"[230] For her, empowerment through Femhack is tied up in autonomy, and the possibility of opening the avenues of autonomy for others in a collective, supportive, and welcoming environment. Yet, she gave pause and recognized "empowerment" as hard to pin down and a near impossible goal to have in mind – that it would be too fast to claim that they have the ability to empower others. Instead, she focused on the possibilities of comfort, care, and feeling supported to explore technical realms on a personal level.

> If you took our workshop and you felt more comfortable [...] with a piece of technology I would be very happy. If you felt more included and you had a discussion that [made] you go and do something by yourself, like use a tool by yourself, I would be very happy. [...] Some people come [back to] us and they say, 'oh my god that's awesome. I felt very good.' And 'ever since I came to your first hackathon, I've done this and that.' So I know that this is happening. I like that, but at the same time we are so informal. Maybe

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[229] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.
[230] CH, interview by author, Skype interview, Canada, October 17th, 2016.

if we had something we could promise people. But at the same time, I mean, it's really personal. Personal paths that people are going through. If this helps them to be more empowered I think that's good.[231]

For her, it was little moments of comfort and gains toward autonomy through collectivity that made Femhack worth it, and made her feel that having more feminist hacker collectives was meaningful. It also demonstrated that their form of empowerment was through the building of relationships and collectively – supporting one another to do something they may have not thought possible otherwise.

Because at the end of the day you feel that there's the need of […] more conversations with somebody who came to the meeting -- helping them change their life, their vision about technology. So, I guess you feel this empowerment.[232]

During a mutual aid workshop in January 2016 I experienced this collective, relational, and iterative empowerment. Prior to me arriving, one participant came as a first-time attendee of a Femhack event, needing to trouble-shoot an issue she was having with her Linux system. After getting guidance and help from Akhe, Sylvie, and Ludost, she eventually showed me how to deal with a similar problem I was facing since I had not been there for the previous walk-through. It was empowering for her to help and further solidify her knowledge, and her guidance was forgiving and rooted in her own experience of having known what it was not to know.

Similar to Ludost, for Drew personally, enacting material control and the very act of putting something material into the world that channeled anger or despair about systems of power and control helped her to feel that she was shifting things. But she recognized its limits:

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[231] CH, interview by author, Skype interview, Canada, October 17th, 2016.
[232] CH, interview by author, Skype interview, Canada, October 17th, 2016.

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I think creation is inherently powerful. And at the same time, no matter how much technical skill I acquire in my nights and weekends, I'm not going to remake the structures of power that I am pushing back against. Regardless, I think that it's incredibly psychologically valuable to be doing something. And I think that there is practical value to that, including but not limited to the practical value of the device itself to the group and the greater world.[233]

While Drew understood the personal psychological shift as empowering and political, she saw Spanning Tree as working towards something explicitly political by shifting awareness in relation to technology-based cultures and their dominant frame – especially in how that dominant frame pushes particular values, voices, needs, and types of people out of the conversation. Yet she saw a limit to the system-changing capacities that she might acquire – a certain type of pragmatism that her actions and their group will never be able to make a shift in the greater techno-cultural landscape. But there is no despair in this regard, and instead the focus is on creating their own heterogeneous narratives and space of experimentation and playfulness, downplaying and breaking from the totalizing effects of hegemonic technology cultures.

Throughout interviews and observations, Femhack participants and organizers demonstrated that they wanted to explore meaning beyond the material and virtual objects that they manipulate, seeking a politicization of actions that indicated a disruption to dominant narratives – or as the creation of a whole new frame outside of the hegemonic and dominant discourse. For them, "making" alone is too indicative of capitalism and consumerism, does not take into account care, and does not enact a transformation. Akhe related that empowerment for her via Femhack often comes through discussions about the uncomfortable aspects of technology production and use and its possible intersections with feminism. She still enjoyed some of the hands-on

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[233] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.

workshops "where I can feel empowered," but there are computer programming exercises that she can openly admit she just did not like.[234] The major difference between Femhack and other hackerspaces or makerspaces is that this is acceptable – there was no pressure to preference certain skills or knowledges and interests over others. Instead of a weakness, Akhe saw this as a strength. Participants and organizers alike all had different skills, focuses, and interests, some of them being not so tech-oriented. The intention was to work with these different strengths to have a diverse understanding of technology development and change. By establishing caring relations between different types of participants, they were trying to establish collective empowerment and a different narrative for engaging technical practice together.

Similarly, a dimension of technological empowerment that Spanning Tree wanted to focus on was political awareness with regards to how these new skills were employed and how they took part in technology manipulation. Drew related, "I want that to be the way that we empower members – by creating awareness and […] skills for spreading awareness. Like making 'zines or organizing, maybe organizing actions."[235] They talked about wanting to demarcate themselves from the corporate feminism that they saw at the core of other women in technology groups, by bringing criticality to how they used technology. Kelli spoke about their interest in a different type of empowerment:

> I am seeing these other women in technology […] organizations in the DC area that are more corporate oriented, that are more towards empowering women to buy and run businesses. [...] We try to be on the other end of the capitalism/socialism spectrum in empowering people as individuals. Not necessarily empowering people within the system of corporations.[236]

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[234] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016.
[235] KB, interview by author, Skype interview, United States, April 5th, 2016.
[236] Ibid.

This is not to say that Spanning Tree did not see an importance to what these other groups were doing – in fact they rather support and align with them for various resources instead of competing with them. Their support of other narratives within technology cultures demonstrates how there can be multiple truths and heterogenous narratives therein. Each might have different value systems and establish different intentions toward many types of spaces that can all claim to be part of hacker and maker cultures.

In 2016, I spent much of August in Montreal organizing, establishing, and communicating with other participants and organizers for the THF! Convergence. I spent most of my time with Akhe and Morgane — who was part of the first THF! Convergence and travelled from Brussels to take part in the cryptography and autonomous infrastructures tracks. In the midst of planning and coordinating we decide to visit the PEC Fablab, a new makerspace in Montreal that Akhe had yet to see. They were holding a collective repair event and we thought they might be interested in the THF! Convergence. We also had some things to repair. I drove to help transport Akhe's broken Theremin and ourselves around the hectic streets of Montreal, which were heavily under construction during the summertime. Along with most streets, the one we needed to turn on was undergoing maintenance, and the detour swung us around the old Olympic swimming pool arena. A vast complex, Akhe pointed out how some things were still functioning, but that the main swimming pool had been non-functional for quite some time.

She also mentioned that she was recently there for the Maker Faire, which was curious to me. While Spanning Tree openly tabled at the Maker Faire in Washington, DC and considered themselves as part of maker culture, I had never heard of any Femhack

members going to, or contributing to "maker" culture up until now. Their interests seemed to lie more in the activist and hacker realm, which, while certainly connected to maker culture, were set apart in various ways. Both in speech and in action, Femhack seemed clear that their actions were about "hacking." The description on their website at this time clearly states:

> Femhack is an autonomous group from Montreal whose mission is to create an empowering and inspiring environment for politicized feminist and queer hackers. Triggered by Do-It-Together practices, learning by doing and curiosity about how things are made, believing in the freedom of technology, privacy, openness and sharing of common goods, Femhack identifies with the most avant-gardist elements of hacker ethics. We take an intersectional feminist perspective to what we do and think, which means that we hack patriarchy, capitalism and other systems of oppression.[237]

"Making" or fabricating in the Maker Movement sense did not seem quite the same thing.

I asked Akhe how she liked it, what she thought, and why she went. For Akhe, the initiative to go was due to curiosity. She quickly related that it was wonderful for children and seemed to be a great thing for getting kids interested in DIY cultures and the making of things, that it had a great mission – but she felt it was not for her. It was nice, but not political. Akhe likened the event and the general discourse around Maker Faire as distractertainment – making for the sake of distraction. "It's not empowering for me." Akhe described the booths and how there was nothing for her own personal identity to engage with there. The event had cool gadgets and flashy entertainment to get kids interested in STEM, but nothing meaty to spark her own personal interests in hacking, art, and creating to upset structures of power.

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[237] "Foufem," accessed November 6, 2016. http://foufem.wiki.orangeseeds.org/.

The following week, Morgane corroborated this sentiment with different reasoning when we stopped by Eastern Bloc, an artist gallery with a Fab Lab, in order to flyer for THF! Rushing in out of a rainy and dreary afternoon, we found ourselves faced with a quiet, open, and empty-seeming industrial art gallery space. As we were searching for places to post our flyer, we came across another flyer for a mini synthesizer workshop on the door of the fab lab. Morgane scoffed slightly and muttered something about it just being a "maker" thing. I asked for her to clarify. Morgane related that she connected "making" to commercialization in that it focused on buying a kit and consuming for the sake of saying you have done the thing. As she saw it, the main problem was that more often than not the inquiry stopped there, with no support for deeper exploration beyond the one-off workshop setting. In a way, this style assumed individuality and the expectation that the person would have enough support, agency, and will to further their technology engagements without the need for sustained collective support. Much as Dewey might critique, there was no social engagement or drive; these projects were an end within themselves. While Morgane did not directly use the term empowerment, her view of "making" is as a false empowerment. It does not subvert or disrupt power relations to top-down technology cultures – nor does it reframe an understanding of technology in relation to self.

Instead, participants in both Femhack and Spanning Tree were invested in creating their own empowerment tactics outside of this dominant maker framing – although they expressed potential interest in engaging dominant technology cultures. But instead of working to change or take over foulab, HacDC or women in tech organizations to reflect their own values, both groups have focused on creating an alternative space for

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those at the margins who want to establish a different frame for technology use, development, and skill-sharing. They hope to disrupt the dominant discourses involved, by creating awareness around inequity within the system and the difficulties involved in trying to survive within the current systemic structures of technology culture. Recognizing the difficulties of making a full shift to the dominant, however, they hope to create and sustain alternate epistemic cultures in this regard, adding to an epistemic plurality. Like most of my field sites, this seems to manifest in the cultivation of an ethics of care related to technology-based practices, developments, and use.

For Akhe, the building of autonomy and empowerment through collectivity was also important, mainly through the exchange and making of knowledge. The way she described collectivity towards autonomy lent a different mindset than DIY or lone inventor rhetoric.

> It gives me excitement to imagine collective building of things, along with thinking about how we relate to knowledge and how we can build relations among each other. That is exciting and caring. Giving us energy, or growing energy for us. [I'm interested in] what all of this making together gives us. How do we *feel* about it later?"[238]

But beyond this collective and inner group empowerment, Akhe saw their practices as also empowering through the awareness and conversations they could precipitate among feminist allies or friends who were not on the margins, and by helping them to understand how they might be reflective of their own actions. She saw Femhack as a group through which to develop pedagogical skills and possibly train or make other external communities aware of the issues within technical skill-sharing practices. In speaking of a friend as a possible ally:

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[238] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016. My emphasis through italicization.

He's really skilled, but I would say he's not skilled in pedagogy. He doesn't know necessarily how to transmit without taking the central position of power. But he wants to learn. So I understand that he can be triggering and he can be unsafe for some people. […] To me those kinds of friends, who are not exactly a feminist ally, but they are a friend – I see them as people we can talk to and we can learn with. For me if you write a feminist methodology, or pedagogy, it would be for us and for them. […] For us to become more empowered but also to be able to talk to our closer friends who are really clumsy.

Mostly for me it has been reacting to certain ways of doing, certain ways of talking, and learning with them what's going on. So that I don't feel unsafe. They are not a techno-feminist ally. But they want to be.[239]

For Akhe, empowerment not only comes from stepping out of and away from these people and unsafe environments, but for the possibility to step back into conversation with them after developing tools, mechanisms, and methodologies to transgress and move beyond.

The potential for such transgressions is reflected in the engaged, feminist pedagogy of bell hooks, the call for a pedagogy of discomfort from Boler, and critical pedagogy as explored by Riley.[240] In *Teaching to Transgress,* hooks highlights the need to create a classroom environment where people can speak and relate freely. Even though this may result in discomfort, her method is to talk through towards mutual understanding. "Rather than focusing on safety, I think that a feeling of community creates a sense that there is shared commitment and a common good that binds us."[241] Hooks argues that shared commitment results in a more democratic and participatory environment. This method of pedagogy builds community by "recogniz[ing] the value of each individual voice."[242] Unless the tensions regarding issues of marginalization along

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[239] AG, interview by author, La Passe, Montreal, Quebec, January 10th, 2016.
[240] Boler, *Feeling Power*.; Riley, "Employing Liberative Pedagogies."
[241] hooks, "Teaching to Transgress."
[242] hooks, "Teaching to Transgress," 40.

lines of gender, race, and class are eventually talked about directly, resolutions and

transgression beyond current systemic beliefs may not transpire. Needed within these

discussions is also the recognition of certain historically contingent becomings,

witnessing, and complicity – which both Boler and Pratt speak to in their own works on

pedagogy and knowledge formation.

This pedagogical shift also relates to breaking down the preference of one type of

voice, or knowledge, over another. Hacker and maker groups usually focus on soldering,

3D printing, coding, and technical skills – shutting out many different people from

feeling useful and able to contribute relevant or useful skills. Beyond the technical, skills

such as active listening, organization, sustaining practices, promotion, design, care,

maintenance, and management are just as important, in their own right, for running such

a group – something that the many feminist hacker groups recognize. Both Spanning Tree

and Femhack employed various tactics to enact empowerment and were aware of the

politics involved in what they cared for and why – and who felt comfort or collective

support to empower themselves or to aid others in cultivating diverse narratives.

Conclusion: The Struggle for a Hetereogeneous Narrative

Both feminist hacker collectives I studied hoped to help established alternative maker and

hacker cultures that take seriously relations of power in technology use and development.

Once I noted their attention to different types of care, I decided to focus on their practices

that dealt with care and (dis)comfort. This revealed different dimensions to their

inclusion, accessibility, and empowerment practices that, while in dialogue with the

dominant discourse, established their own narrative and epistemic culture. A narrative of

different valuations of care came to light as a reading of maker and hacker cultures in

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relation to and with technology. Attention to the power relations involved in 'careful'

learning and knowledge sharing practices then allowed for the development of different

methodologies for translating awareness beyond safe space toward mutual understanding

with others about the violence as well as the joy that technology-based production,

"making," and "hacking" can enact.

In *Gut Feminism*, Wilson calls for feminists to take seriously the biological

sciences and the mechanisms through which biological research and its material

outcomes are framed, to be able to reframe and reconsider its claims in regards to gender

and diagnoses tied to depression.[243] Likewise, Barad, Audrey Bennet, Stacy Alaimo,

Samantha Frost, and other feminist materialists argue for feminist theorists to take

seriously the effects of the material world in conjunction with discursively inscribed

cultural power dynamics.[244] Feminist hacker collectives join in on this conversation by

taking seriously technology and the material practices therein. But they do this on their

own terms, and in a way that could have productive outcomes for how technical

knowledge and artifacts are produced, shared, and framed. They are not discounting the

import of technology production and material cultures. Instead by engaging and working

with technology-based cultures and hands-on praxis they hope to remake ontologies,

structures, and cultural dynamics. This involves a focus from the start on relations and

sociality – the micro-ecologies tied up in these groups in terms of place, people,

interactions, care, and comfort.

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[243] Elizabeth A. Wilson, "Gut Feminism," *Differences: A Journal of Feminist Cultural Studies* 15, no. 3 (2004): 66–94.

[244] Barad, "Posthumanist Performativity."; Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham: Duke University Press, 2010).; Stacy Alaimo, *Bodily Natures* (Bloomington: Indiana University Press, 2010).; Samantha Frost, "The Implications of the New Materialisms for Feminist Epistemology," in *Feminist Epistemology and Philosophy of Science*, ed. Heidi E. Grasswick, 69–83 (Amsterdam: Springer Netherlands, 2011).

By distancing themselves while also staying in conversation with the dominant discourse, both Spanning Tree and Femhack have unique positions for acknowledging and evaluating what has not worked in the dominant discourse's attempt for inclusion and accessibility. Since most of the hackerspaces they grew out of have proven ideologically unsupportive, they partner or are symbiotic with co-working spaces, political library and community spaces, public libraries, feminist arts organizations, and arts galleries. In order for their vision of transformation to flourish, they recognize the need to focus on solidarity practices – on collective care and a network of hacker, tech, or education groups that are not directly, but tangentially aligned.

Through collective action in conversation with care they work to create alternate space and actions that take into account differentiated needs, a recognition of different knowledges, and critical engagement of technology. These actions toward reshaping or even more so establishing new technology cultures, education, and creation demonstrate what Bernstein and Armstrong argue as a multi-institutional approach toward shifting power dynamics that are often made to be invisible or neutral in the way technology is framed. Currently, they hope to become safe havens for those who are marginalized within dominant technology cultures and to build an alternative pathway for themselves towards technical knowledge acquisition, recognition, and development. As one organizer of Spanning Tree relates, "I see it not as a catalyst for change, I don't see us as necessarily contributing to the good of humanity overall in a way as much as supporting a particular subset of people as a community."[245] Gibson-Graham argue that these small interventions and the awareness of such groups may yet help to create fissures and

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[245] KB, interview by author, Skype interview, United States, April 5th, 2016.

inroads of change to dominant framings and discourse.[246] Coming from differentiated standpoints from below and sideways, these feminist hacker collectives may yet be able to critically develop their own practices toward a new framing of technology.

Along with the willingness for feminist hacker collectives to discuss openly their hopes toward and their mechanisms for inclusion or accessibility, they want to examine their own downfalls and the politics involved as well. Both Spanning Tree and Femhack organizers acknowledge that using inclusive language is only part of the picture and does not result in greater diversity. Unlike Maker Movement discourse which often leaves their claims of inclusion at the rhetoric of "everyone makes," assuming that accessibility has been unlocked in the utterance, feminist hacker collectives recognize that the maintenance of accessibility and inclusion is hard work. They acknowledge that it involves a process of creating collective awareness, understanding, and culture with other marginalized groups. That it also comes through growth, acknowledging privilege, and iterative practices of care work. This is reflected in Drew's plan to talk to Howard University, as well as Akhe's intention to reach out to politically-aligned groups and individuals for future events planning, and her solidarity with friends who face adversity due to gender, race, (dis)ability, or otherwise.

To sustain their practices, they may need to more fully partner with established institutions, or other like-minded groups to create alliances and solidarities – to share resources, energy, and space, thus fostering meso-level interactions. This entails giving weight to differences and experience, and celebrating difference instead of shutting down discrepancy for mass agreement or alignment of practices. However, tension might arise

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[246] Gibson-Graham, *The End of Capitalism*.

if they end up having to partner with groups not so similarly aligned in fostering difference, disagreement, or disruptive practices. This has come up for Spanning Tree as they grappled with the idea of corporate sponsorship and considered the use of the expensive Catylator space. It is the same for Femhack as they assess potential partnerships with other feminist or activist organizations like Studio XX and La Passe where they have to contend with issues of wheelchair inaccessibility for events.

Building on the work of Freire's consciousness-raising techniques and Boler's pedagogy of discomfort, I would argue that the most relevant methods regarding accessibility, inclusion, and empowerment within these groups is their engagement with critically-engaged pedagogies in conjunction with their attention to the politics of care embedded in technology-based practice. They are committed to creating a learning environment that is dynamic, engaged, and in conversation with participants – their needs, values, what they care about, their comforts, and discomforts. They are also interested in cultivating such experiences as happening through group practice, maybe creating discomfort in some senses, but allowing for collective witnessing and acknowledgement of flexible situatedness and accountability to each other. One organizer described of technology-based educational practices, "I think technology is imminently relevant to people's lives and that there's got to be a way to make the early stages of learning closer to what people care about."[247] As I have observed, feminist hacker collectives are interested in skill development since it influences who gets to take part and have a say in shaping technology, to influence the material world and its outcomes.

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[247] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.

This includes further recognition of those already taking part who might be currently marginalized or unrecognized.

> There's this idea that if you make somethings with your hands, that's what's real. And to be stuck on the outside of that […] then you're kind of stuck out of the making of the material world.[248]

By holding others, as well as themselves, accountable feminist hacker collectives believe they might be able to intervene through awareness, recognition of marginalized technology cultures, and shifting the informal educational landscape. They hope to instantiate material participation and accountability to implicated actors. They do not want to make just to make. Through fabrication and hacking, feminist hacker collectives are interested in an accountability to technology and its implications. Centered on an ethics of care in relation to DIY and DIT technology, they instantiate individualized becoming through a collectivity that allows one to "be one self" while taking part in technological shifts and changes – and ultimately for recognition and creating alternative pathways toward technical critique and use.

Within many of the interviews, off-hand discussions, and events that I attended, aspects of comfort and discomfort came up, as was signaled by the story that opened this chapter. As I have examined in other work, comfort is different from and yet connected to expertise, and the cultivation of expertise.[249] Levels of comfort and the differentiation of comfort along varying cultural values and in terms of gender, race, class, age and (dis)ability have a large effect on accessibility and inclusion – and towards the instantiation of empowerment. Comfort is a feeling that care can enact or that signifies a

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[248] DH, interview by author, Silver Spring, Maryland, September 25th, 2016.
[249] Yana Boeva and Ellen K. Foster, "Making: On Being and Becoming Expert," *Interaction Design and Architectures* 30 (2016): 65-74.

certain kind of familiarity with a situation. Different variables affected by care practices include physical comfort, emotional comfort, socio-cultural comfort, and comfort with ability, tools, and skills. As Boler has demonstrated through her own work historicizing different labors and emotions in educational practices, comfort and feelings also greatly affect education and the transfer or collective and flexible instantiation of knowledge. These factors come into play within educational realms, and encourage certain populations to take part and experiment more so than others – due to discomfort. This is also the case within hacker and maker cultures, and is often at the root of why feminist hackerspaces or collectives feel they must subsist.

Feminist hacker collectives focus on empowerment, comfort, community-building, and shifting definitions or recognitions for what counts as technical skill or as important knowledge within technology production. But they also work to acknowledge discomforts. This includes exploring the importance of exclusion, unpacking why discomforts persist in relation to different cultural values and modes of belonging and non-belonging, and recognizing the violence that a simple admonition of "care" can enact. This facet of feminist hacker practice supports Murphy's argument that care must be unsettled, or troubled, and not so easily written off as positive. Even in such critically-engaged groups, the politics of care need be explicated toward more accountable and equitable forms of technoscientific practice.

In her theorization for a pedagogy of discomfort and working through difficult biases and issues of systemic power, Boler calls for the hard work of remaining flexible and learning collectively thus fostering accountability instead

of getting caught up in individual self-reflexivity. In this, she highlights education as a becoming that is historically and collectively contingent.

> To avoid an oversimplified version of self-reflection or an uncontestable invocation of 'experience,' pedagogical strategies must push beyond the usual Western conceptions of the liberal individual. Instead the process of 'becoming' may be understood as an undertaking that is both: (1) collective [...] (2) flexible: leading to a willingness to reconsider and undergo possible transformation of our self-identity in relation to others and to history.[250]

Through a pedagogy of discomfort, feminist hacker collectives might be able to hold others, and themselves, accountable to many issues at the root of systemic oppression within technological systems. It is a different kind of care work that takes differentiated experiences and needs into account. This includes a cultivation of collective witnessing through Pratt's "contact zones," and a move away from the autonomous individuated framework of technical expertise, production, and education.

Instead of focusing on making everything comfortable (categorizations of which are still set by a particular culture or demographic regardless), groups like Spanning Tree and Femhack are moving toward mechanisms in which they can critically unpack discomforts around race, gender, sexuality, class, mobility, and age. In fact, in October 2016, Spanning Tree opened themselves up to this discussion by holding a panel on non-binary identifying people in technology-based fields and the tensions within women-in-technology groups around DC. They had faced their own discomforts and non-sensitivities around genderqueer and non-binary members, so they reacted by engaging topics of gender identity politics, inclusion, exclusion, and the women-in-technology scene within which they are situated. Attuned to care and (dis)comforts, such practices enable a new narrative or reveal narratives previously obscured in technology cultures.

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[250] Boler. *Feeling Power*, 178-9.

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These issues around comfort and discomfort are complicated and nuanced. Many feminist hacker groups decided to escape the discomfort of masculinist dominant spaces, yet they recognize that confronting some discomforts is required for critical political resistance. Politics are involved in who has the power to explore discomforts and who stands to gain when the uncomfortable speak from positions of vulnerability. Politics are also caught up in how such communities decide when and where to suffer versus when to escape and rebuild. Participants from feminist hacker collectives work to establish their own narratives set apart from dominant discourse, but individuals may have different reasons for and mechanisms that cause discomfort – which need to be unpacked and considered in different ways. In one instance, attention to the importance of discomfort and wanting to work through differences enables Akhe to engage her non-feminist friend toward creating alliance.

Overall, the participants of these groups acknowledge that it is not their intent to include *everyone,* and take *all* needs into account for technology intervention and empowerment. However, they are invested in leveraging collective resources toward equity in the technological landscape, toward cultivating collective situated knowledges, and towards explorations of feminist technologies and infrastructures. Feminist hacker collectives hold an important position in considering the situatedness and contingent nature of the maker and hacker cultures and programs and critically-engaged technology groups. They demonstrate the ways in which the Maker Movement phenomenon might take on different narratives and standpoints, according to the intersectionality of various configurations of gender, race, age, socio-economic class, location, and mobility. Ultimately, they argue for greater recognition and cultivation of heterogenous narratives

in DIY technology cultures with the possibility for broader participation and

empowerment.

CHAPTER FIVE: LIBRARY MAKER PROGRAMS

Introduction: "You don't even have to be a US citizen"

Searching for the Harold Washington Library Center's Maker Lab, I travelled through

sparsely occupied grand corridors, marbled stairwells, and arched ceilings, past fountains

and modern art, and moved upward on escalators through open courtyard architecture.

Image 5. 1. Escalator and art in Harold Washington.

When I came upon the Maker Lab its welcoming glass double doors were swung wide

open, flanked by posters describing the space and an awards display of their first exhibit

at the 2013 Chicago Maker Faire.

Image 5. 2. Entrance to Maker Lab.

Inside, the staff were bustling and buzzing, getting ready for a 3D printer workshop in which participants would make a chess game piece while they were also helping stray patrons from the open hours that had just ended. Two women with name tags talked emphatically about something that seemed to be work-related, so I refrained from interrupting. A young Latino man helped an African-American youth work on a vinyl cutting project. One older white gentleman dressed all in black talked gregariously with people who appeared to be regulars while working actively on his computer. I looked around, taking in the various computers, the working stations, the rules on the whiteboard walls.

The young Latino man noticed my roving eyes and asked if I had any questions. I relayed that I was curious about how things are run, what happens during open hours, etc. He gave me a short spiel, relating that I can come whenever, and that the Maker Lab is

fully open to the public, not just Chicago residents or library members. "You don't even have to be a US citizen," he joked, with utmost serious undertones about the openness of their operations. A similarly inquisitive, artsy looking African-American man was also looking around starry-eyed, trying to get a general grip of what was going on here. We both collected colorful neon paper sheets with information about the Maker Lab, similar types of spaces within the city, helpful software resources and a bibliography of Maker Movement related reading materials. Since the young Latino man was quite busy getting ready for a workshop, I assessed that he went out of his way to acknowledge me and the other potential patron in the first place. I decide to move on. I was impressed and fascinated by this space, by the possibilities it held. Yet at the same time I felt overwhelmed, wondering something that I have heard many patrons ask as they ducked into the various library maker programs I have visited. "Is this for me? Really?"

As library makerspaces focus on providing a service to the typically underserved, I am examining the mechanisms through which they "diminish barriers" for people to feel welcome in these spaces.[251] This includes an analysis of the programming they provided, the tools and skills shared, and the rhetoric they employed. As a community service, the library makerspaces I visited were invested in reaching out to the underserved, and empowering others. Although, as the beginning of the fourth chapter implies, this was entangled with empowering themselves within tech-oriented spaces. I also explore what is at stake in these shifts within public library infrastructure. From a staff perspective, they often identified the library makerspace function as that of tool- and resource-sharing space, with a tangential goal of fostering community development and

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[251] Here, "diminish barriers" terminology is taken from: MA, interview by author, phone interview, United States, December 17th, 2015.

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garnering relevancy to a tech-savvy society were physical books where quickly becoming

obsolete. While rural libraries have started makerspace programs geared toward

community and economic development, my research focused only on major city library

makerspaces.[252] I have also noted tensions within library systems when larger urban

libraries serving the inner-city hub garnered makerspace resources and funding, whereas

more suburban or rural libraries did not.

Precursors to makerspaces in libraries go back at least as far as 2009 with the

YOUmedia Learning Lab at the Harold Washington Library in Chicago, but the real

opening up of spaces and programming started around 2012 and 2013.[253] The first library

makerspace in the US was founded in Fayetteville, New York, which opened its doors in

2012. Not long after that, the Institute of Museum and Library Services (IMLS) and the

John D. and Catherin T. MacArthur Foundation supported The Maker Lab at the Chicago

Public Library as a continuation of the YOUmedia Learning Lab. In subsequent years,

via conferences, word of mouth, and IMLS support, general excitement as well as

funding opportunities led many public library systems and staff to explore the options

therein. Currently, library makerspace programming exists in over 30 library systems,

and is not exclusive to large cities alone. As these spaces have emerged, so has

scholarship on the topic, with most academic studies coming from library scientists,

practitioners, and information studies scholars. Research has often focused on how

makerspaces can function and integrate into libraries, case studies of such spaces, and

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[252] "Growing Makerspace Learning in Michigan Libraries | University of Michigan School of Information." Accessed October 2, 2016. https://www.si.umich.edu/node/14229.

[253] Kyungwon Koh and June Abbas, "Competencies for Information Professionals in Learning Labs and Makerspaces," *Journal of Education for Library and Information Science* 56, no. 2 (2015): 114-129.

their innovative educational developments.[254] Most commonly, secondary materials about these spaces comes from numerous books and blogposts, which write about experience in the field and about the best practices of running such spaces.

At first glance, the push to have makerspaces or at least maker programming in libraries seems to be a continuation of the "access" and "digital divide" rhetoric that went hand-in-hand with the movement to establish Community Technology Centers (CTC). Often located in community centers, their own spaces, or in libraries, CTCs typically involved the establishment of computer labs where the public could freely access computing and internet technology services. One issue with these spaces was that they lacked critical engagement with technology and assumed a neutrality to the technology – that everyone experienced IT in the same way and that general access meant full equity, which was never the case. Virginia Eubanks has explored the pitfalls and biases that have played out across CTC programs. As Eubanks argues, in order for any information technology access center to create equity or to be efficacious, the structure and nature of the technology should be critically engaged and hopefully enrolled in the name of social justice.[255] Since makerspaces in libraries are often tied to a computer lab – providing free

[254] John Burke, "Making Sense: Can Makerspaces Work in Academic Libraries?," *ACRL 2015 Conference Proceedings*, March 25-28, 2015.; 2015; Fourie, Ina, and Anika Meyer. "What to Make of Makerspaces: Tools and DIY Only or Is There an Interconnected Information Resources Space?" *Library Hi Technological* 33, no. 4 (2015): 519–25.; Shannon Crawford Barniskis, "Steam: Science and Art Meet in Rural Library Makerspaces," *iConference 2014 Proceedings*, 2014.; Angela Pashia, "Empty Bowls in the Library Makerspaces Meet Service," *College & Research Libraries News* 76, no. 2 (2015): 79–82.; Mark Bilandzic. "Connected Learning in the Library as a Product of Hacking, Making, Social Diversity and Messiness," *Interactive Learning Environments* 24, no. 1 (2016): 158–77.; Mizuko Ito and Crystle Martin, "Connected Learning and the Future of Libraries," *Young Adult Library Services* 12, no. 1 (2013): 29.

[255] Virginia E. Eubanks, "Trapped in the Digital Divide: The Distributive Paradigm in Community Informatics," *The Journal of Community Informatics* 3, no. 2 (September 14, 2007).

access to internet and computing technology for library users, including the resource poor

– the ways in which library makerspaces played with bounding themselves inside and

outside of the "digital divide" rhetorical realm, the "haves" and the "have nots," is worth

exploration as they navigate inclusion, accessibility and empowerment in the frame of

community engagement.

Rather than generalize across library space programming to make formal

assessments or claims, in my analysis I characterize the epistemic culture as tied to

library practices and ideologies, and identify both barriers and opportunities to instantiate

a different kind of maker culture in the libraries I studied. As a continuing analytical

thread, I have again sensitized my data to look at dimensions of these groups that attend

to valuations of care, explicating the politics therein. In looking at the politics of care, I

reveal absences, tensions, and productive discomforts – something that comes to the

foreground more so in these groups than within the feminist hacker collectives.

Field Site One: DCPL Fab Labs

In the landscape of shrinking funding and other resources, and cultural shifts in the

relevancy of US public libraries, some librarians on the Fab Lab staff at DC Public

Library relate their own internal ideological tension over the intention of libraries and

funding practices. In the context of questioning of the efficacy and needs of the Fab Lab,

library associate Andrew relates:

> I felt conscious about it at the beginning because it was such a diversion of
> funds. […] Every time we got a new toy how many children's books could
> that be? Or how many children's computers could they have purchased for
> that 3D printer? So, I still do feel a real pressure to hide the expense. We
> have to make sure that we show that this is valuable and desired because
> […] it is so new, there isn't a lot of user input or data on the stuff.

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> Sometimes it seems like we were sort of gambling on it being viable and that made me nervous because it is a lot of money and libraries don't have a lot of money.[256]

This sentiment from a staff member, who was studying for his library science degree at the time and had been a part of the Fab Lab from the start, demonstrates that it was not about whether they were currently relevant, but whether they could sustain that value in the eyes of the library administration, of themselves, and of the public. The Fab Lab had won the initial trust of the administration, but now they needed to follow through. So, they worked to establish programming and provide educational resources that were relevant for patrons. This was true of most library makerspaces – and even just makerspaces that ran through public or grant funding in general – proving to the greater community that they were relevant, that they should exist, that they had something different or new to provide, and that they could provide relevant resources beyond catering to a small, select group.

Some Fab Lab staff members related that there were tensions at the inter-branch level – with neighborhood branches wondering why the Fab Labs were necessary when the smaller libraries needed more resources just to stay open. In a recent discussion with Kai, an interlocutor from YOUmedia who facilitates longitudinal studies of library maker programming, she cited this anxiety or unease as not based on funding needs, but as an anxiety about cultural shifts and change to position requirements.[257] For librarians long in the field, there was unease about new training or retraining and whether this would stick as relevant knowledge for them to learn. It was a lot of expertise to acquire for a trend

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[256] AS, interview by author, DCPL Fab Lab, Washington, DC, United States, September 22nd, 2016.

[257] Discussion with KFS as well as reference to her article: K-Fai Steele, "The Future of Libraries and Nontraditional Staffing Models," *Young Adult Library Services* (Fall 2014).

that may go as quickly as it came. To waylay any misunderstandings or mysteries about the Fab Lab and its intentions, the DCPL Fab Lab initiated outreach missions to the neighborhood branches. The first of these appointments was in late September of 2016 at the Chevy Chase branch, and other visits were planned throughout the fall. When the MLK branch shuts down for renovations, scheduled to begin winter and spring of 2017, one possibility is for Fab Lab staff to set up satellite makerspaces at different neighborhood branch locations, so talking about the resources needed and the possibilities in programming is also important at this time. Garnering cultural support and ushering in a new framework for library programming that is supported by the institution may well demonstrate a success for the Maker Movement as a multi-institutional approach.

In exploring a conflict of interest with people who want to keep libraries as traditionally quiet and calm places to find information resources, many staff-members and other makerspace library advocates argued that this is not really anything new for libraries.

> To me the idea of putting makerspaces in non-traditional collections in general libraries, […] aligns with how libraries have always worked – which is to make accessible things that are too hard and too expensive for most people to have access to. In the Middle Ages that was books, and then in the pre-computer era, it was books and information searches in general. [Now] things like 3D printers and power tools and laser cutters are things that are becoming increasingly desirable to people, but are way out of reach to most of the population.[258]

Parallels have also been drawn between the 3D printer and the computer as emergent technologies. Just as arguments are made against bringing 3D printers and other fabrication equipment into libraries due to their trendy nature and their near-certain

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[258] EB interview by author, DCPL Fab Lab, Washington, DC, United States, September 22nd, 2016.

probability to lose relevance quickly, two of my interlocutors pointed to the history of computing in libraries and public schools as following the same course. These arguments of relevancy and rhetoric about lowering the "digital divide" come out of institutional strategizing as the library system works to prove its worth and relevance to greater society.[259] Makerspace advocates and workers seem to be caught in the middle, as it is seen as both a way to prove relevancy, and yet is constantly needing to prove its relevancy in an institutional frame that still sees it as out of place – an institution that often resorts to techno-liberalisms and technological determinism to stake a claim for the need to have a makerspaces.

Many staff at DCPL – and certainly Maker Jawn – push against a digital focus, arguing for the inclusion of fiber arts and different maker practices in the Fab Lab. The Fab Lab grew out of the Digital Commons – the digital literacy lab downstairs which opened in 2013. Like many library makerspaces, the DCPL started with one 3D printer for staff to explore as a new technology, and then for public use. Demand and interest grew for the 3D printer and the waiting line for printing increased to six months. This amount of interest led the staff involved to start exploring the possibility of a makerspace at MLK. Research ensued. After a 2013 visit to the NYC World Maker Faire, the Fab Lab staff started visiting local spaces like HackDC and Nova Labs in Virginia, while also making a trip to the San Francisco Maker Faire.

I talked to Andrew, a spunky 30-something librarian assistant roller-bladder who had been with the Digital Commons and the Fab Lab since its inception, about the beginning of the Fab Lab and their trips. He was interested to engage the new technology,

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[259] Shannon A. Crawford Barniskis, "Metaphors of Privilege: Public Library Makerspace Rhetoric," *iConference 2015 Proceedings*, 2015.

but also critical of it. He recalled: "People were easily distracted by gadgets and sometimes the information there was sort of lost. So, we talked a lot about what the library's role in having a makerspaces would be. And if we did it, what would it look like."[260] Through discussion, they worked out whether a makerspace would actually be advantageous for their own situated needs. Yet much of the rhetoric I came across in interviews with staff, and other analyses of library and organizational materials regarding makerspaces, explained that this is not really anything new. Andrew continued:

> I started to really realize that if we were going to do it as a library, it would need to be about the information and access and not so much about generating original content. We're here to provide access and information. [...] The format of that information access can be different. It could be a book or a magazine or a movie or how to use a clamp.[261]

This mindset was typical of these spaces as they replicate the maker cultures displayed in promotional materials involved in Maker Faires, other spaces, and in glossy magazines – where projects are more individuated than engaged with community needs.[262] The intention being to create a cadre of self-starters and motivated people who would share ideas, but might also use the space as a catalyst to continue their own projects at home, or outside the space. This argumentation in line with *Make:* Magazine and Make Media rhetoric drove the project and its actualization forward, although it has shifted since.[263] The administration supported funding – later with some additional funds from Google – Andrew hypothesized because "it's just really a hot thing right now in libraries." [264] His comment is reflected in initiatives in other major libraries, blogposts, scholarship, and

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[260] AS, interview by author, DCPL Fab Lab, Washington, DC, United States, September 22nd, 2016.
[261] AS, interview by author, DCPL Fab Lab, Washington, DC, United States, September 22nd, 2016.
[262] See Chapter 3, this dissertation.
[263] With the change from NK to MA as managers, less of a technocentric model, but it still holds true to focusing on the individual rather than community programming, advocacy or efficacy.
[264] AS, interview by author, DCPL Fab Lab, Washington, DC, United States, September 22nd, 2016.

topics at recent annual American Library Association meetings. MLK wanted to be on the cutting edge of library programming, but they wanted to be careful.

> [S]o there was a lot of planning as far as what we would do in this space. What are we going to put in here? How are people going to use it? How much can we back off as far as supervision?[265]

After construction in what used to be a storage closet and plans for programming were complete, the DCPL Fab Lab opened its doors in early 2015.

Staff related that the institutional bureaucracy helped to foster reflexivity before the start of programing, but now that staff had identified changes that needed to happen according to community engagement while in full swing, it has been difficult to incorporate different styles of "making." As identified in the previous chapter, the politics of design are crucial to establishing particular kinds of dynamics, barriers, inclusions and exclusions in these technology heavy spaces. With top-down bureaucratic measures valorizing stereotypical maker dimensions, such as start-ups, entrepreneurship, 3D printers, and CNC machines, they are setting a certain precedent for who can become part of the community in the space and who feels welcomed here. Yet, staff, librarians, and even patrons still employ tactics to upset the dominant discourse still at play in these informal education spaces. Much like the other library programming I studied, and like the feminist hackers, they too enact practices of care toward different positionalities within the DIY register. And yet, the DCPL Fab Lab still struggles to break from the technocentric and sometimes technoliberal rhetoric handed down from the administration. Currently, the equipment is heavily digital, as is clear in image 5.3.

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[265] Ibid.

Image 5. 3. Computers at the DCPL Fab Lab

Field Site Two: Albany Made Creative Lab

My first time at the Washington Avenue library in downtown Albany, New York was to

visit their new makerspace, which I thought would be open at the time. Walking through

stacks of CDs in the music section, I easily located the room, but it was dark and the

lights were off. It was hard for me to tell if this was where I wanted to be – but from an

announcement I was certain this was the branch location, and this was the correct time. A

man and woman stood inside around a few working tables with sturdy stools. On the

counter-tops various tools and equipment were neatly arranged.

I knocked and the woman turned toward me with smiling face and opening the

door –with short white-blond hair, and stylish vintage cat-eye glasses, she seemed to fit a

kind of subcultural DIY narrative. She quickly told me that the space had not opened yet

and handed me a brochure with future hours, offering to put me on the email list. I

complied by leaving and after a quick glance inside, made my way out of the library.

Image 5. 4. Main workspace at the Albany Made Creative Lab.[266]

With two large tables and wall-installed counter-spaces, there was ample room to work in

the space. They had a small library on DIY cultures and projects, a fabric station, a bike

repair station, a sound/recording area, a screen printing set-up, a laser printer, and a 3D

printing station – along with a small counter, sink, and kitchen-type area. Right away I

was struck by the prominent display of the fiber arts section – which most makerspaces,

even in libraries, usually have tucked away into a small corner.

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[266] Albany Public Library, accessed March 13th, 2016,
    http://www.albanypubliclibrary.org/programs/albany-made-creative-lab/#post_title.

Image 5. 5. Fiber art materials at Albany Made Creative Lab.

Image 5. 6. Sewing machine at the Albany Made Creative Lab.

I soon came back for open hours to observe and discuss the space. During an interview

with both staff members of adult services who run the space – Bryan and Suzi – I

eventually found out the reason for the delayed opening:

> It's just because the MakerBot keeps going down. […] I had it fixed and then it was messing up for a while and then I fixed it. I printed out these things, and I was like "oh it's working again!" And then I started printing a bigger job and it messed up again. [W]e can't open until it's ready, because like we said, it's pretty much all anyone cares about.[267]

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[267] RS and SC, interview by author, Albany Made Creative Lab, Albany, New York, United States, April 23rd, 2015.

Through surveys of interested patrons, Bryan and Suzi found that about 90 percent of the patrons were most interested in the 3D printer. However, Bryan, who has been on staff at the library for eight years prior to his position within the Albany Made Lab, was hopeful that when people came in to use the 3D printer or see how it worked, they would realize the usefulness of other tools and be inspired to use them – particularly the recording equipment. Both he and Suzi are musicians and part of the Albany underground music and arts scene. They help to facilitate music programming in the garage of the library and host live-score screenings of silent films, featuring local musicians. In their actions and interests, they demonstrated an investment in the creative culture of Albany outside of work, and while work was work, there was a connection across as well.

The initial drive in creating the space came from several sources. Many of the staff members are musicians, so conversations about special collections of sound-recording equipment for the public were already on-going. When some librarians attended a talk by Fayetteville librarians about their Fab Lab at the New York Book Expo in 2012, interest was further sparked to create a specifically designated fabrication room. The Albany Washington branch then decided to host Fayetteville, and ran an event where the visitors and hosts shared ideas and possibilities about library makerspaces during a 2013 staff development day, further enrolling interest. The library acquired a 3D printer at the end of 2013, and the process to centralize other equipment already owned by the library, including recording gear, began.

Meanwhile, a reference librarian hosted an Etsy class through adult services in the fall of 2014. Attendance had been full and the waiting list long. Out of this experience, the staff believed there was interest within the public to build upon hobbyist skills toward

creating personal businesses, and so they determined that the makerspace they designed

would be housed in adult programming and address this local interest and need. With

some left-over funding from recent construction, the library renovated a previously empty

storage room and turned it into the Albany Made Creative Lab. Since construction,

Albany Made has become part of the library's overall operating budget, and Suzi has

become the head of Creative Services, which did not exist prior to the Creative Lab.

Their main drive at the moment of my research was to cultivate a sense of community

and ownership with the patrons through the space.

While Bryan was encouraging of all users at the Creative Made Lab, the practical

fixers were his favorite patrons: the man who did not speak English and tailored his coat,

the dad 3D who printed a replacement part for his porch table, the man who fixed a flat

tire on his bike, and the woman newly moved from California who used their sewing

machine instead of buying a new one.

> She said she had lost her sewing machine. Which is cool. It's nice to see that
> people are like, "oh well I don't have this thing at my house anymore, and I
> can't afford to get a new one, so I'll just go to the library and use theirs."[268]

For him, this was the purpose for which the space, including the 3D printer, was

intended. Practical uses and as a resource for the community to fix their things or develop

an idea, putting it into the material world. It was meant as a safe space to explore,

experiment, and gain any little kind of confidence over material praxis that might have

effect on a patrons' day-to-day lives. His hopes for the space to connect to real life

problems and social dynamics of learning demonstrated thinking similar to Dewey's in

The School and Society.

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[268] RS, interview by author, Albany Made Creative Lab, Albany, New York, United States, September 9th, 2016.

Yet Bryan was also excited to foster creative play and new creations. During a visit to Albany Made on June 6th, 2016, I came in to find Bryan helping three young African-American boys with several 3D print jobs. One was patiently watching his print – the other two were waiting for one to complete while playing games and watching videos on a computer usually reserved for video or photo editing. Since Bryan knows the boys well, he allowed them to use the computer differently – lessening the institutional grip on what the space was "supposed" to be according to the library. Fostering user ownership and playfulness has been well-documented by Ito as a step toward connected learning and specifically in libraries by Crawford Barniskis as a way in which staff and librarians tactically subvert the technocentric register involved in the tension between an openly messy, creative space and the library institutional frame.[269] At different times, I saw Suzi and Bryan switch between modes of tactics and strategies, sometimes aligning with non-traditional use or bending the rules a bit, other times sticking with the protocols set forth by the foundation.

One of the boys had printed out a visor to wear for play, but the 3D model had a defect, and so it printed in two. Bryan excitedly took out some work aprons and gave the boy eye protection. "Now for the real shop class," he announced. I was not used to Bryan getting as involved with participants' projects. But recognizing the need to foster a more social learning dynamic, and two pairs of hands, he switched modes out of his usually hands-off stance.

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[269] Mizuko Ito, Sonja Baumer, Matteo Bittanti, Rachel Cody, Becky Herr Stephenson, Heather A. Horst, Patricia G. Lange et al., *Hanging Out, Messing Around, and Geeking Out: Kids Living and Learning with New Media* (Cambridge: MIT press, 2009).; Crawford Barniskis, "Metaphors of Privilege."

Bryan pulled a Dremel out from the cabinets above the sink, and guided the boy through preparing the two edges of the printed object for repair. Once this step was complete, they applied glue and worked together to vice the two pieces together, then setting it aside to dry.

Image 5. 7. Collaborative making at Albany Made.

Image 5. 8. Product of material constraints and collaboration.

The need to continue working the object, material, and form after the 3D printing process completed was typical in these spaces, and demonstrated complexities and group social dynamics. It also revealed a mangle of practice between types of people, expertise, comfort, machine tooling, and materials, that is often overlooked. The ways in which it is handled in library spaces demonstrates a "community of practice" and epistemic cultural narrative that fosters care, a diverse collaborative environment, and non-judgmental experimentation.

The care and attention that Bryan gave to the young boys and their projects was not patronizing or authoritative, but helpful. From my observations, he treated all the younger patrons as peers. This was a stance he held with all patrons who came in – with mixed results. Some adults wanted an expert to guide them through exactly how to use all the equipment and tools. So, when Bryan would tell them "I don't actually know how to use that tool, let's figure it out together," it added a dimension of vulnerability or uncertainty. Some patrons were not used to an open-ended learning environment after a long indoctrination into teacher-led and banking-method style education. Meanwhile, the younger students seemed to be more flexible and amenable to this shift in educational tactics. This style of educating, and of working together through the problems if there were any, reflects an engaged educational program dynamic, explored by Giroux, Dewey, hooks, and Boler. In this dynamic moment – with lab-coats, goggles, and all – the library quickly shifted into a place for experimentation, not only in material praxis, but in education, social learning, and something Michael Lachney theorizes as "cultural brokerage."[270]

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[270] Michael Lachney, "Culturally Responsive Computing as Brokerage: Toward Asset Building with Education-Based Social Movements," *Learning, Media and Technology* (2016): 1-20.

Field Site Three: Philadelphia Maker Jawn

Unlike the DCPL Fab Lab and Albany Made Creative Lab, Maker Jawn did not focus on the fixing, maintenance, promotion, and use of 3D printers. The lone 3D printer that they did own sat broken in their main offices. But this was of no concern to them. The staff recognized that they have bigger issues to resolve within their assigned locations, and that they need to use on-the-ground tactics, rather than follow the strategizing and techno-liberal rhetoric that other libraries have often taken on to garner funding and space when setting up makerspace programs. I see this as a product of where and how they are situated within the Free Library system of Philadelphia, the way in which they developed programming, and their mission towards social justice aims rather than the techno-liberalism taken on by most programming. This has created tensions with the greater library system, its management, and their own grant reporting.

One of the co-founders and original managers of Maker Jawn, Kai, has written and presented extensively about the program. During a TEDx presentation at the Philadelpia FPL, she explains dynamics of accessibility, inclusivity, and empowerment – how by situating themselves in historically underserved areas, the Maker Jawn programming stepped into Maker Movement discussions with social justice and community empowerment as the root of their organizational development. With this intention, they quickly stepped away from much of the technoliberalism and strategizing rhetoric typical of such programming. She also highlights an aspect of the program that speaks to cross-cultural collaborations between underserved youth and young artists, writers, and musicians. In talking to Kai, who now lives in San Francisco, I was able get a deeper background of Maker Jawn, as well as the broader scope of current maker

educational programming, and grants around what some museum and library professionals are calling "post-emergent makerspaces" – of which Maker Jawn is part, and my other field sites would also be considered.[271]

Originally connected to The Village of Arts and Humanities in Northeast Philadelphia, a community center focused on technology outreach accessibility in a lower income neighborhood, Kai started working at the FPL of Philadelphia to help jump-start STEM outreach for teens.[272] This instantiation of the Philadelphia Maker JAWN sprung from many different sources, including the "Teen Media Week" initiative, which was initiated by a team of digital resource specialists at the Free Library during the spring of 2011. Part of the Hot Spots initiative, this project was funded by the Knight Foundation, which was specifically interested in supporting "computer labs embedded in community centers as a way to engage teens" one of which was located at The Village.[273] However, the space and programming at The Village was not as simple as a computer lab, and included dynamic programming such as a garbage fashion show, slam poetry events, dance classes, a Halloween haunted house fundraiser, and an urban garden. It was housed in a deeply engaged and dynamic community center, which had neighborhood roots reaching back to the 1990s. When she transitioned from The Village to the Public Library system, Kai and other staff began working informally with Dr. Yasmin Kafai, who taught at the University of Pennsylvania's Graduate School of Education, to create youth-centered lessons and programming that focused on e-textiles.[274]

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[271] KFS, interview by author, Skype interview, United States, February 6th, 2017.
[272] "The Village of Arts and Humanities – A Multifaceted Arts Organization Dedicated to Community Revitalization through the Arts," accessed October 2, 2016. https://villagearts.org/.
[273] "About – MakerJawn," accessed October 2, 2016. http://makerjawn.org/about/.
[274] "About – MakerJawn," accessed October 2, 2016. http://makerjawn.org/about/.

In January 2012, this working group received an IMLS grant to design a learning lab at the Central Library of downtown Philadelphia. Once formal construction of the space was initiated, Kai and others worked to bring the concept out of the Central branch to the neighborhood libraries. They also joined the YOUmedia Network, "a national cohort of libraries and museums whose goal is to come up with ways to better serve teens in STEAM fields and 21st century skills."[275] Dr. Kafai then made the group aware of a Maker Education grant early in 2013. They won the grant, and through it ran a Maker Corp summer series, a precursor to full Maker Jawn programming.

Image 5. 9. Maker Jawn participants work on a circuitry project.[276]

Original sites for the summer 2013 programming included the Village of Arts and Humanities Hot Spot, the Institute for the Development of African-American Youth Hot

[275] Ibid.

[276] bwalker, "Connected Messages at IDAAY," August 14th, 2013, accessed August 14th, 2017, http://makerjawn.org/blog/2013/08/14/connected-messages-at-idaay/.

Spot, Heavenly Hall, Widener Library, and McPherson Square Library.[277] After that summer and into the fall, programming was based solely in the Kensington Neighborhood library, but it continued to expand. At the time of this research, Maker Jawn was located in six neighborhood branches in Northeast and Upper North Philadelphia, considered some of the more economically disadvantaged areas of Philadelphia. The branch locations included Cecil B. Moore, Kensington, Rodriguez-Ramirez, McPherson, Widener, and finally Lillian Marrero, which closed doors for renovations in 2016. Each location had one to two mentors during their hours, and the main supply of resources was stored in the Maker Jawn offices in the basement of the Rodriguez Ramirez branch. Maker Jawn was funded by satellite grants through the IMLS, the American Library Association (ALA), the National Writing Project (NWP), and through City and Foundation resources. After the Maker Ed Initiative grant ended, the program sought continuation resources through many small local as well as several national grants.[278] Beyond central funding, the Maker Jawn programs at Widener and Kensington were also funded through Curiosity Creates grants – Widener focusing on an afro-futurist fashion show and Kensington on local food justice with the creation of a cooking show and cook book.

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[277] Kfaisteele, "Maker Celebration on Saturday! – MakerJawn," accessed October 2, 2016. http://makerjawn.org/blog/2013/08/14/maker-celebration-on-saturday/.

[278] These grants include a national Leadership Grant from the IMLS, a 21st Century Solutions grant via NBC10/WCAU and Telemundo61/WWSI, a Frameworks for Post-Emergent Library Makerspaces grant through the NWP and IMLS, and a grant through the Philadelphia City Institute.
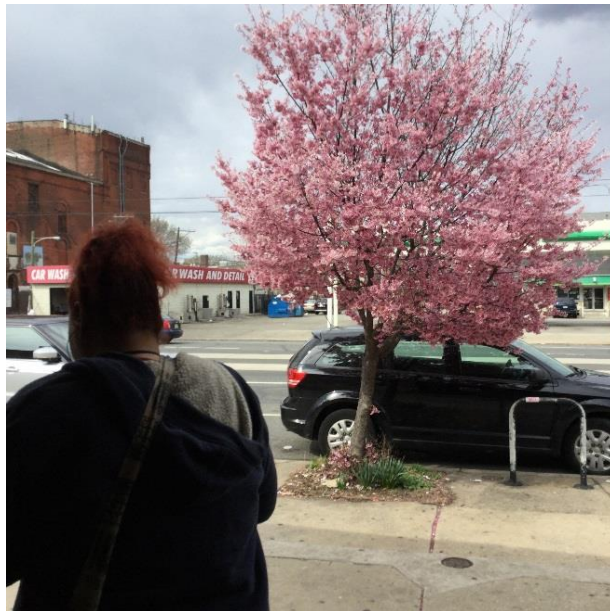
Image 5. 10. View from the entrance to Rodriguez.

Image 5. 11. Main offices of Maker Jawn.

The piecemeal way in which Maker Jawn funding needs were met was not

uncommon in makerspaces. Within libraries in particular it lines up with the immense

amount of resources needed to run maker programs and technologies. In Northeast

Philadelphia resources were limited. For the Maker Jawn program to stay afloat and

remain viable, according to staff, they have needed to prove their worth not only through

evocative and helpful programming, but also through the acquisition of competitive grant

awards. Because they were not officially embedded in the infrastructure of the public

library system, unlike the DCPL Fab Lab and Albany Made Creative Lab, the labor of

Maker Jawn mentors is often two-fold: keeping the program afloat both in making it

happen, as well as seeing that it gets funded.

Kai shared a recent webinar she had led discussing the content of the *Makerspace*

Playbook: Library Edition with various groups involved in the making and writing of the

most recent edition. Through a content analysis of this discussion, the Makerspace

Playbook itself, and the TEDx talk that Kai gave about Maker Jawn, several recurring

themes arise. One was the need for community engagement and feedback in terms of

interests and needs – a stance that often fell by the wayside due to technocentric

narratives and relevancy rhetoric within library makerspaces. Another focus was that of

accessibility, which was already considered part of the library ethos. This involved not

only access to information, but critical literacy and accessible pathways toward analyzing

information. I have yet to see critical endeavors involving social justice at any of my

sites, but different programs at locations across the US were involved in the Makerspace

Playbook discussion. Another theme involved inclusionary practices and diversity.

According to Kai's TEDx talk, not enough libraries were addressing how the Maker

Movement could be leveraged to provide access to education and creative, self-directed

learning environments for resource poor communities, or ways to building community –

which was reflected in the Maker Jawn entry in the *Makerspace Playbook: Library*

Edition. In the Maker Jawn setting, the way toward this was something Kai calls

"personally meaningful artifacts," and it was the focus of their programming to help

facilitate the production of such artifacts for everyone who took part.

Hailey, who had been with the program since spring of 2014, recalled initial

projects involving Drawdios, MaKey-MaKeys, and ArtBots.

> We did a lot more things that you would see at Maker Faires. […] And I
> think that stuff looks really exciting. When you're using each other as a
> keyboard and using a MaKey-MaKey, that looks cool. But those things, […]
> they're limited. And very quickly after I started, we were doing skill-shares
> that were a lot more – there's a loom at Kensington and we had a weaver
> come in and teach us how to weave. We did a bunch of paper machê at the
> beginning. [W]e were pretty quickly doing things that were more traditional
> technologies or arts or crafts.[279]

As mentors became less concerned about fulfilling a specific definition of "maker"

cultures for the grants, they expanded and brought in projects that organically grew from

student as well as their own interests and from other experts they engaged within the

community.

<p style="text-align:center">*   *   *</p>

Having introduced the descriptive narratives of my three library field sites, I now

turn to analyzing their practices, design, and organizational dynamics attuned to the

politics of care they enact. I focused on elements of these communities of practice that

were not only technology-based, but with an embedded value-system different from the

techno-liberal or entrepreneurial. This was done while recognizing that such values and

ideologies are entangled – and that focusing on care does not erase the technological, but

is instead caught up in its bounds. I also noted that there were entanglements between the

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[279] HH, interview by author, Milano Library Branch, Philadelphia, Pennsylvania, United States, March 17th, 2016.

politics of care and the dominant discourse, amongst the library maker programs more so than the feminist hacker collectives since they were housed within greater bureaucratic and funding infrastructures. In the next few sections I describe the practices and tactics, sensitized toward care, that these library maker programs enacted to engage issues of accessibility, inclusivity, and empowerment.

Accessibility

Dimensions of accessibility regarding design, geography, culture, and knowledge have interesting implications for library-systems, which have a foundational value-system that is based upon access to information for the general public. Taking up an entire city block of downtown Washington, DC, the Martin Luther King Jr. Memorial Library was the central location for DC's library system. It also housed the DCPL Fab Lab, one of my field sites. Designed by Mies, the building's outer walls were comprised of huge glass windows and a simple open first floor plan which was both aesthetically appealing and facilitates an ease of use.

Image 5. 12. View of MLK Library from outside first floor.

Image 5. 13. Interior of first floor main Foyer at MLK.

This openness, however, did not reach through all of its corridors – an invisible

infrastructural value with which I was confronted during my first visit to the Fab Lab.

Walking up to the Digital Common's reference desk, I asked the staff where to find the

Fab Lab, knowing that the two were associated. The woman on desk had a septum

piercing, short hair, and pleasant round face. Giving me directions, she mentioned

something about a "portal" that I did not understand. Warning me that it was behind

several sets of very heavy doors and notoriously hard to find, she nodded me along with a

smile.

I quickly found that she was right. Locating the Fab Lab proved to be quite

difficult and tested my own persistence to seek out the space. I ended up finding another

librarian on the 2nd floor to direct me and they wished me good luck as I went. Passing

through one giant firewall door into a vestibule, I stepped through another into the

landing of a stairwell. Before me I finally saw the portal.

Image 5. 14. The portal and entrance of the DCPL Fab Lab.

Image 5. 15. Interior of the DCPL Fab Lab.

I later found out that this digital structure was not only fabricated at the Fab Lab, but was a tactical measure taken by staff to attempt getting around the institutional measures preventing the Fab Lab from being a more welcoming and noticeable space.[280] While portals have had many purpo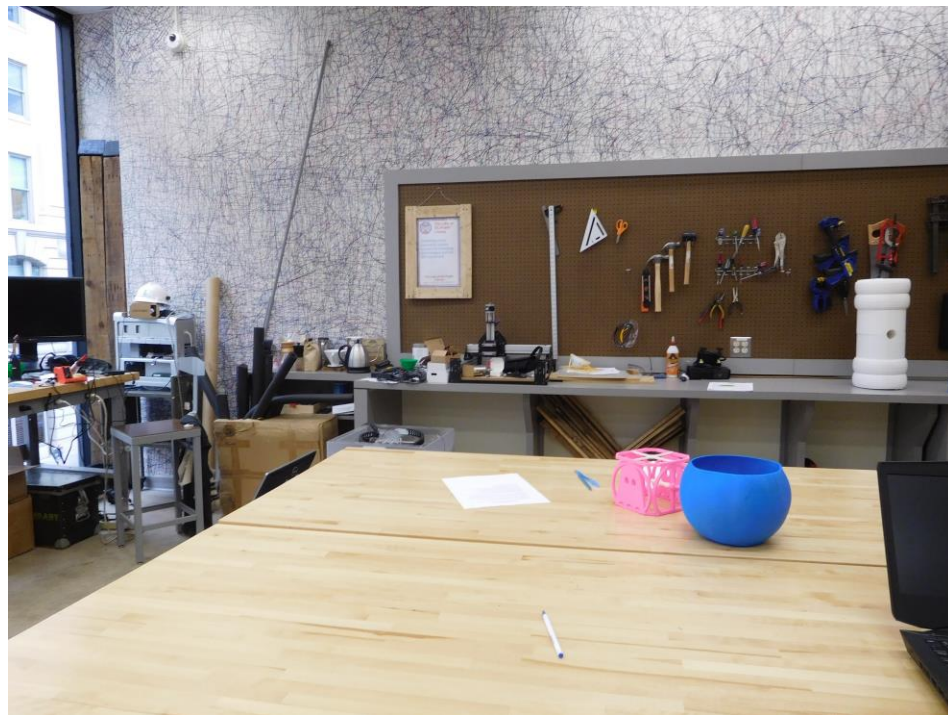ses in other hackerspaces and fab labs, the function for this particular portal was meant as a way to create awareness and welcome passers-by, since the heavy metal doors were not able to be modified to include windows. It was but one of the tactics that staff fashioned to get around obdurate infrastructures and bureaucracy that do not allow unapproved physical modifications to the institutional structure. The mechanisms of the door portal were fabricated on site, appropriating e-waste materials from the library. Read in relation to the interpretive lens of care, this portal was not just a cool technology fix, but a caring technology that highlighted different needs in terms of engagement and accessibility.

The space itself was open and bright. Two 3D printers were broken, leaving three functioning machines. For the amount of print-jobs that patrons typically sent into the DCPL Fab Lab, having them all running at once was ideal in order to get prints done in a timely manner.

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[280] Maxigas writes extensively on the politics of door openers and locking mechanisms in hacker cultures in Eastern Europe. Most hackerspaces I have visited have built digital portals for ease of bounding access. It also often relays to an online system that can be checked to see if anyone is at the space. Such mechanisms function as a way for members to gain 24-hour access, without concerns of there being only one key (digital), and are a clear, distinct mechanisms for excluding, or keeping non-members out.

Image 5. 16. Second interior of the DCPL Fab Lab with full view of 3D printers and attentive staff.

While there were infrastructural or organizational concerns, the DCPL Fab Lab was lucky in that it had human resources to consider accessibility needs and how better to accommodate different patrons. At the beginning of the Fab Lab's existence, the Center for Accessibility visited the space and assessed their ability to accommodate patrons with diverse needs. One work-table was adjusted for wheel-chair use, but most of the machines, including the laser cutter which needed to be watched from above for operation, were still inaccessible. Some staff related that they tried to be in conversation with the Center and patrons in order to figure out what they could do to make the space more welcoming – others admitted defeat and that there were certain built-in barriers over which they just had no control.

> We have our regular users […] who use both digital commons and the upstairs accessibility center, but never the lab space. So I think that's an issue. We aren't trained or capable of offering truly accessible programming.[281]

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[281] BM, interview by author, DCPL, Washington, DC, United States, September 20th, 2016.

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Another staff-member related, "We mainly see it as an administrative issue. It's come up because patrons have asked, [but] we're going to close soon and we don't really know what our fate is going to be."[282] Due to the bureaucratic nature of the library system, the main factors that hindered any infrastructural changes were primarily institutional, and tied into a full-building renovation which was originally slated for winter 2016 and which commenced during Spring of 2017. During that time, however, the Fab Lab also hopes to create a Mobile Maker Lab that could be set up in parks and travel to the neighborhood branches. This will be an opportunity to further test programming, engage more communities, and set up more outward facing and external relationships with patrons who may have not been able to engage the Fab Lab.

Meanwhile the placement of Maker Jawn programming was explicitly trying to shift geographic inaccessibility to resources related to Fab Labs that typically make it to the central branch, by clearly targeting the populations of those living or going to school close to the libraries they served. Brett, a Maker Jawn staff mentor at the McPherson Branch, saw this extra-locality in relation to their geographical location as a boon: "I think we're doing a pretty good job in [that] we did target underserved neighborhoods."[283] Yet he also recognized the impossibility of being accessible if the greater community did not know they existed.

> I think in general, big communities are unaware of our program and so, once the kids come in, I think well, they have access – the supplies are accessible and I think we're fairly accessible in terms of once you come into the program, but not accessible in terms of, I don't know how many of the people in the community at large would be like, "Oh, yes, children's program in the libraries."[284]

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[282] ES, interview by author, DCPL Fab Lab, Washington, DC, United States, January 15th, 2016.
[283] BB, interview by author, Rodriguez Library Branch, Philadelphia, Pennsylvania, United States, September 14th, 2016.
[284] Ibid.

In deciding to work on a certain aspect of diversity that provided caring resources for at-risk populations and letting geographic diversity fall by the wayside, Maker Jawn demonstrated what Erika Halverson called "the diversity of diversity."[285] Non-promotion was possibly a tactical exclusionary practice, where Maker Jawn recognized that if they promoted aggressively, they may have ended up not actually being able to provide for the community that had organically grown out of library patrons in economically depressed neighborhoods.

Similar to Kelli of Spanning Tree, Hailey of Maker Jawn referenced maintenance and cleanliness of the space as enabling accessibility for her participants.

> We're always cleaning and organizing and that isn't that big of a deal, but some kids get really into that and want to help figure out how to make the space work better and feel more accessible.[286]

Further, getting kids involved in the care work gets them to experience dynamics of collective care, while also establishing ownership of the space. Even though the library was public, the theme of wanting to enable patron ownership of these spaces – through the mechanism of 'community experts,' long-term projects, or cross-patron collaboration – came up time and again in my observations.

Beyond physical accessibility, economic and culturally accessible programming were other dimensions that these groups considered. The MLK branch, which was the central location of the DC library system, had a vibrant variety of programs, centers, and special collections. In addition to the Digital Commons and the Fab Lab, they had punk and hip-hop concerts in the basement, a Go-Go music archive, a DC hardcore punk

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[285] Halverson, Stanford FabLearn Conference.
[286] HH, interview by author, Milano Library Branch, Philadelphia, Pennsylvania, United States, March 17th, 2016.

archive, a Memory Lab, a Studio Lab, and the Center for Accessibility.[287] Since the Fab

Lab, and the other creative components of the library, were at no cost to the patrons

(taxes aside), it was radically more economically accessible than other similarly equipped

makerspaces in the area such as TechShop, HacDC, and the Catalytor. They also worked

to be culturally responsive with programming and collections – such as recording studios,

concerts that engaged the local community, and free coffee meet-ups for the large

homeless population.

      Attention to cost for their patrons was also a practice taken on by Albany Made

Creative Labs. In trying to be accessible to the local users, and in conjunction with most

library makerspaces, using the space was free, and the material costs were minimal. In

talking about accessibility, Suzi stated,

> It's the core of libraries. It's definitely essential. […] We're supposed to be
> charging people for printing materials, and we've just been like, "first time's
> free." And then they come back, and it's like "yes! First time's free." […]
> We want it to be enjoyable and we don't want anybody to be held back from
> using the space.[288]

The sharing freely of materials and encouragement regardless of institutional protocol

demonstrated another tactic that library staff employed to create a community and culture

of play – again as Suzi relates to make it "enjoyable." Suzi described this as a typical

practice in libraries.

> In general libraries try to break the rules for people when they can to keep
> customers and to keep people using the space, like the kids. If the kids owe
> money, they can read down their fines. They can sit in the children's room
> and read a book and earn fake money to pay off fines.[289]

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[287] Not only was the Center for Accessibility in communication with other departments and parts of the
library, but they worked as a catch-all space for people who had accessibility needs regarding sight,
sound, movement, or otherwise.

[288] SC, interview by author, Albany Made Creative Lab, Albany, New York, United States, April 23rd,
2016.

[289] SC, interview by author, Albany Made Creative Lab, Albany, New York, United States, April 23rd,
2016.

It is important to take note how this disruption of capitalistic profiting practices, that are often naturalized in American society, not only affected certain aspects of the library resources, but had reach to all programming. Thus, the cultural values of the library as an institution, non-capitalistic at its core, affected the maker programs, how they were designed, how they were run, and in turn affected the culture of the space. This demonstrated how a value of care for the public to use the library's resources more generally overcame dominant discourse reasonings for maker practices as profit-yielding and globally competitive.

While there was a lowering of economic barriers, implicit barriers at both Albany Made and the DCPL Fab Lab remained and some types of programming may have spoken to some and alienated others, albeit unintentionally. It is possible that programming ran along a certain track due to the administration, something that Emily noted at the DCPL, which was constraining in terms of the skills that were highlighted and the types of audiences they reached.

Another dimension of accessibility with which these spaces dealt in some way was digital literacy. As staff working at the DCPL Digital Commons already knew, digital literacy was an issue with a majority of the patrons they served. Since most of the tools in the Fab Lab were digitally controlled, this might have made it an intimidating space to walk into for those without previous technical or digital-making expertise. The staff were engaged and provided a welcoming environment, having a great deal of experience with facilitating digital literacy. But they were limited in their resources and time to care for every individual, and so a certain type of gate-keeping occurred with the selection of digital tools instead of sewing machines or hand-tools. However, the

incorporation of diverse types of tools for varying skill-sets continually shifted in the

DCPL Fab Lab to deal with this issue, and staff were concerned to create a space that

cultivated multiple types of usage.

Maker Jawn tried to push for diverse programming that aligned with many

different skill levels and interests in diverse types of technologies. This may have been

shifting as they rolled out a new badging program in order to document the progress of

students within certain skill fields. Unlike the boy or girl-scout badging system, Maker

Jawn's system existed in the digital form. While younger generations were astute at using

computers and certain Maker Jawn curricula and projects helped to hone these skills,

issues still existed with who had access to computers at home. A mentor at Rodriguez

was apprehensive about how badging would work across the different age groups that

they accommodated:

> I think for the younger kids it might be more challenging just because they
> don't have social media accounts, although a lot of them do Instagram. Also,
> they might not have an email to use or are not fluent on the computer yet,
> so it's about accessibility as well.[290]

One mentor recalled that some grants were less about specific technology, and more

about accessibility. "What's written more about is having accessible interest-driven

programming. It's not actually that specific on how much computer-related or tech-

related stuff we have to have."[291] This gave the maker mentors the freedom to play

around with how "technology" was defined in their activities. However, small grants

about building specific kits and configuring a digital platform for badging fostered

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[290] C, interview by author, Rodriguez Library Branch, Philadelphia, Pennsylvania, United States, March 17th, 2016.

[291] HH, interview by author, Milano Library Branch, Philadelphia, Pennsylvania, United States, March 17th, 2016.

conversations that highlighted the tension around what grant proposals indicated Maker Jawn is doing and the actual tactics they enacted on the ground to foster community engagement and break from technocratic models.

Connecting to the relevancy issues brought up by many of the DCPL staff, one mentor noted their position within the Philadelphia library system: "it's not about checking out books anymore, it's about providing a space that people can come to engage, and learn on any level. Libraries are becoming community centers."[292] As community centers, a large part of how libraries might function deals with different instantiations of care and comfort as they have become spaces in which to gain informal knowledge and feel welcomed to experiment. This shifts the type of work, programming, and community development of which librarian staff may be part – and has the possibility to be devalued as labor connected to care so often has been historically. Library makerspaces may fit into this narrative as a different understanding of what makerspaces can do and how they can engage and enable local communities to build capacities and situated knowledge systems.

Accessibility to expertise and creating relevant programming was breached at Albany Made by involving caring community members to share skills – thus also dealing with the issue of too few staff. During one of my visits to Albany Made in Spring of 2016 I met Ali, a volunteer community expert in sewing. In later visits, I saw Ali in action, helping an older man to make matching couch arm covers, and then working on her own projects. During an interview, she told me about her background in the punk and noise rock scene of Western Massachusetts, and her involvement as a volunteer teaching

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[292] MN, interview by author, phone interview, United States, April 4th, 2016.

sewing classes for the homeless and elderly at a community center in San Francisco. She related missing the rampant creativity and support of the DIY scene in San Francisco, and was hoping to foster more of that through the library makerspace.

The idea of community experts as a way of engaging community members toward taking ownership of the space and its direction was something that Suzi and Bryan had had on their mind since the inception of the space. It appeared to be an exciting shift in the model of community engagement and promotion in general for library makerspaces – and I even took part in this model by leading a soldering workshop. But sustaining these relationships and commitments could be tricky. Later, Ali relayed her excitement about a clothing swap she had planned for October. But when she found out that another big library event was happening the same day, she was disappointed – would patrons even know or realize that her event was happening? At both the DCPL and at Albany Made, promotional fliers, Facebook events, and postings to the library calendar all had to be done far in advance and through the approved mechanisms. For patrons who helped facilitate workshops and were signed on to become community experts, it felt standoffish when the library did not seem to follow through in full promotion. However, this was out of the hands of staff running the day to day of the spaces – especially for Albany Made. It also pointed to a need for care in relation to library volunteers in such spaces to sustain programming, interest, and motivation to take part.

These expectations or needs also affected accessibility in relation to the resources and the aims in the space when sharing skills and teaching how to use the equipment. Suzi and Bryan both told me several stories of patrons wanting one-on-one training. Suzi recognized the difficulty of not being available for everyone.

> We can help you teach yourself how to use it. [...] But people have different kinds of learning abilities and that doesn't work for everybody. So, I'm hoping that we can maybe address different styles of learning with the programming that we do in here.[293]

Bringing in expert volunteers from the community, who already knew their way around a skill or tool, helped alleviate these issues. But the expectation of volunteers to come forward to teach specialized skills creates precarity for the types of programming. This also demonstrated the tension of having just barely enough resources, or possibly not enough. Bryan and Suzi's time in the space was limited and they had many other tasks – other staff could help a bit, but they then needed training and the cultivation of expertise to help patrons run the machines. As related earlier, and in relation to Maker Jawn programming, practitioners have written about the possibility for new staffing models being needed for these new spaces and programs.[294] Due to administrative and institutional constraints, Suzi ended up using tactical measures, like getting community members involved to help run the space. In turn, this cultivated patron ownership and control of the space.

It was not just time, but also emotional and affective labor that often went unacknowledged in these situations. Suzi told a story of how "this one woman keeps asking for one-on-one help with the 3D printers and I should just schedule a time for her to come in. [But] I don't think we can sustain this at this point and it's something that's hard to offer to somebody but not to everybody else."[295] These expectations from different patrons with different needs were hard to handle in the face of limited staff,

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[293] SC, interview by author, Albany Made Creative Lab, Albany, New York, United States, April 23rd, 2016.
[294] K-Fai Steele. "The Future of Libraries."
[295] SC, interview by author, Albany Made Creative Lab, Albany, New York, United States, April 23rd, 2016.

limited resources, and an inability to change the way programming is run. According to Suzi, the board of trustees had to sign off on any changes they made to programming, policies, or the infrastructure of the space. If they wanted to change the mechanisms of teaching, they had to be definite in making shifts – which she eluded was difficult in an experimental and start-up phase.

As librarians and staff strive to make these spaces and programming more sustainable, it is becoming clear that community development and cultivating programs that address local social dynamics and needs is more important and in the long-run more sustainable than the cool, trend factor of 3D printers, especially in an environment of increasingly limited resources. By valuing care – a care for their patrons; for the spaces they inhabit; for the artifacts inhabiting them; for the ways in which skills are taught; and a care for the selection of what skills and expertise enters the space – librarian staff are often able to tactically enact accessibility beyond the resources and mechanisms made available to them at the institutional levels. This does not erase the fact that there are politics involved in what and who is cared for in the space and in what ways. Something highlighted by the story from the beginning of the previous chapter.

Inclusion

In writing about library makerspaces, Basinkis and Rebekah Willett have identified technoliberal rhetoric as populating articles, blogposts, and higher institutional measures in contrast to librarians who employed tactical practices to foster creativity and growth in whatever capacity.[296] The cultivation of such tactics to enact inclusionary practices

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[296] Crawford Barniskis, "Metaphors of Privilege."; Rebekah Willett, "Making, Makers, and Makerspaces: A Discourse Analysis of Professional Journal Articles and Blog Posts about Makerspaces in Public Libraries," *The Library Quarterly* 86, no. 3 (2016): 313–29.

follows what I have observed in my three field sites. Typically, 3D printers were the point of departure for fabrication, catering more to patrons interested in prototyping or testing out new technologies. This could quickly shape the space and who felt comfortable to participate, and who felt that their skills, interests, or knowledges were welcome. Such tensions around inclusion were a tricky topic in the space at the DCPL Fab Lab. According to some staff, the space was diverse and inclusive, while others saw it as having implicit exclusions that resulted in a predominantly white and middle to upper-class crowd – with a majority of interested patrons coming from the DC Tech scene, and, as referenced in the chapter 4, possibly issues in regards to gender dynamics.

A tension existed between living up to popular expectations of what a fab lab entails and serving the local, diverse patron interests. Being aware of this, and in order to iteratively increase inclusion, staff and management developed more in-depth surveys to canvas patron interest. Thus, as the space and its patron base has developed, new tools and new programming to meet diverse interests have been included, such as sewing machines and hand tools. Certain members of the staff have also been assigned, such as Penelope, to set up beginner programming that pulls in diverse community and family-oriented interests. This has included the off-site visits to various neighborhood branches to gauge interest. Yet I still observed the issue of technoliberal rhetoric entangled with practice, as it came to bear on how funding was allocated in the space, how programming was formulated, and who was actively encouraged to come take part, tinker, and play.

One Maker Jawn mentor talked about inclusion in terms of abilities and different levels of capacity among the makers in their programming, demonstrating a more

engaged and hands-on approach to including different skills and capacities. She also

pointed to the difficulties of creating fully inclusive and sensitive programming.

> We have so many ranges of abilities coming in, and that's the part that I
> struggle with more. Not including girls, or boys, or different races. Not
> those separations as much as where people are in their ability to learn and
> understand concepts or use their hands, their dexterity, or their mental
> capacity. Because a lot of my older kids are autistic. [So] having projects
> that have different entry points is pretty important too.[297]

This sentiment highlighted another dimension of inclusion – particularly ability and

capacity, but also in what might get included in the activities or "making." Since the

program was interest-driven, they pushed to remain flexible to the desires of the makers

involved. When makers did not have ideas about what they wanted to do, though, having

projects on hand was helpful.

A focus on flexibility came up often at these sites. Since this was a newer

endeavor in libraries in general, the DCPL Fab Lab initiated the programming and its

associated technologies in whatever capacity possible as experimentation, with the hope

to shift according to feedback as patrons utilized the space. As the Fab Lab came into

their second year of existence, they started to record more feedback and pay closer

attention to the questions posed by patrons daily. At the end of the summer in 2016, they

created an official system for staff to record patron needs, and any questions, difficulties,

or suggestions that came up during open lab hours. They hoped that this would be

particularly helpful for tailoring certification classes to better meet patron needs and

create a welcoming, inclusive atmosphere.

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[297] HH, interview by author, Milano Library Branch, Philadelphia, Pennsylvania, United States, March 17th, 2016.

Iterative programming, flexibility, and patron feedback was also brought up in the case of Albany Made Creative Lab. But in talking to one of their interns, I observed a more nuanced issue of local community engagement and reflectivity in terms of outreach practices. Located in downtown Albany, a historically diverse and underserved community surrounded the Washington Ave Branch. In thinking through inclusionary practices, the staff of Albany Made defined inclusion as their own acceptance of anyone who might want to come in and work on projects within the space – to use the tools and equipment. Bryan related that he only kicked people out of if they were not using the space – which at the time had only happened twice.

> Everyone should be included here. I don't care who comes in here. Some of the people coming in here, and it's like "ah, that guys' coming in? I can't stand that dude." [...] But he has a right to be here, so I put on my smiling face and am just like "all right man, what do you want to do?"[298]

This statement revealed the extent to which the Albany Made staff, and really library staff in general, have a dimension to their jobs that involves the labor of care. In valuing care and acceptance, they wanted to ensure that all patrons received equity in how they engaged the spaces and the knowledges which the library provided. This was enacted through caring relations and engagement to evaluate different needs in context. Not all patrons needed the same amount or kind of attention, and this shifted from location to location.

Despite this intention to be fully inclusive, race, class, and often age were still issues in relation to who felt welcome in the space. "A lot of the older people from this neighborhood specifically come in and when I tell them what it's about they get so

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[298] RS, interview by author, Albany Made Creative Lab, Albany, New York, United States, September 9th, 2016.

pumped. They fill out a sign-up sheet, but then they don't come back. I don't know why that is."[299] Since they never returned, Bryan never got the chance to get feedback from these community members and ask what they would like to see in the space. In a moment of reflexivity, he recalled the survey generated by their initial sign-ups – before the space even opened.

> We did that initial survey, […] but I don't think that really covered a lot of demographics. I think that was predominantly white, suburban adults or people who live in Center Square or Pine Hills.[300]

Kim, a University of Albany Masters of Library Science student who interned at Albany Made for a special topics class on library makerspaces, made interesting observations in this regard. She had specific insight into inclusion as she saw it within programming. Although inadvertently, she recognized that the programming itself targeted the interests of certain demographics over others – as connected to bias embedded in Maker Movement rhetoric.

> One of the issues I have with makerspaces in general is that the Maker Movement seems to be a very specific group of people. For instance, knitters, most knitters are white women. So [if we were to say] "We have a knitting place in the library; everyone can learn how to knit!" The people who are all [going] to come knit are all […] the same people. [...] I don't want to force […] people to knit, but at the same time do other people in the community feel that they can come to this space and learn how to do something that's different from what other people they hang out with might do?[301]

Involved in this analysis is comfort, and the discomfort of stepping beyond cultural or community expectations. Thus, Kim expressed her own analysis that the cultural barriers were high for certain demographics to get involved in the space. Other librarians and staff

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[299] RS, interview by author, Albany Made Creative Lab, Albany, New York, United States, September 9th, 2016.
[300] Ibid.
[301] EW, interview by author, Daily Grind, Albany, New York, United States, June 15th, 2016.

on site did not necessarily feel this way, and were working hard to foster use by different demographics, cultures, and interests in the space. But a lack of actively reaching out, or a lack of resources to be able to do so, often resulted in a self-selection process.

To disrupt this self-selection process, and to create extended networks, the DCPL Fab Lab cultivated connections to Black Girls CODE and other community projects. Meanwhile Maker Jawn engaged the community through programming by involving local artists and makers through an afro-futurist fashion show, story-telling programming, and a local food cooking show. Reflecting on maker cultures and their limiting framework, Kim continued,

> [Y]ou can't force people to be interested in something, and that's not something I advocate, but at the same time there's definitely a certain group of people that are going to be interested and seek it out. And then there's a group of people that you might need to reach out to more – to get into the room. Maybe that's something that will come more with time. As there's more exposure and there's more things going on. But […] I guess that's an issue of inclusivity that I notice.[302]

Albany Made's place within the bureaucracy of the library system also affected their abilities to shift things and be fully supported while doing so. As related earlier, they did not have full control over promotion, and it ended up being "very flat, and very basic"[303] because of this.

It was also hard to do things as only a two-person team. Bryan's recognition in a more recent interview that the surveys, and most likely their email list, catered to a particular suburban crowd spoke to the very issues around promotion and programming that Kim posed. But overall here, as well as in Maker Jawn, they seemed to struggle due to lack of support within the institution. If all the library staff, administration, libraries,

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[302] EW, interview by author, Daily Grind, Albany, New York, United States, June 15th, 2016.
[303] EW, interview by author, Daily Grind, Albany, New York, United States, June 15th, 2016.

and other moving parts did not care for or were not in support of the maker programming, sustainability and the ability to flourish was difficult.

The DCPL Fab Lab was replete with many staff and support. This also meant that inclusionary practices were not the same across the board. Each staff member had their different experiences and their ways in which to deal with inclusion, something that became clear not only through interviews, but also through observation. Different from the feminist hacker collectives that focused on relationality and interactions, inclusion at the DCPL Fab Lab was regarded as individuated with little thought to group inclusionary practices, or how to create a collaborative environment through which to cultivate inclusion. When they did happen, collaborative moments were spontaneous but welcomed.

Staff members had different methods for teaching certification classes – some elicited more involvement from the students, creating a more open or discussion-based session. Others focused on the material they had prepared, getting patrons to practice hands-on skills so they could create and fulfill their endeavors. The same was the case for how different staff members handled patrons one on one, and resolved conflicts – or how they themselves experienced the space. One male staff member, Dan, who was part of the radical punk feminist scene in DC, talked about working to create an inclusive space in terms of gender and race, but had a hard time articulating exactly how he did this.

> I don't have a codified way of doing that. It's [just] something I'll keep in mind. I think about it […] especially when young women, teen girls use the space. I try to make sure that they feel comfortable here – empowered to use anything they want.[304]

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[304] DE, interview by author, DCPL Fab Lab, Washington, DC, United States, January 13th, 2016.

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Creating this intention demonstrates how inclusion could lead toward empowerment. While there was greater diversity at the DCPL Fab Lab than at a typical non-library makerspace or hackerspace, according to staff and my own observations, the typical users of the space were more technically-competent, upper-middle class, and white than the public that inhabited most of the rest of the library. Some library institutions misread such tech-oriented spaces as great equalizers, meant to build access for the resource poor, but politics were designed and built into such things as well. It was clear that the DCPL Fab Lab and its staff struggled with these issues.

The nuances of inclusion and exclusion regarding behavioral issues and the capacity of staff to deal with such things were revealed in my observations of the Maker Jawn programming. In the Spring of 2016, I visited the Kensington location of Philadelphia Maker Jawn. I had been in touch with Hailey, the mentor at Kensington, over email to figure out the best date to visit and talk during my spring break. It turned out this was her last week at Maker Jawn, and so she warmly invited me to the last events of her last days with Maker Jawn. The event would be a food celebration since Hailey was working with a grant to create a cooking show, using locally-sourced ingredients.

Getting off the highway at the Girard Avenue exit, I drove up Front Street, under the elevated subway. The evening light cast a warm glow on shop-goers, students done with school, commuters, work-crews painting store fronts, and the lively energy of a vibrant neighborhood as it unfolded. This area was changing, and had already changed substantially since I moved out of Philadelphia four years prior. But the neighborhood was still predominantly Puerto Rican and African American, reflected in the shop-keepers and crews that I passed. This neighborhood has a long history of local activism,

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which Nancy Naples has documented in her work on the "war on poverty" women community organizers.[305] The Maker Jawn program fits somewhere into this narrative as they struggle to advocate for the local communities – but even more so were the LEAP leaders who are often women who grew up in these communities.[306]

Peeling off Front Street at York, I passed by dilapidated buildings – residents hanging out their front doors, empty lots, and Philadelphia's signature preponderance of

Image 5. 17. Kensington Branch food show party.

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[305] Nancy A. Naples, "Activist Mothering: Cross-Generational Continuity in the Community Work of Women from Low-Income Urban Neighborhoods," *Gender & Society* 6, no. 3 (1992): 441–63.
[306] JA, interview by author, Rodriguez Library Branch, Philadelphia, Pennsylvania, United States, June 15th, 2016.

street trash. I parked my car near the Dauphin Street SEPTA stop, where the Kensington branch library is located.

There was a general good feeling in the air. I noticed an urban garden lot just down the street from the library, and a few neighbors were talking on the sidewalk. Commuters streamed out of the elevated subway stop, and a small group of individuals were hanging around the entrance to the library. Through the entrance, I made my way to the children's desk, and was directed by the cardigan-wearing librarian to a room in the back of the library. As soon as I looked in, a woman, one of the mothers of the children, smiled and motioned for me to come in. The room was full of energy and activity, carpeted and decorated with projects and materials.

Image 5. 18. Food-making table using local produce at Kensington Branch

Several tables were set up with crafts, food to make, food to take away, and bags of materials and art to take. Behind tables set up for the event, were cabinets full of cookware, cooking supplies, and crafts. I found Hailey, but I could tell her hands are full. So, I held off on questions, hanging out by the material closets in the back of the room, facing forward toward the noise, activities and projector screen which would later be used to view the collaborative cooking show which the kids made.

A past mentor, Alan, who had helped with making the videos, joined me in the back. He told me about tension within the program regarding the focus on art versus technology versus science versus what Maker Jawn really is. From his perspective, due to grant funding requirements, it needed to be about education, and the intersection of science, technology, and art. He related that this was hard since most of the mentors were artists and did not have a background in science and technology. He then clued me into the story behind a forlorn kid, Bobby, who I passed while outside. Alan had worked with Bobby specifically, who has learning and socialization disabilities. They drew a lot and it was a great outlet for him – Alan showed me the drawings Bobby did for the cookbook. Bobby has been banned for a week because he was picking on another kid.

While issues of exclusion did not seem to come up often in relation to the Maker Jawn, they arose in relation to the invisible care labor that mentors may or may not have the capacity to do as conflict de-escalation managers, social workers, and special needs educators. Maker Jawn mentors often did not have the training or the support to help students with serious behavioral or learning disabilities – which was often a large percentage of the students that came. While the DCPL Fab Lab was explicit about their space as being off-limits for those with mental illness and were conscientious of its

accessibility downfalls otherwise, this was not the case with Maker Jawn. They wanted to be radically inclusive to all kids, whatever their disability might have been. These sentiments that often bumped against other library staff who attempted to ban students from the program due to behavioral issues.

These difficulties of dealing with behavioral and mental issues came up most clearly during the two Maker Jawn staff meetings which I attended in late July, 2016. During one, various staff members shared stories and gave each other advice regarding at-risk children, disciplinary measures, and how to keep building a sense of community at their sites. It was a tricky situation that put a lot of emotional strain on the mentors and added a difficult dimension to their work. One mentor related the internal conflict she dealt with when considering disciplinary measures: "I am angry that they fought and I want them to leave, but on a grander scale of things I don't want them to leave. Because all they're going to do is go somewhere else and fight."[307] Mentors worried about where makers might go, but they were also trying to create a safe space and welcoming environment for everyone. If someone was being a bully or creating a negative atmosphere, taking them out of the environment was the easiest way to re-establish that safe space as Maker Jawn mentors defined it.

Several of the mentors I interviewed felt the same ways about inclusion – that through creating a welcoming and comforting environment inclusion might be reached. But this also called for creating a specific kind of safe space – which was hard to impose on children who might be used to interacting with one another in an antagonistic way.

> The kids that come into the library make fun of each other a lot and pick on people's inabilities or differences. So for me it's keeping this idea of 'we don't do that in this space.' We're not speaking negatively, and saying 'I'm

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[307] SF, Rodriguez Library Branch, Philadelphia, Pennsylvania, United States, June 9th, 2016.

kidding' afterwards doesn't make it OK. Even though that might be part of the way you interact outside, and you might not care, I care.[308]

In this instance, Hailey related how it connected to her own affect and valuations of care. Similar to the way feminist hacker collectives posed it, creating a safe space ended up being as much for the mentors as it was for the makers. Ciara also brought up safe space when considering inclusionary practices and emphasized her own emotional state as factoring into the definition of safe space that she used. "In terms of inclusivity it is constantly trying to make a space that feels safe emotionally for me."[309] Keeping the balance of letting kids do things flexibly and freely, while being strict on how they acted, created some intentional structuring that might be needed – regardless of the mentors' hope for the environment to be completely freeing.

Some mentors argued that by the nature of their locations and the communities they serve, Maker Jawn programming is inherently inclusive toward the local communities and the predominantly economically disadvantaged groups for whom they were hoping to be available. Or, according to Sharon, who managed Maker Jawn at this time, it was a non-issue. Inclusion does not even come into play with their programming because of where their sites are situated. While all but one of the maker mentors is white, all the makers I saw were people of color. Gender-wise demographics often aligned with the gender of the mentor for each site. Kevin's site had more boys, while the sites managed by Ciara, Sally, Gina, and Hailey drew in more girls.

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[308] HH, interview by author, Milano Library Branch, Philadelphia, Pennsylvania, United States, March 17th, 2016.

[309] C, interview by author, Rodriguez Library Branch, Philadelphia, Pennsylvania, United States, March 17th 2016.

Brett, pushed up against the narrative of default inclusivity when thinking about inclusion and bias and the types of programs or activities involved in Maker Jawn.

> Inclusive is getting as close as you can within the biased system and overcoming your own biases as much as possible, [along with] the sort of dynamic relationship that has to exist with that. You're never actually going to be [fully] inclusive but you try and get close.[310]

In order to get close, Brett worked to build a "sense of community so that people feel that they're welcome, that this is as much theirs as everyone else's."[311] In the end, Brett did identify maker-type programs as a mechanism toward an inclusive space:

> So, the nice thing about the maker tradition is it doesn't come with any sort of expectation that you have to do things [a certain] way. Saying, "Well, we're going to do this and we're going to do it this way," is exclusionary. So, the openness of it allows people to engage on their own terms. […] They're allowed to just hang-out. And within Maker Jawn, you do your best to try and let the kids just be themselves. And as best you can you try and make everyone feel welcome and own [this as] their space.[312]

Brett's characterization of the 'maker' tradition is a different view than that given by Dr. Ackermann, but it does align with her hope of what maker culture can and should be away from the initial foundation of what the Maker Movement label stood for. Within Maker Jawn, some mentors want to do more direct outreach to other community centers in the area such as a foster home that showed interest in bringing residents to programming. Through the Creativity Creates grants, mentors often connect with and bring in local artists and members from the community such as poets, artists, gardeners, farmers, and the Patchwork story-telling group.

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[310] BB, interview by author, Rodriguez Library Branch, Philadelphia, Pennsylvania, United States, September 14th, 2016.
[311] Ibid.
[312] Ibid.

Focusing on the value of care for the communities in which they are located, and being in conversation with local needs and community members, the Maker Jawn programming is cultivating a particular kind of inclusion that works for marginalized communities in Philadelphia. Thus, much like feminist hacker collectives, they use care and the dimension of comfort to frame how and who they engage. While Albany Made and the DCPL Fab Lab are also hoping to cultivate this aspect of their inclusionary practices and outreach, inclusion comes out more prominently in relation to the skills they make available, and in particular their interests in breaking down digital literacy stereotypes for makerspaces – instead including fiber arts, bike repair, screen-printing, and other making activities.

Empowerment

Image 5. 19. Exterior shot of Widener Branch.

As I described earlier, inclusionary and accessibility practices can help to achieve some form of empowerment. Empowerment practices in library spaces differ from feminist

hacker collectives, because they are less entangled with self-empowerment and more attuned to providing programming and empowerment for 'the other.' Thus, library spaces and groups are geared to create a service that has the potential to empower. Of course, embedded in this intention are power relations – a giver and receiver – and assumptions in regards to what empowerment means. Thus, empowerment is a relationality that changes over time, and is also framed in such a way that can reinscribe hierarchies of power. Maker Jawn tries to circumvent this tricky scenario the best they can, reflexively and critically engaging themes of empowerment so as to not fall into 'digital divide' rhetoric and tropes of transfers of knowledge from 'privileged' to 'non-privileged.'

Part of the Maker Jawn initiative, the Widener library branch has its own room for programming including a smart screen, a small collection of musical instruments, and some nicer sound recording equipment. I visited this site several times during Spring of 2016. Gina usually mentored here, but in her place today, I met Jessie who has recently moved from Colorado and started working with Maker Jawn in the past few months. With fifteen makers in attendance that day, making dance videos, pillows, outfits, music, shelves, and masks – the room was buzzing. As she helped various makers, Jessie and I talked about the space and what the kids have been up doing. She handed me a copy of the magazine from the afro-futurist fashion show that Gina helped to organize, and we talked about her background in design.

At one point, a girl tried to get our attention and ask for help – the sewing machine was broken. But we were busy helping and supervising a group of makers who wanted to saw wood. By the time we were free to help, the girl had already taken the sewing machine slightly apart. "It's just the needle" she explained to us, "do you know

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where the extra needles are?" Jessie and I started looking in the nearby of sewing

supplies, but she eventually found some herself.

Image 5. 20. (a) Looking for a new needle (b) inserting the new needle (c)
finalizing the sewing machine fix.

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"Do you need help?" I inquired, but the girl had clearly done this before. "Fixed it!" she exclaimed after replacing the needle. In this moment, I recalled Gina describing the various fixing and repair activities that have gone on at Widener. She had often worked with participants to fix the broken sewing machine – something Gina said she did not know how to do beforehand, so it was a learning experience all around. Her own lack of expertise helped to foster a dynamic where students could take a more agential and pro-active role in the problem-solving and interacting with unfamiliar technologies. This stepping back and encouraging patrons to participate with technologies from an engaged standpoint and their own previous knowledges was typical for practices at both Maker Jawn and Albany Made, an instantiation of empowerment enacted through tool use.

One path towards this form of empowerment that Maker Jawn focused on was the ability to demonstrate and teach skills to others, which I observed through participants helping each other to saw, sew, solder, and create stop-motion animations – particularly at the McPherson Branch.

Image 5. 21. Interior and main foyer at McPherson.

Located in a public park, the setup of this location was vastly different than CBM,

Rodriguez, and Kensington. It was an older structure with a domed roof – a building that

technically belonged to the Parks and Recreation Department of Philadelphia located.

Due to its association with Parks and Recreation, McPherson was part of a free-lunch

program which in turn brought in many more kids than the other branches. During one of

my visits a young mom on probation was relieved to find out she could bring her

daughter, not only for free lunch, but for the Maker Jawn programming as well. The

library itself was calm, but according to Brett and several Spring 2017 articles in a local

Philadelphia newspaper, a heroin epidemic had hit the area hard in the past year, and the

park surrounding McPherson was often riddled with used needles.[313] It was for these

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[313] Mike Newall, "For These Philly Librarians, Drug Tourists and Overdose Drills are Part of the Job,"
Philly, May 24th 2017, accessed May 24th 2017.
http://www.philly.com/philly/columnists/mike_newall/opioid-crisis-Needle-Park-McPherson-narcan.html.

reasons that he felt the presence of Maker Jawn in that area of north-east Philadelphia as particularly important.

When I arrived in the McPherson library basement, Brett was helping a boy to make claws for a costume for the big group project they are currently working on – a vampire movie. Other children are busy building sets, while still others are using the tablets and computers to watch videos or play games. The boy working on claws then asks to use the sewing machine. Brett set it up at a table away from the other makers playing games or working with papier-mache. The boy knows how to use the machine and starts working on making a pillow – meanwhile another girl who has not used the sewing machine asked to try it out. Brett started out by showing her how to create a knot using the sewing machine, but then had to go help elsewhere. In his absence, the boy took over leading the girl through the sewing machine steps. They worked through thread jams and other issues – talking about the process as they went.

Image 5. 22. Brett helps a maker with sewing.

Image 5. 23. Two makers work together on the sewing machine.

Brett brought over the Bedazzler for them to decorate their pillows if they like. He admits

not knowing how to operate the Bedazzler, but the girl volunteers that she knows. After

making sure by reading the instructions, she starts to work on her pillow. When the boy

wants to partake, the roles have been switched and she now leads him through the steps

of Bedazzler operation. While not obvious, subtle teaching tactics are present.

> Once I get kids that have been around and know how to do things, I try and
> get them to [do] the knowledge sharing and skill sharing. It's just dealing
> with kids, I think. It's all about process and seeing […] the individual child
> grow. You can give them more – and you just try [to understand] wherever
> they're at [and] get them to do the next stuff.[314]

By stepping back from the situation and letting both the boy and the girl take the lead in

collaborating toward completion of their projects together, Brett removed any need for

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[314] BB, interview by author, Rodriguez Library Branch, Philadelphia, Pennsylvania, United States,
September 14th, 2016.

him to be involved. This was in part the end-goal of Maker Jawn – to have participants

take full control of the space, with the mentors acting merely as facilitators.

Image 5. 24. (a) Maker setting up the Bedazzler. (b) Makers sharing skills using the Bedazzler.

Hailey related how she felt it was important for girls to be encouraged to

transgress expected boundaries around tool use.

> It is really important to me for girls in particular to learn tools. I don't find [it] hard [to encourage them]. It's not like girls are like: I don't want to use a hammer. But sometimes [I'm] a little bit more intentional about it. […] Even when we're moving stuff around in the room, being like, can the girls help me move this thing? […] That kind of tact is something, personally, that I always want to make sure I'm doing.[315]

There are politics involved in how to enroll different students and learning types. Having

flexibility around the type of learning environment created in relation to a student's needs

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[315] HH, interview by author, Milano Library Branch, Philadelphia, Pennsylvania, United States, March 17th, 2016.

is important, and is an organic process that often takes time and consistent visits – which is not always the case for these programs.

Brett also described empowerment in terms of pushing beyond limitations set forth either by another, but most often by ourselves. "I think empowerment comes when you feel that there's a boundary and you're empowered when you think you can actually push past the boundary."[316] Brett explained how kids would come in saying they could not draw, and would refuse to try. By leading them through a project with one step in which the participants had to draw, he hoped to slowly build up their confidence toward cultivating different abilities – getting the kids to try things they did not think they could do. And for him it was a large part of the purpose of Maker Jawn.

> I think empowerment is just a huge part of what we're trying to do. I think education is empowering in that any time kids learn a new thing, they're gaining a new ability. So, I was a big advocate for hand tools because they're very empowering. This little girl, Nicole, she can saw really well and once she discovered that – she was glowing: 'I'm really good at this.'[317]

In all the Maker Jawn sites, building up confidence was the low-hanging fruit of impact they envisioned as possible with their programming. And through the mediation of tools and different forms of technology, they saw empowerment being that much more immanent.

Each Maker Jawn site was geared toward reading the crowd and finding out how they might better meet their needs. While many talked about the spaces as transformative, it was not in the sense that they would facilitate a patron in getting a job – they were hoping to transform at the level of self-confidence, skill-development, and creativity

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[316] BB, interview by author, Rodriguez Library Branch, Philadelphia, Pennsylvania, United States, September 14th, 2016.
[317] Ibid.

development, all towards empowerment or self-actualization and identity development.

Hailey shared that she saw it as a rewiring, as facilitating people to believe that they

could change their environment and world.

> And that's the goal to me is them feeling like they have the ability to make whatever they want or realize that the world is made by people and they can be part of that process rather than an observer. […]

> That they can take part in it. I think that's to me the really important thing. Yes, you can take part in it. Your world, you can change it.[318]

Breaking down systemic oppression is a huge task – especially in a society where many

populations and their actions are controlled or monitored through state surveillance, low-

pay occupations, and other violent infrastructures in a biased system.[319] Regardless,

Maker Jawn hopes to make some small shift through individual and group empowerment.

As the day and projects progressed, I noticed a teen boy who is working with the

recording equipment. He has a whole separate area set-up with audacity open on a

computer connected to a microphone, and lyrics sheets displayed. This is Malik, a maker

that I have heard a lot about, and who has been involved in Maker Jawn for the past two

years. Both Kevin and Gina have mentioned him in interviews. At the end of the day, as

we clean up Jessie gets the rest of the makers to leave the room, letting Malik stay to

record in silence.

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[318] HH, interview by author, Milano Library Branch, Philadelphia, Pennsylvania, United States, March 17th, 2016.

[319] Virginia E. Eubanks, "Trapped in the Digital Divide: The Distributive Paradigm in Community Informatics," *The Journal of Community Informatics* 3, no. 2 (September 14, 2007).

Image 5. 25. Malik working on music at Widener.

Kevin dropped by, and added some vocals to one of Malik's tracks. His creative works

and interests in the program are inspiring for the mentors. Gina described his

accomplishments:

> He's so committed. And […] he was really shy I guess. The teen librarian
> told me […] 'ever since you guys started doing the programming here
> Malik's just really changed and come out of his shell. He used to be afraid
> to talk to even us.' […] I've tried to get him involved with other programs,
> so he did a thing at Scribe Video Center where he did a documentary project
> on food access that was really good. […] And he had started rapping and he
> went to a teen poetry slam at the downtown library. [He] performed in front
> of 60 kids and he said it was horrifying and really bad but he said "it's gonna

be better in the Spring when I go again." Just working with him has been really amazing and inspiring.[320]

In conjunction with this greater transformation, Malik enrolled other makers to partake in his music and videography endeavors. This resulted in collaborations and relationships that go beyond the bounds of Maker Jawn – including effects on external institutions like Scribe Video Center and the teen slam poetry night. To share his projects, he also started SoundCloud and YouTube accounts – something with which he did not have prior experience.

The maker mentors characterized empowerment in relation to Maker Jawn as subtle. They did not have false expectations in regards to the impact of their work. They defined empowerment in terms of learning, self-direction, and cultivation of confidence to have control over one's environment in whatever small way possible. The results and stories of Malik and other small interactions were the most that Maker Jawn could ask for.

Bryan of Albany Made Creative Lab also pointed to small interactions as important for moments of empowerment.

> I see it in little subtle ways, when someone accomplishes something. Like this woman who is teaching herself to knit. Most of the time she's like "Ah damn!" But every now and again she'll be like "oh cool! I did it!" I see that as empowerment, in those really subtle ways. […] We can kind of guide people and help them, but when you see them actually figure out what it is they're trying to do and they do it, and they're stoked about it, that's cool, and that happens a lot here, in this room.[321]

While she figured out knitting, Bryan related that the woman would check in with the kids who were 3D printing, curious about their projects and wanting to talk about their

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[320] GT, interview by author, Philadelphia, Pennsylvania, United States, December 30th, 2015.
[321] RS, interview by author, Albany Made Creative Lab, Albany, New York, United States, September 9th, 2016.

creative endeavors. Overall, Bryan was skeptical of the 'empowerment' rhetoric. He related that empowerment is "not necessarily a personal goal of mine. I think that's one of the three "E's" in the library motto, I think it's Educate, Entertain, Empower."[322] Yet, he was interested in cultivating collective excitements and small, personal triumphs.

Moments of cross-patron collaboration were a highlight of DCPL, and I also observed such interactions during a contact microphone workshop that I led at Albany Made. While I demonstrated the making, and gave advice along the way for each participant, I designed the workshop to open up the space for them to cultivate their own expertise and path towards completion. This often happened through collaboration between participants in the workshop. For many of the children and youth I have observed using Albany Made, the way they are treated as peers and as responsible individuals helps to create the context towards empowerment.

Maker Jawn mentors relate how in their programming, modes of empowerment are not only open to the kids, but to adult community members as well. Hailey told me about one adult who regularly came into the Maker Jawn hours, and who had been in recovery from addiction. This is the case for many if not most of the patrons who come to adult services at the Kensington and Rodriguez branches – outpatient clinics are nearby and the library is the closest free community resource. Before taking part in the Maker Jawn program, this woman never thought that she had the ability to draw, to make, to produce, or to be creative. Having supplies and activities readily available broke down barriers and provided accessibility to aspects and abilities within herself of which she was

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[322] RS, interview by author, Albany Made Creative Lab, Albany, New York, United States, September 9th, 2016.

not aware. She was incredibly grateful, and let me know during our brief interaction how much Hailey would be missed. There were also several other interactions I observed of mother and child duos where encouragement was fostered by doing projects together.

Intergenerational connections, having adults and children in the same space to encourage one another, was also a part of the dynamic at the Albany Made Creative Lab, where families often came in to engage the new space. A Latina mother and son were very excited about using the space during the winter of 2015. He had an interest in 3D printing, and his mother accompanied him since he was quite young, about 9. While Bryan had him looking at and setting something up at the 3D printer, I noticed her scoping out the sewing machine. "Do you sew?" I inquired. "No, my grand-mother sewed in the factory – I was always too scared that the needle would get me." Having not only a fear of the machine, but also a familial history of possibly intense working conditions associated with sewing led me to think that she would not want to even try, but we decided to work it out and see what happened. Watching her son make and get involved in the makerspace facilitated her own interest and involvement. We made some test stitches, and soon she was trying out the different styles and patterns of stitch on the sewing machine. Her son came over and wanted to learn too, so they led each other through the steps. While nothing "useful" was made of this experience, the mother's push to move beyond her own fear has merit, as she worked to move beyond a boundary of what she thought she could or could not do – she was excited to come back and test things out and made sure I was coming the next week. This moment also illustrates the importance of one-on-one mediation and encouragement and the importance of different

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forms of making (3D printing versus sewing) to engage different communities, interests, and backgrounds.

To Hailey of Maker Jawn, empowerment meant feeling that one was able to be creative and to transform the world – to have any kind of influence on the world at hand. She saw the program as having great possibilities for adults in the area, who also did not typically have access to arts or STEAM programs, or who did not think they are capable. This was a sentiment held by many of the mentors who discussed during an organizational meeting the possibility of creating more adult services or outreach within Maker Jawn. The cutting of arts and creative programs in public school systems is prevalent in the Philadelphia public school system, and thus there is little room for playful experimentation in the classroom. According to several mentors including Brett, Hailey, and Kevin, Maker Jawn's overarching aim was to help actualize a world beyond that with creative practice and playful becoming.

Within all three sites, tactics are used within the space to foster empowerment, particularly in terms of confidence and failure. Many of my interlocutors at DCPL talked about overcoming their own intimidation within the space and how this gave them insight into being more patient and knowing how to handle or warn the patrons of possible failure. For Mallory, the manager of DCPL Fab Lab, this gave her perspective in understanding where others might be coming from, and most of the staff did not come from a technical background. This seemed to come across as a positive, instead of negative, in terms of making others feel comfortable and open to failures and experimentations of their own. This particular instantiation of empowerment – the confidence in failure – is a theme that comes up in maker education program approaches,

but is also an important component of feminist hacker collectives.[323] It is also connected

to comfort within oneself and one's surroundings.

Another way DCPL staff members talked about empowerment was in regard to

having patrons take ownership of projects – which entailed making sure staff were not

overbearing.

> You have to let people do things themselves. You have to treat them like
> they're capable of doing it themselves. […] I think it's empowering to do
> something yourself and to realize that you can, that it's not just the purview
> of people who have been doing something for years.[324]

Beyond certification classes, the Fab Lab tries to establish and cultivate a self-directed

learning environment. In particular, they want to assert that they are not a service center,

but a place to gain skills via self-motivation and participation. Recently, the library

bought a subscription to Lynda.com, giving access to tutorials on digital fabrication

platforms. Patrons are made aware of the website and how they can log-on for free access

through their own library card number. This still poses the issues of time and labor and

whether patrons have the free time to spend learning digital platforms and taking time-

intensive online design coursework. It also plays into the individuation narrative; there is

a tension between the top-down institution imposing themselves, and wanting to cultivate

free play, and patron ownership of the space.

During one visit to the DCPL, I interviewed a patron who expressly uses the

space to work on cosplay costumes. Lucy is an economist that works nearby, but is

interested in cultivating her creativity. She has been making costumes for many years, but

finding the community and a free space where she could explore her creative endeavors

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[323] Martin, "The Promise of the Maker Movement."; Rosner and Fox, "Legacies of Craft."
[324] DE, interview by author, DCPL Fab Lab, Washington, DC, United States, January 13th, 2016.

has been enabling for her own material participation. Her main reason for coming to the

Fab Lab is that the 3D printing services, apart from materials costs, are free. TechShop,

which has a space in Arlington, is much too expensive. She has also become a regular

due to the camaraderie, its proximity to her work, and the comfort with which she felt in

the space from the start – she cares about the space and the community and her freedom

to be there and as involved as she likes.

During my first visit to DCPL I met another regular, Rob. A middle-aged African-

American man with an engaging and driven energy, he instantly started talking to me

about best practices, and about the various projects he has been working on. He wore a

long-beaded necklace with an Adinkra stamp symbol icon, and showed me the project he

was currently working on – a miniature guitar – as well as various projects that he has
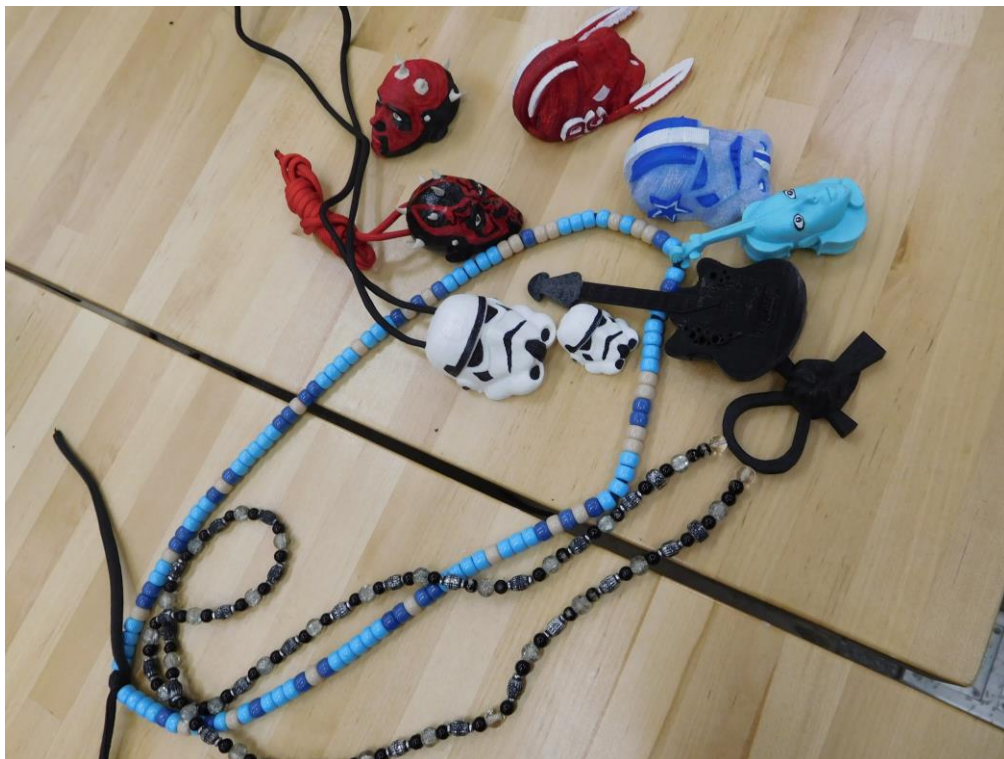
already printed to sell on the street.

Image 5. 26. Rob's 3-D printed and painted emblems.

Having studied computer science previously, Rob became immensely fascinated with the 3D printer technology, and came in about every day. His regular presence created a sense of community and user-ownership in the space, which the staff appreciated – many of them hoping that there was more involvement by other patrons in this way.

> Something I like to see is when the regulars and the patrons start talking to each other and developing these collaborative relationships. Now people see [Rob] in here all the time and they ask him for help when they're 3D printing. He can give it to them really easily and probably in a different language than I would do it because I, like, read the MakerBot manuals and do video tutorials. He does that stuff too, but he has such a more hands-on experience with everything.[325]

Rob's presence helps to cultivate ownership, but also cross-patron collaborations instead of individuation – an aspect of education that Dewey has identified as a better model for learning in *School and Society,* and Ito pointed to in his work on 'connected learning.'[326] The staff wanted a space where people felt comfortable to learn not only alone, but together, and work collaboratively on projects. They also *wanted* the patrons to care: about the community, about the space, about the tools, and about their own projects – and they tried to cultivate this through their own valuation of care in design of the space, maintenance of the space, programming, the patrons, and themselves. Maker programming in libraries is just one part of their push to foster an epistemic culture of library learning, and broader sense of community beyond the walls of the library. Patrons are often curious about each other's projects, and so they will start conversations, ask what the other is doing, eventually ask for a name. Sometimes they ask for advice as well, and as a staff member relates, she herself has used the Fab Lab as a sounding board

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[325] DE, interview by author, DCPL Fab Lab, Washington, DC, United States, January 13th, 2016.
[326] Dewey, *The School and Society.;* Ito and Martin, "Connected Learning."

for her own making practices. Space and the way things are run needs to be designed in such a way to allow such organic collaborations and interactions to occur.

Conclusion: The Struggle to Establish a Diversity of Diversity

When asked about the main intention behind the Fab Lab, one of my interlocutors from the DCPL responded in a way I did not expect: "Trying to make the library more relevant."[327] I pressed further, "Relevant in what way, and to whom?" With a laugh she responded, "Relevant to modern life." This response speaks to the anxiety within the public library system of becoming obsolete, and thus not needed, in the current and future world. It also reveals why library makerspaces often take on the dominant discourse regarding technocentrism to garner funds and wider support. But for those who use the library most regularly these days, the underserved, relevancy is certainly is not access to a 3D printer. She continued, "It's very strange, because a lot of the people that we get that are using the library are having very digital divide issues. […] So that kind of makes me wonder. I definitely value teaching people to use more technology, but […] was this space conceived so we would look more relevant?"[328] The implication here is to greater culture, greater society, but the greater culture and society that holds power – relevance to the tech-elite epistemic cultures.

Instead of finding out how to bridge the so-called "divide" or create a tech-elite within the underserved communities, library programs are starting to realize that it is important to create and cultivate alternate epistemic cultures in these spaces. As

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[327] ES, interview by author, DCPL Fab Lab, Washington, DC, United States, January 15th, 2016.
[328] Ibid.

demonstrated by an analysis with attention to care practices, setting up a collectively shared value system among patrons helped establish sustainable programming. This was exemplified by the Philadelphia Maker Jawn fostering relevancy in ways that serve its publics needs via care work inflected by social justice beliefs. Such work contributes to the argument in a recent article by Jaeger and Bertot who point to the trend of transformation of libraries into social justice centers in relation to law, informal education, human rights, and support.[329]

Yet, Barniskis points out in her article that the current institutional strategies around makerspaces in libraries in regards to blog posts, ALA standards, the IMLS, and other funding agencies including each city's foundation center, focus on a techno-liberalist and technocentric metaphors that speak of "leveling the playing field," and "dissolving barriers."[330] While the DCPL Fab Lab manager reflexively joked with me about similar metaphors and buzz-word narratives she used to talk about the Fab Lab during our interview, her role in management speaks to how library makerspace staff have had to position themselves to argue for relevance within libraries toward the greater bid for libraries to argue relevance in society. Either they are caught up in the dominant discourse, or co-opting the register to shift culture in libraries toward knowledge societies and the cultivation of a locally-based epistemic cultures.

At Maker Jawn, one mentor, Kevin voiced concern regarding the Maker Movement and its technology trends.

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[329] Paul T. Jaeger, Brian Wentz, and John Carlo Bertot, "Libraries and the Future of Equal Access for People with Disabilities: Legal Frameworks, Human Rights, and Social Justice," in *Accessibility for Persons with Disabilities and the Inclusive Future of Libraries*, 237-253 (Emerald Group Publishing Limited, 2015).
[330] Crawford Barniskis, "Metaphors of Privilege."

This is going to end, possibly – it's not clear yet – and libraries are really investing a lot of time and money into these makerspaces. [And] there's lots of people who are lining up to take credit for stuff and put their name on things, but not really willing to necessarily see it through.

[I]f you're going to buy a 3D printer, what are you going to do with it that's interesting and meaningful and cool? And what does that require? It means having staff and people who have interesting ideas and want to push projects further.[331]

In his critique, the downfall within these library spaces is when they fall back on technocentric maker rhetoric to guide or shape their actions, intentions, and programming – instead of thinking about meaningful or care-ful programs from the onset.

The techno-liberal dominant discourse still has its effects. In the Albany Made Creative Lab, it came through patron surveys which related that they were most excited about the 3D printer. After considering the geographic and demographic data of the survey, however, Bryan has since recognized such interest is not the case for all, especially those they hope to draw in further in terms of gender, race, and socioeconomic class. In the DCPL, it shows up in the demographics of the Fab Lab versus the rest of the patron community at the library in relation to "digital divide" issues. It also comes up in some internal strife about the funding of expensive equipment over other library programs and results-based pressure to let it be known that they are successful, needed, and relevant to greater cultural values. Finally, in Philadelphia's Maker Jawn the dominant discourse and its effects are acknowledged behind closed doors at staff meetings, as staff question the grant-fulfilling initiatives to focus on kits-based learning, something they see as antithetical to the very nature of their work and the mission of Maker Jawn.

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[331] GR, interview by author, Philadelphia, Pennsylvania, United States, December 29th, 2015.

Staff and librarians often end up reconciling strategic handlings and institutional mechanisms with tactical measures of bricolage, playful learning, flexibility, working with limited materials, and things that fall out in between the "let's buy a 3D printer" and the actual day-to-day handlings of education and tool-sharing in a tech-heavy space. If the institutions could shift even further to accommodate a register about technology outside of the technocentric 3D printer buzz and toward collective care, they may sustain practices in the communities they serve more easily. This might in turn enact a focus on local social justice, environmental concerns, gender equity, creative empowerment, or other issues related to community needs. As many staff relate, "this is nothing new," and so in owning that, libraries could identify those within their community who are already involved in making or creative endeavors. Administration and the dominant discourse in the library system assert strategies for implementing that often do not work. Meanwhile, staff and librarians use tactics to transform spaces, remain flexible, enact care, involve community members, and re-work programming.

Through tactical measures librarians have historically broken rules to better address patron needs. Suzi from Albany Made characterized their distance from other makerspaces and maker culture as a path towards accessibility. Specifically, she saw their lack of larger and more complicated fabrication machines as a vital part of fostering comfort – and a reason to for the space to garner relevancy in conversation with the community.

> I don't feel like you have to identify yourself as a maker to use and get something out of this space. Maybe you'd have more of that [intimidation] feeling in a bigger, better-equipped makerspace. That you can't take part; you can't be a maker because you're seeing all these other things happen.[332]

[332] SC, interview by author, Albany Made Creative Lab, Albany, New York, United States, April 23rd, 2016.

One Maker Jawn staff member theorized how to appropriate the Maker Movement to get

funding to focus on the dimensions of their program that she sees as more important and

effective.

> I would like to use [the Maker Movement] as a whole to focus more […] on
> the organic things that we're doing that aren't based on, expensive, high-
> tech tools and have more of a focus on accessibility, community-building,
> skill-sharing, and tool-sharing. […] I think that the idealism behind
> makerspaces as a whole, and the way that they approach education [is] all
> well and good. But I think acknowledging class is extremely important, and
> it doesn't really seem that it's something people really talk about when it
> comes to makerspaces.[333]

Library spaces may be the place to cultivate these lines of inquiry and difficult

conversations, but they may also work even better apart from and within their separate

realm of maker cultures – creating an alternative narrative that could, but does not have

to, engage dominant maker discourse, trends, and ideologies.

One of the most productive aspects of the library maker programs that I studied

was their commitment to community growth and development - their focus on

establishing collaborative space between patrons, patrons and librarians, and among staff

in a care-ful and responsive manner. They worked together to address problems within

the space, sometimes bringing in "community experts" to contribute their own knowledge

to the program. In this collaborative work, there was a "reflection in practice" with and

together – not as individual work, but collectively to create culture and create community

within a space.[334]

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[333] MN, interview by author, phone interview, United States, April 4th, 2016.
[334] Donald Schon. *The Reflective Practitioner: How Professionals Think in Action* (New York: Basic
Books, Inc., 1983).

This also included productive tensions between what the librarian staff might think was needed in the space, who they wanted to use the space, how those communities felt about the space, and how other staff in the library interacted and negotiated the resources that the new programming both brought in and used. Such tensions, and the ensuing discomfort, highlighted various important power dynamics in relation to socioeconomic class, race, disability, and epistemic injustice. The ways in which groups involved were able to negotiate such discomfort was affected by their willingness to address things candidly, having a structure to support open acknowledgement difficult dynamics, and a working together instead of smoothing over or ignoring. This was seen at Maker Jawn among children makers, between LEAP leaders and maker mentors, and between makers and mentors; at the DCPL Fab Lab between the Lab and the Center for Accessibility and between Fab Lab staff and researchers; and at the Albany Made Creative Lab between community experts and patrons as well as between librarians and patrons. Tied to Strategic Action Field theory, there is a possibility for collaborations between different publics to create new communities of practice and cultures – but such things take time to cultivate and grow. They also take dedicated mechanisms and attention, which Boler's development of a pedagogy of discomfort as well as Pratt's exploration of contact zones demonstrate. Through attention to both comforts as well as discomforts, these collaborations among different communities help to reframe how libraries function, how publics engage the library, and the agency they have in restructuring the library as institution.

As library makerspaces shift popular and administrative conceptions of what a library can be and do, the spaces themselves are shifted in their capacities to function

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openly and freely for the public. Thus, the ability to move beyond cool factor towards critical technical engagement and an informed public is difficult. If community uptake and engagement is not achieved, libraries risk ending up with a heavy load of obsolete technology decades down the line. Such endeavors also take many resources – not just in funding, but in staff labor and training, intellectual labor, emotional labor, and a shift in library infrastructures. Specialized staff-members, who work with the equipment for maintenance and cultivation of programming, may need to exist. Yet, this also opens room for the public to get more involved in the spaces in order to become experts that help to run the programs. However, if the desire and the time and capacity are not there, the spaces may not be viable. One way of solving this issue may be by further attention to care, comfort, and discomfort toward imagining diverse modes of accessibility, inclusion, and empowerment. Thus, contributing to a heterogenous narrative according to different modes of care or local values.

Philadelphia Maker Jawn seems more in-line with the focus of the feminist hacker collectives in relation to confidence-building, community development, valuing care, and creating a safe, welcoming environment to increase inclusion and to reflect participant interests and needs. I would argue that Maker Jawn ends up taking issues of comfort more seriously into account than other groups, because there are many levels of discomfort that they are working through and addressing with regards to race, socio-economic class, and culture. Maker Jawn staff attend to many discomforts and work to create mutual understandings with the makers in their spaces, with the librarians on staff in their locations, with other staff members, and the neighborhood communities at large. Since no formal structure is in place for dealing with such discomforts, they create best

practices and share advice amongst themselves, giving mutual support. Although there

was tension with other library-staff initially (regarding sound, space, and resources), they

have also created networks with the children librarians, summer teen programming, and

LEAP leaders.

More so than feminist hacker collectives, library maker programming tends to rely

on the dominant cultural framing of technology, STEAM, and distributive rhetoric to

stake their claim in the current technosocial landscape. However, their inclusion and

accommodation of different framings of technology has shifted according to patrons'

needs, interests, and involvement. This has resulted in the acquisition of more sewing

machines in the cases of the DCPL Fab Lab and Albany Made, and a cultivation of

flexible programming in the case of Maker Jawn. This has also meant the recognition of

different framings of technology, technical literacy, and technological citizenship as

related to differently situated community contexts. This comes with an attention to needs

and the understanding that values of care shift according to context, materials, local

politics, environment, and how these different elements relate to one another. Like the

feminist hacker collectives, library maker programs build up a different register that is

attuned to taking care, comforts, discomforts, and needs within their immediate

communities. While technologies are part of these care practices and communities, they

are just one part of the picture – and are shifted according to community needs and

capacities along with many different components that are considered along and together.

The push for maker programming in the public library system demonstrates

another multi-institutional approach within Maker Movement framing. Unfortunately, the

funding and dominant narratives in the Maker Movement out of which these programs

and spaces are derived are at their root technocentric. In the case of the DCPL Fab Lab, they are beginning to recognize the fact that the space attracts those from far outside the local community – entrepreneurs and small business owners interested in prototyping for their start-ups; hobbyists interested in making costumes in their downtime after work; academics hoping to use the 3D scanner to help preserve or make use of archaeological objects in new and exciting ways. Yet the majority of MLK's patrons are the homeless. They make great use of the Digital Commons computer lab, but rarely make their way up to the Fab Lab.

While it is easy to draw the comparison to the 3D printer as emergent technology and as leading this trend within library development, what is more relevant is the ability for library makerspaces to have flexibility regarding what they offer in fabrication spaces. 3D printers and expensive equipment, as Maker Jawn demonstrates, are not essential. Sustainability rests in the ability for a community to evolve and grow with and through these programs that sustain the practices of care already entangled in the accessibility, inclusion, and empowerment that libraries hope to cultivate. In other words, to give light to the alternative practices that libraries enact in contribution to a heterogenous narrative and in conversation with local instead of dominant discourse.

CHAPTER SIX: FIXING AND REPAIR COMMUNITIES

Introduction

Image 6. 1. Fixing session at Hack Manhattan.

The image above shows the well-lit hackerspace Hack Manhattan, where the New York

City (NYC) Fixers Collective meets once a month. It depicts a moment in time, on

February 24th, 2016, where some of the many different activities involved in a typical

fixing night (including conversation, collaboration, observation, soldering, careful

dissection, and documentation) were on display. A few weeks prior to this fixing session,

The Verge published an article about the group, with a focus on the Right to Repair

legislation and lobbying practices of which Fixers Collective members were part.[335] This

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[335] "Meet the Fixers Collective: The Geeks Who Are Fixing iPhones for Free," *The Verge*, February 22nd, 2016, accessed March 7th, 2017. http://www.theverge.com/2016/2/22/11051236/fixers-collective-iphone-repair-association-dmca.

resulted in an increase of exposure and subsequent interest by the public, making the fixing session pictured, which was two days later, one of the largest the Fixers Collective had seen yet.

Image 6.1, taken by the researcher, documents the involvement of non-regular or non-core members as a vital part of the Fixers Collective's activities. In the foreground of this image, a 14-year-old adolescent girl is seated with her back to the camera. She is helping to fix the iPhone of the woman to her left. Meanwhile, the paying member of HackManhattan who helps the Fixers Collective gain access to the space is kneeling to her right, helping, and observing her work. To the far left, a woman is working to fix a pair of binoculars that she brought, getting tips here and there from the fixers on hand. The 14-year-old's mother is standing behind the girl and conversing with a reporter.

While these participants keep the Fixers Collective practices vital, as does the rotating cast of objects in need of repair, the regular involvement of core members keeps these sessions running consistently. The variety of roles involved in the group speaks to the diversity of skill levels involved in fixing sessions, as well as the importance of volunteer labor. Hierarchical categorizations of importance still exist and help to structure these sessions, as organic as they may seem. Off camera near the reporter is Vincent, the main organizer and veritable face of the Fixers Collective who is also in the role of documentarian, his camera just barely in my shot. In the background to the left are three younger regulars – Dave, Isaiah, Rachel – who are all in their 30s and either bring in objects to repair or bring their own tools and knowledge-sets for fixing. Dave has been coming for four years; Isaiah is a new member, with this being one of his first sessions. Rachel is a long-time participant but her commitment is starting to taper off as she is

increasingly busy with other commitments. To their right in the background is another mainstay group of older men, the fixer regulars who are committed to coming every month and have backgrounds in electrical engineering, electrical appliance work, or a long-time personal interest in tinkering, repair, and fixing. The group includes Mike, who helped me to fix my lamp this same night, and Carl, who often gives brief informational talks about technology and repair. A longtime tinkerer, Carl's knack and interest in repair started with ham radio and homebrew computing.

This image is but one example of the busy, bustling energy that I have found quite demonstrative of these events and groups – and much like the other groups I have studied they have created a dynamic and social learning or knowledge exchange environment. Each event involves a lot of talking, sharing of ideas, and connecting socially via an often technology-based endeavor. Conversations revolve around food, politics, research, relatives, or travels. From what I have observed, and in hearing my interlocutors speak about the sharing of best practices, and the indoctrination of new fixers or participants, these repair groups have built *communities of practice*, through which to connect and share with one another in socially dynamic forms. In his theorization of "broken world thinking" through the lens of repair cultures, Steven Jackson describes the practice of Bangladeshi ship dismantling and recycling as "the site of a remarkable and distributed expertise."[336]

It may seem that broken ships are disconnected from fixing appliances, but when something is broken or inoperable, there is also an expertise associated with breaking it

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[336] Steven J. Jackson, "Rethinking Repair," in *Media Technologies: Essays on Communication, Materiality and Society*, Tarleton Gillespie, Pablo Boczkowski, and Kirsten Foot, eds. (Cambridge MA: MIT Press, 2014): 228.

down, scrapping it, or making it into new things. As Jackson observed, the knowledges, and the tools used to do so, are aggregate – an aspect of fixers and repair groups that I also observed consistently. Even within the downsized practices of repair groups distributed expertise is at the forefront of how fixes are handled. In this distribution is the need for social dynamics and mechanisms, revealing the socio-cultural dimensions of technology and its continued use that are often made invisible in the world of working and sustained technologies. Akin to the feminist hackers and library maker programming, within these repair groups efforts are collective and collaborative – not individualistic and competitive. Thus, they are another example of diverse alternative narratives in an alternative reading of maker cultures. By shedding light on the intricacies, timescales, social worlds, and non-continuous functioning of technologies, fixer and repair groups demonstrate a new way of theorizing and engaging technology – as well as its wastes, byproducts, and maintenance routines – something that Jackson calls a "standpoint epistemology of repair."[337] Much like feminist hacker collectives, and library makerspaces, they foreground a different positionality to technology and innovation – that of an ethics of care. But the care fixers exemplify, more so than the feminists and librarian spaces (although they too focus on this aspect of care), is that of maintaining and caring for objects. As part of the Fixers Collective mission statement reads, which is similarly aligned to Repair Café endeavors: "The goal of the Fixers Collective is to increase material literacy in our community by fostering an ethic of creative caring toward the objects in our lives."[338]

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[337] Jackson, "Rethinking Repair."
[338] "Fixers Collective," *Proteus Gowanus*, accessed January 7, 2017.
   http://www.proteusgowanus.org/proteus-gowanus-archive/fixers-collective/index.html.

The Rise of Repair Cafés and Fixers Collective

Many scholars have studied the issues of American consumer markets and cultures built upon getting the "next new thing" regardless of whether one's current devices are still functioning.[339] However, during and shortly after 2008 there was a fleeting pop cultural shift toward saving money, 'making do,' and getting crafty.[340] Low-cost craft sales rose during the Christmas season, Amy Sedaris published her parody of the whole situation "Crafting for Poor People," and the Fixers Collective was formed.[341] "Intentionally aligning itself with forces generated in reaction to the current economic crisis, the Fixers Collective promotes a counter-ethos that values functionality, simplicity, and ingenuity and that respects age, persistence, and adequacy."[342] While originally a one-off social experiment as part of the *Mend* show at the Brooklyn-based art gallery Proteus Gowanus, they continued practices due to popular demand. As part of a DIY movement tied into the Maker Movement that was also gaining popularity around this time, their intentions and practices were different than typical DIY or fabrication groups by focusing on repair. While repair practices have gained a more popular or commercial audience in the US over the past ten years, many have been happening on the margins for quite some time in working-class neighborhoods or communities. For these populations, this is nothing new,

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[339] Giles Slade, *Made to Break: Technology and Obsolescence in America*, (Cambridge: Harvard University Press, 2009).

[340] It can, and is argued, that such a shift was also market-driven as big craft stores such as Michaels and Jo-Ann's pushed their own products – profiting off a general interest in saving a bit of money. See: Doreen Jakob; Crafting your way out of the recession? New craft entrepreneurs and the global economic downturn. *Cambridge J Regions Econ Soc* 2013; 6 (1): 127-140.

[341] Claire Cain Miller, "For Craft Sales, the Recession Is a Help," *The New York Times*, December 22, 2008. http://www.nytimes.com/2008/12/23/business/23craft.html.; Dan Fastenberg, "Amy Sedaris on Why Arts and Crafts Are Recession-Friendly," *Time*, November 2, 2010, accessed May 3rd, 2017. http://content.time.com/time/magazine/article/0,9171,2029469,00.html.

[342] "Fixers Collective | Proteus Gowanus." Accessed January 7, 2017. http://www.proteusgowanus.org/proteus-gowanus-archive/fixers-collective/index.html.

but just a way of life. The same goes for many non-Western contexts, such as the informal economy of scraping and repair in Western African nations, like the scrap sites Suame Magazine and Agbogbloshie in Accra, Ghana as well as the bricolage, repair, and small-scale production.[343]

The Fixers Collective is not the only repair and fixing group in the United States. iFixit has a strong online community and runs intermittent events, while Patagonia company has repair sessions throughout New York City.[344] On the West coast and in the Midwest respectively, FixIt Clinics, Repair PDX, and Swap-o-Rama events are organized for exchanging and mending clothes, electronics, and other items.[345] Within the past eight years there has been a resurgence in the promotion of fixing and repairing objects, workshops, as well as increased discourse. This is also reflected in the world-wide (although Euro and Western-centric) founding of the Repair Café Foundation in 2009, nodes of which I have researched and will describe further.[346] It is possible that this demand for repair groups and sessions in some way reflects the decline of neighborhood repair shops. In their absence, volunteer-run repair and fixing events may be popular since there is nowhere else to regularly fix devices. But it also speaks to a different need,

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[343] Anna Waldman-Brown et al., "Innovation and Stagnation Among Ghana's Technical Artisans." Paper presented at the *22nd Conference for the International Association of Management of Technology (IAMOT)*, Porto Alegre, Brazil, April 14-18, 2013.; Ron Eglash and Ellen Foster, "On the Politics of Generative Justice: African Traditions and Maker Communities," in *What Do Science, Technology, and Innovation Mean from Africa?,* edited by Clapperton Mavhunga (Cambridge: MIT Press, Forthcoming 2017).

[344] https://www.ifixit.com/; "Worn Wear Spring 2015 Tour" Patagonia Blog. April 2 2015. http://www.patagonia.com/blog/2015/04/worn-wear-spring-2015-tour-free-clothing-repairs-and-more/;

[345] http://fixitclinic.blogspot.de/p/bring-your-broken-non-functioning.html; http://repairpdx.org/; Swap-o-rama is a name and group identified by an interlocutor within my library makerspace field sites. I am currently working on finding other basis for their mention.

[346] As described in the introduction, the Repair Café Foundation was first started in the Netherlands in 2009. Much like Makerspaces, it is a collection of independently and privately run groups that do not necessarily need to report to the head agency. On their website, they tell visitors to find a Repair Café near them – and if there isn't one to start their own.

desire, and mindset within its participants, as the repairs are a collective effort instead of an individualistic or commercialistic endeavor and the events are socially-driven and participatory.

While at first glance the discourse and rhetoric of today's fixing, repair, or Maker Movement interest in fixing might seem to gloss over the rich and deep cultural narratives that have previously enabled these practices, things are not so simple. In the context of some Repair Cafés and within the Fixers Collective, they work to make alliances with repair practices already present in the community. Many of the fixers involved in these groups are older tinkerers and repair enthusiasts who have already been working in this realm for decades. Repair and fixing groups also tap into communities that have been mending or seeking out repair businesses for the same amount of time. Questions might also arise as to whether the offer of volunteer labor for repair takes business away from shops still struggling to survive in the Digital Millennium Copyright Act (DMCA), which has made it difficult for smaller businesses to obtain legal rights to schematics for repairing electronics. However, the Fixers Collective and Repair Cafés do not think this is the case, as they do not meet so often, and they direct participants who need more intricate repairs to local community businesses. They also tell attendees about locally-run parts stores for getting supplies to finalize a fix. In this way, they hope to create symbiosis instead of competition. As one organizer of the Graz Repair Café explained, he informs attendees about a business in the community for purchasing parts, often handing out their business cards at events. In turn, the business gives these individuals a discount when they indicate that the Repair Café has sent them. This demonstrates that there is room for partnering between businesses and volunteer-based

repair groups in order to change the systemic narrative and intertwined industrial

practices or toward at least keeping alternative pathways open for different publics to

traverse.

Repair and fixing groups as well as online knowledge-sharing communities such

as iFixit appear to have an increasing role to play as public and corporate interests take

note of their practices. In my research, I have also noted an increased recognition for

repair on the margins within scholarship, in the face of a decline in repair businesses in

Western countries.[347] Some precursors that have laid the groundwork for these scholarly

and discursive interests include Mierle Ukeles' work on maintenance in the art world,

Julian E. Orr's work on Xerox copy machine repair, Susan Leigh Star's call for

ethnographies of infrastructure, and many other historical narratives of automotive repair

and ham radio hobbyist cultures.[348] These research endeavors highlight how possible

precarity or uncertainty within such systems are made to be invisible until something

goes wrong, gets dirty, or breaks. As related earlier, Jackson's work into "broken world

thinking" calls for a focus on these moments to reveal the humanistic and social elements

of technology that are always already there, regardless of focal points. He calls for deeper

scholarly exploration of a repair standpoint epistemology for new inroads into analysis

and critiques of technology and the effects and powers that the socio-material world

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[347] Daniela K. Rosner, "Making citizens, reassembling devices: on gender and the development of contemporary public sites of repair in Northern California," *Public Culture* 26, 1 (2014): 51–77.; Steven J. Jackson, "Rethinking Repair."; Lara Houston, "Inventive Infrastructure: An Exploration of Mobile Phone Repair Practices in Downtown Kampala, Uganda" (PhD diss., Lancaster University, 2015).; Rosner and Turner "Theaters of Alternative Industry." ; The Maintainers Conference, Stevens Institute, Hoboken, NJ.

[348] Mierle Laderman Ukeles, "Maintenance Manifesto," in *Feminist Art Manifestos: An Anthology*, edited by Katy Deepwell (KT press, 2014).; Julian Orr. *Talking About Machines: An ethnography of a modern job.* (Ithaca: Cornell University Press, 1996).; Susain Leigh Star, "The Ethnography of Infrastructure," *American Behavioral Scientist* 43 no. 3 (1999): 377–391.

holds. By engaging a marginalized standpoint that often gets steamrolled by dominant

technology-based cultures which focus on innovation in relation to fabrication, fixing and

repair groups have a similar stance to that of feminist hacker groups in wanting to create

alternative inroads to technology use and development. They are further interconnected

due to their interest in care.

In this chapter, I will demonstrate how fixers focus on building communities of

practice and awareness around the issue of e-waste and planned obsolescence. This

enables fixing and repair groups to actively and successfully indoctrinate one-time

visitors and stabilize a long-term member-base. Through examination of their practices, I

continue to query the roles that accessibility, inclusion, and empowerment play, and how

these groups may be set apart from or embedded within dominant maker rhetoric. I am

interested in the social spaces and cultures opening up around these repair and fixing

practices. I am of Jackson's mindset – that by examining cultures at the point of

technology breakdown, particularly micro-interactions in my case, scholarship might

reveal social dynamics which narratives of innovation and fabrication often erase. His

call for a standpoint epistemology of repair brings the technological and the social more

closely together – and works to reveal their entanglements. Through breakdown, the

social dynamics often made invisible by smooth, working technologies are exposed.

> Thus, a standpoint epistemology of repair may offer a different response to
> the longstanding problem of commodity fetishism, by which the meaning
> and politics of technology are obscured, stripped, and neutered, and the
> fiction of separate "social" and "technological" worlds is produced.[349]

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[349] Jackson, "Rethinking Repair," 230.

Both within and without the greater cultural, and ideological, framings of maker cultures, many self-identified fixers see themselves as a subsect of the Maker Movement, and their practices as a route toward cultural transformation and awareness and becoming better fabricators.[350]

The standpoint epistemology of repair demands that "in moments of breakdown [...] we learn to see and engage our technologies in new and sometimes surprising ways."[351] Taking this into account, I am concerned with the shifts that fixers wish to enact, with a recognition that they are in turn shaped by said waste and fixing practices. These (re)-users and fixers of obsolete and broken devices are not only dedicated to the idea of recycling. They are also invested in remaking how societies deal with e-waste as well as consumer electronics production and innovation practices. They hope to scale up their micro-interactions to influence macro-level institutional practices. Through analysis of how their practices do or do not succeed in subverting consumerism and reconceptualizing obsolete or broken objects, the research of this case study also engages scholarship that critically examines consumerism, waste, material flows, and the cultural practices therein.

Scholarship that focuses on consumption from an anthropological and sociological angle has matured in the past decade, complicating simple consumer culture narratives that characterize users as non-agential and easily manipulated. According to David Miller, the relationship between self and stuff is not unidirectional.[352] Instead, it is a multi-faceted dynamic of constant conversation, and thus an ongoing process of

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[350] This is something I observed in the field, and which Turner and Rosner talk about in "Theaters of Alternative Industry."
[351] Jackson, "Rethinking Repair," 230.
[352] Daniel Miller, *Stuff* (Cambridge: Polity Press, 2010).

becoming. For him and various other theorists, understandings of consumption and mass

consumer culture shift away from the dismissive toward nuanced critiques that highlight

end-user agency and actions. David Graeber problematizes the 'consumption' descriptor

altogether.[353] He relates that what is happening today in the realm of DIY, appropriation

of technology, and fan culture remixing, can no longer be labelled as 'consumption.' It is

something different altogether. As Miller relates in *Acknowledging Consumption*,

> […] the new regimes of leisure have allowed a massive democratization of
> production as most people have increased opportunities to be creative with
> respect to some form of labour which previously was dominated by services.
> Whether this labour is in car-care, cake decoration, do-it-yourself or hobbies,
> there has arisen a plethora of pursuits in which people buy small-scale
> production facilities (e.g. beer-making equipment) and from that point take
> over those production activities with which they choose to be involved. [...]
> The point being of course that consumption, so far from being opposed to
> production, increasingly involves production at those points when the
> consumer prefers to be involved in creative labour.[354]

Meanwhile, Colin Campbell notes the difficulty of synthesizing one definition of

consumption due to the many authors populating the sociology and anthropology of its

realms.[355] He thus defines consumption broadly as "[…] the selection, purchase, use,

maintenance, repair and disposal of any product or service."[356] As Campbell further

relates, a focus on the disposal, reuse, and maintenance of objects is sorely lacking in

theorization and research within sociology. In working to define 'waste' in other written

work, I have pointed out how scholars are starting to focus on the cultural and material

conceptualizations of 'waste' to counter or align with a focus on consumption and

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[353] David Graeber, "Consumption," *Current Anthropology,* 52 no. 4 (2011): 489 – 511.

[354] Daniel Miller, "Introduction," in *Acknowledging Consumption: A Review of New Studies,* edited by
Daniel Miller (New York: Routledge, 1995): 24.

[355] Colin Campbell, "The Desire for the New: Its Nature and Social Location as Presented in Theories of
Fashion and Modern Consumerism," in *Consuming Technologies: Media and Information in Domestic
Spaces*, edited by R. Silverstone and E. Hirsch (London: Routledge, 1992).

[356] Ibid, 100.

production. This work includes analyses of nuclear waste storage and disposal, food waste regimes and infrastructure, household recycling, as well as e-waste.[357]

The mechanisms, paths, and infrastructure of e-waste transport are often made to be invisible. Yet, its effects are quite stark in countries and marginalized communities that deal with the repercussions of e-waste daily. This process and the repair and scraping cultures surrounding it are examined by an increasing body of scholarship including Houston, Jackson et al., Eglash and Foster, Waldman-Brown et al., and Jenna Burrell.[358] In 2012 alone, the US Environmental Protection Agency estimated that 20 to 50 million tons of e-waste were generated worldwide.[359] While some consumer electronics are truly broken beyond repair or worn out, most of these objects flow into scrapyards and waste repositories due to 'planned obsolescence.' Planned obsolescence is defined here as the built-in mechanism for material goods to degrade, go out of style, or quickly become unusable. Often the tendency to fail, break, or become incompatible with new software is built into electronic systems. This is particularly illustrated by Apple's ruthless upgrades and obscuration of how to fix their technology, as well as voided warranties when a user attempts to fix an item themselves or through a non-certified repair shop.

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[357] Pedro De la Torre III, 'An Unsettled Future', *Inheriting Hanford Blog,* 31 May 2015, accessed 14 January 2016. http://inheritinghanfordblog.com/2015/05/31/an-unsettled-future/; Gille Zsuzsa, "From risk to waste."; Guy Schaffer, "Discard Studies Compendium," *Discard Studies*, June 25, 2014, amccessed August 15th, 2017, https://discardstudies.com/discard-studies-compendium/.; Giles Slade, *Made to Break: Technology and Obsolescence in America* (Cambridge, MA, USA: Harvard University Press, 2006).

[358] Houston "Inventive Infrastructure."; Steven J. Jackson, Syed Ishtiaque Ahmed, and Md Rashidujjaman Rifat, "Learning, innovation, and sustainability among mobile phone repairers in Dhaka, Bangladesh," In *Proceedings of the 2014 conference on Designing interactive systems*. 905–914 (New York: ACM Press, 2014).; Eglash and Foster, "On the Politics of Generative Justice."; Waldman-Brown et al., "Innovation and Stagnation."; Jenna Burrell, *Invisible Users: Youth in the Internet Cafes of Urban Ghana* (Cambridge: MIT Press, 2012).

[359] US EPA, "Municipal Solid Waste Generation, Recycling and Disposal in the United States; Tables and figures for 2012," Feb 2014, tables 12 – 14.

In a culture of waste-making, Packard theorized planned obsolescence as a manufacturing endeavor initiated by companies to increase demand and sell more products.[360] Instead of being built to last, Packard surmised, products were being built to break or go out of style. Planned obsolescence becomes a complex sociotechnical problem, with the resulting e-waste instantiating a 'wicked problem.'[361] Currently, "planned obsolescence is the catch-all phrase used to describe the assortment of techniques used to artificially limit the durability of a manufactured good in order to stimulate repetitive consumption."[362] Giles Slade argues that consumers are much to blame in this scenario. Yet he also identifies them as having the agency and the ability to engage these issues by acquiring technological literacy or informed consciousness in dealing with e-waste. Fixer and repair groups hope to help in this shift of focus toward not only a transformation of production practices, but on reuse, recycle, and repair strategies that users themselves can enact.

Fixers Collective and Repair Café members who are interested in e-waste reclamation hope to instantiate change by challenging consumers to see the recourse of their action or inaction. To do this, they are creating small community groups to raise local awareness. At the same time, they are joining their own voices with other advocacy groups for the change of manufacturing and repair policy. By instigating awareness practices, repair and fixing groups are constituting a public that grapples directly with the

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[360] Vance Packard, *The Waste Makers* (Brooklyn: Ig Publishing, 1960).

[361] 'Wicked problems' were first theorized by C. West Churchman in his 1967 work: Churchman, C. West (December 1967). "Wicked Problems," *Management Science* 14, no. 4 (December 1967). Here, I am interested in more recent instantiations of this term in relation to e-waste and waste issues – particularly the work of Max Liboiron regarding oceanic plastics waste and subsequently Guy Schaffer in relation to food wastes.

[362] Slade, *Made to Break*, 5.

material repercussions of e-waste.[363] Particularly, they deal with e-wastes caused by institutionalized planned obsolescence and barriers to repair. In taking care of objects or reconstituting defunct technology for new use, groups engaged in waste reclamation demonstrate that throwing e-waste 'away' has but a delayed repercussion. Consumer norms in countries like the United States allow for a separation from cycles of production and destruction – an unsustainable practice that already has dire consequences for many communities and, Slade argues, will have worsening effects if such practices continue.[364] Putting maintenance work and reclamation practices more fully on display through public meet-ups, workshops and websites, fixers demonstrate the importance of repair and care. They pull maintenance work from the margins into the focus of technology-based sustainability in the Western world.

An increased interest in repair within the US is also demonstrated by the push for legislation in states such as Massachusetts, Oregon, and New York to support fair repair to ensure that smaller repair businesses and consumers have access to specs and parts so that they can fix devices themselves. In the realm of policy change, US repair groups are collaborating to create the Repair Association, of which the Fixers' Collective is part. On their website, *repair.org*, the Repair Association states that it "advocates nationally for a competitive repair market, as well as improvements to the quality and longevity of products." This includes lobbying to pass state and federal legislation that support informal and after-use repair since "repair, resale, and reuse keep equipment in service and out of the waste stream." One of the first acts of legislation, colloquially known as the "Fair Repair Law," was defeated by corporate interests in July 2016 and never made

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[363] DiSalvo, "Design and the Construction of Publics."
[364] Slade *Made to Break.*

it to the floor for decision in New York State. But the Repair Association continued their advocacy work and, at the time of this study, was gearing up for the next legislative cycle in 2017.

Their practices have been gaining scholarly as well as public press attention, such as in online journals like *The Verge*, but also through scholarship like Jackson's theorizations and outlining of broken world thinking as a way to engage "the nature of technology and its relationship to broader social worlds."[365] As he himself argues, by bringing maintenance work into the limelight, such practices "may hold up a clear and revealing light to relations of value and order that are sometimes made invisible under the smooth functioning of complex sociotechnical systems."[366] Daniela K. Rosner writes about repair narratives from a gender-inflected critique – taking on the implicit biases of what counts as repair versus mending, which practices get taken on more than others, as well as the subject formation therein.[367] Meanwhile Lara Houston, who is part of Jackson's and Rosner's repair thinking group, explores fixing and repair in marginalized communities in the global south.[368]

In this chapter, I focus on the skill-sharing practices, micro-interactions, and the social engagement narratives that play out during sessions, and which are reflected upon during interviews and through examination of collective care practices. I am interested in explicating how fixers hope to enable cultural shifts on many levels, how they reveal the

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[365] Jackson, "Rethinking Repair," 221.
[366] Jackson, "Rethinking Repair," 230-31.
[367] Rosner, "Making Citizens."
[368] Lara Houston, "Inventive Infrastructures: An Exploration of Mobile Phone 'Repair' Cultures in Kampala, Uganda." PhD diss., Lancaster University, 2013.

humanistic, social, and agential dynamics of technology through an attention to care, and how their tactics play out in practice.

Field Site One: NYC Fixers Collectives

The Fixers Collective based in New York City is explicitly interested in using the DIT or DIY ethics and skill-sharing practices of maker cultures to change mindsets around excessive technology consumption and acquisition. From the Proteus Gowanus website, where the group was originally based:

> The goal of the Fixers Collective is to increase material literacy in our community by fostering an ethic of creative caring toward the objects in our lives. The Fixers Collective seeks to displace cultural patterns that alienate us from our things, by collectively learning the skills and patience necessary to care for them.[369]

The Fixers Collective developed from a one-time art installation in 2008 at the Proteus Gowanus gallery in New York City. They garnered so much interest and felt so strongly about the implication of their work, that they began weekly meet-ups, instigating events at Proteus Gowanus as well as at nearby hackerspaces such as Hack Manhattan. Once Proteus Gowanus shut down operations, they fully migrated to Hack Manhattan. They are also involved in the Maker Movement, showing up to various large and small Maker Faires, and are featured in publications such as *Wired* and *Make: Magazine*.

I first came across the NYC Fixers Collective at the NYC World Maker Faire in June of 2013. The group's set-up impressed me. Whereas all the other booths were geared toward displaying new innovations, cool gadgets, fun hacks, or projects involving mainly new materials, the Fixers Collective set-up was focused on fixing the broken

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[369] Proteus Gowanus, "Projects in Residence," 2011, accessed 10 February 2015. www.proteusgowanus.org/fixers-collective/.

artefacts of visitors. Not only was the repair group interested in performing a service, but they were invested in imparting skills, making tools available, and giving others a sense of technological literacy. The Fixers Collective also made available their Fixipendence, which was derived from the Fixers Collective Code of Conduct written by David Mahfouda (one of the co-founders of the Fixers Collective) and possibly others. The document relates their passion and commitment to fixing and battling the increasing problem of planned obsolescence in the electronics industry – by focusing on a value of care instead of consumption. It also demonstrates humility in admitting the inability to fix everything and highlights the service component of repair groups to share knowledge with others.
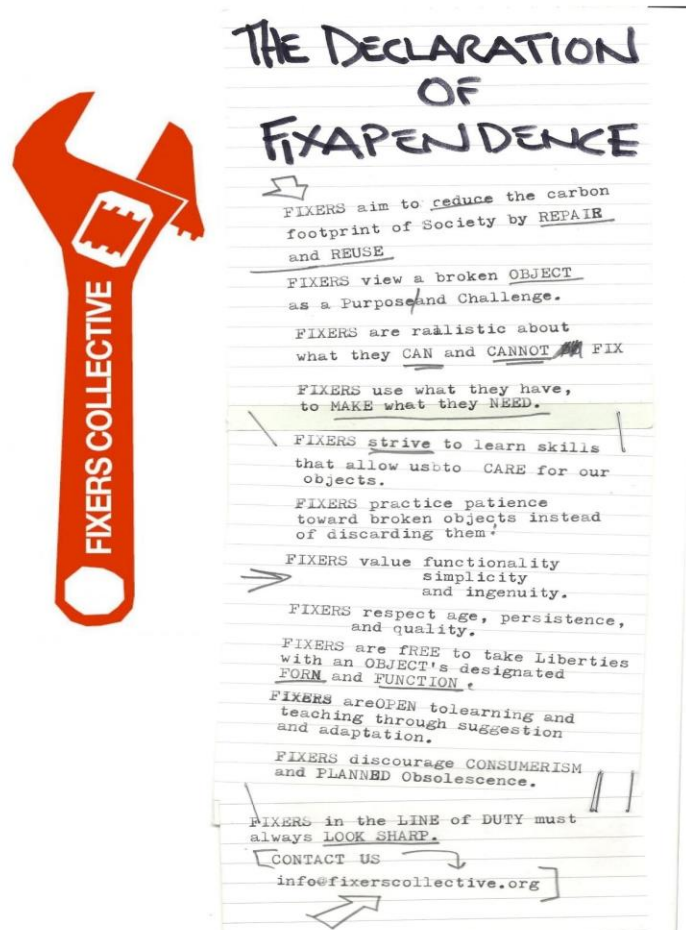
Image 6. 2. Fixer Manifesto.[370]

Various fixing and repair groups in the US have partnered with hackerspaces and the Maker Movement to allocate resources, build up awareness, and help provide access to tools for repairs. This has become increasingly important as the Maker Movement starts to create greater inroads for shifting public education policy and public community services, as cited earlier.[371] Thus, members of the Fixers Collective are interested in the Maker Movement due to this potential to engage public participation and awareness –

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[370] Image used by permission of Vincent Lai.

[371] The White House initiated its first Maker Faire in June of 2014. Meanwhile an increasing number of US public libraries and schools are starting their own makerspaces through the Maker Ed Initiative, reallocation of funds, and other small grants.

particularly in relation to sustainable technology development as well as fixing, reuse, and sustainable e-waste recycling practices. The Fixers Collective demonstrates the possibility for different methodological practices and forms of public engagement to transform mindsets – whether through conversation about repair or through hands-on doing, learning, and facilitation. In Nina Eliasoph's theorization of "Making a Fragile Public," she describes the different roles, faces, discussions, and utterances that people will make in public spaces – and how democracy or publics are made via interaction, or cramped through lack of open-ended public-spirited conversations.[372] For the Fixers Collective, the public is made not only through discussion and a sharing of values or ideas, but by physically instantiating those views through repair and reflective action. The way the Fixers Collective makes a public also changes from one context to the next in relation to the built environment and how they are received by the greater public, the types of fixing practices used, the kinds of objects brought, who participates, who *wants* to, and who feels *comfortable* doing so.

Since Maker Faire, I have seen the Fixers Collective appear in several locations, and in the summer of 2015, I attended one of their fixing events at the Brooklyn Public Library. As part of the annual Skillshare hosted by the Brooklyn Library Information Commons, the Fixers Collective held a session for several hours. The Skillshare event also included sessions about bike repair, break dancing, cryptography, and zine-making. For the fixing session, I brought two pair of broken ear-bud headphones, hoping to make one usable set. It was a success, and in the process, I learned how best to solder very fine wires, relearned how to tin the tip of a soldering iron, and how to seal connections with

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[372] Nina Eliasoph, "Making a Fragile Public: A Talk-Centered Study of Citizenship and Power," *Sociological Theory,* Vol. 14, No. 3 (1996), 262-289.

shrink-wrap rubber – a practice I had never been exposed to in my five years of soldering. The Fixers Collective members were patient and committed to the practice of teaching instead of running the session as a non-participatory service. They continually praised participants for engaging circuitry and soldering practices. The fixers also took on simple questions, helping interested participants to open up and confidently explore the 'black-boxes' which they had brought.
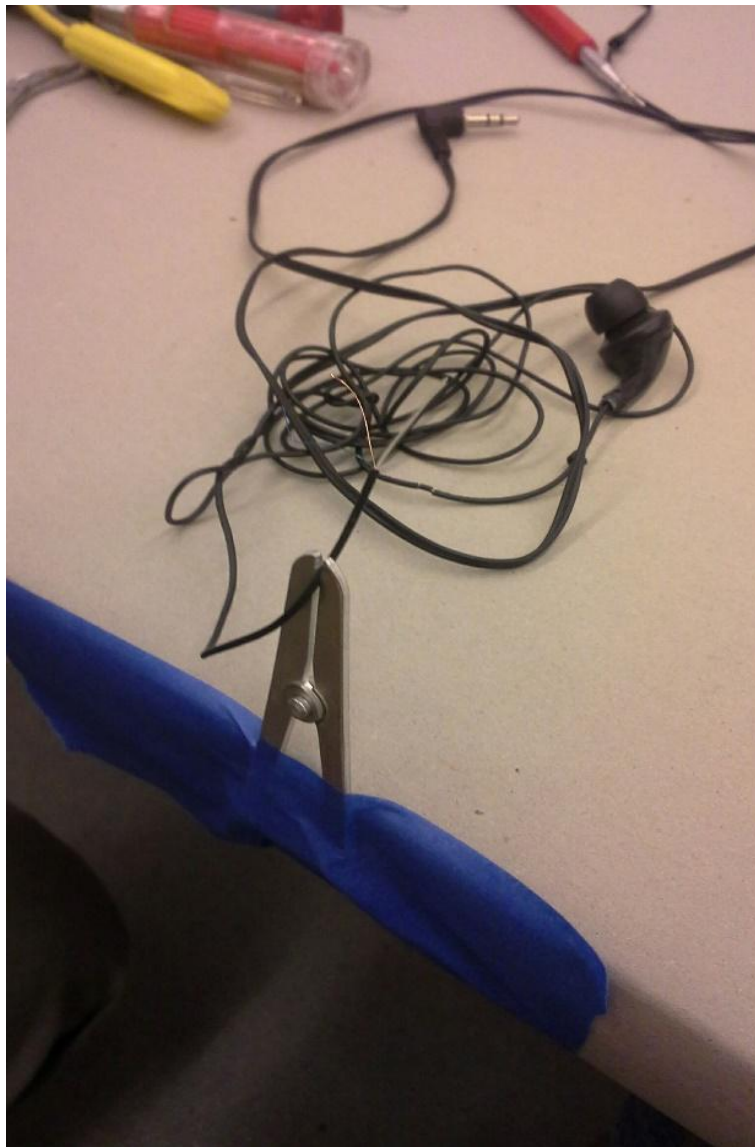

Image 6. 3. The author's guided repair of headphones. Note appropriation of wire cutters used as holders.

During the event, one of the main organizers, Vincent, worked to replace a chip in a mobile phone, which was achieved quickly and effortlessly. He continued to talk about his practice while completing the task. By socializing instead of receding from the group during the task, he helped to build a sense of community with participants and the other fixers. This kind of public-spirited engagement during action or object engagement demonstrates the multi-dimensional engagements and dynamics at play within these sessions. There was also work done to tie this session to other aspects of daily life and the social world – to give the practices context.

Important yet simple wisdom for electronics repair was shared throughout the session, in easily understandable ways. Meanwhile, participants shared stories about why their device is important, or where it is from. Their acknowledgement of their own experience, understanding, and responsibility to the object demonstrates a different, more locally-based, and hands-on form, of Marres' concept of material participation. Local knowledge about aspects of repair cultures in the area were also shared, demonstrating that such sessions involved more than the sharing of technical practice. When someone mentioned off-hand that RadioShack was a business where a participant can go for spare parts, the room erupted into a lively discussion about the company going bankrupt, their history, and other parts stores long-gone or still around. One fixer related that in troubleshooting broken technology, an individual should always try the least invasive action first. If your headphone jack seems broken, clean it out with a Q-tip and give it some much needed attention. It may turn out that easily removable dirt is in the way of full contact between the jack and headphones plug. These maintenance-based

knowledges were not downplayed, but recognized as important and object-saving

practices that were too often overlooked or unknown.

The work of the Fixers Collective is well-aligned with Alaimo's "trans-

corporeality" concept, as caring for the objects becomes about caring for oneself, caring

for the environment, and caring for the system to which material cultures are

connected.[373] Through trans-corporeality, barriers between dialectical pairs are shown to

be permeable, necessitating a blend between material and discursive, natural and cultural,

biological and textual territories. These connections, and breaking of boundaries

previously considered concrete, demonstrate that our views of a dialectical world are not

so descriptive of the sociotechnical world at large. Alaimo examines how various models

of trans-corporeality are emerging not only within scholarship and theory but also in

popular culture, literary texts, and social practices. Her "[…] intention is not to conjure

up a new theory so much as to work across separate fields, forging connections and

suggesting ethical and political perspectives."[374] Through the social practice of fixing and

repair, participants are made to acknowledge their own material participation in a

consumer culture and examine their commitment different care practices with different

relations of power.[375] This can lead to rethinking their roles as users, consumers,

producers, and fixers connected to their material objects in a more entangled and complex

way.

People of all ages and types came to have repairs done. Members of the Fixers

Collective tended to be on the older end of the spectrum, although a few younger men

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[373] Alaimo. *Bodily Natures.*
[374] Ibid, 3.
[375] Marres. *Material Participation.*

take part who come from backgrounds in IT, electrical engineering, or other technical fields. In the scene I opened with, the newest fixer was a fourteen-year-old girl – who was very excited to share her knowledge. The meeting of old and new perspectives on technology, which often reflects a difference in class, as well as the meeting of different types of knowledge systems such as technical, organizational, social, and so forth, demonstrates that these events and communities are what Mary Louise Pratt calls "contact zones." Pratt explicitly acknowledges and theorizes "contact zones" as negotiations of power and uses the term "to refer to social spaces where cultures meet, clash, and grapple with each other, often in contexts of highly asymmetrical relations of power."[376] In the next section, I introduce Repair Cafés as the second case study of repair groups. I then go through the different ways in which both groups engaged accessibility, inclusion, and empowerment.

Field Site Two: Repair Cafés (Vienna and Graz, Austria)

Repair Cafés, which were started independently from Fixers Collectives by Martine Postma in the Netherlands, have exploded in popularity across the European continent since being founded in 2009.[377] Although the establishment of Fixers Collectives and Repair Cafés occurred separate of one another, both groups have a similar ethos, set of practices, and stances on issues of planned obsolescence and material literacy. Like Fixers Collectives, Repair Cafés are geared toward fixing an object, as well as imparting skills to the owner and care-taker of said object. The mindsets and goals of widespread

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[376] Mary Louise Pratt, "The Arts of the Contact Zone," *Profession* (1991), 34.
[377] https://repaircafe.org/en/about/.

Repair Cafés have been explored in a survey run by Charter and Keiller, which also studies the common practices of European hackerspaces:

> Findings suggest that volunteers at Repair Cafés are most strongly motivated to take part because of what they can do for others, namely their desire to help others live more sustainably, to provide a valuable service to the community and to help improve product reparability and longevity. Increasing product longevity is one of the central considerations of Circular Economy thinking and one which the newly emergent Fixer movement clearly supports.[378]

One thing to note is the naming of a 'Fixers movement' which Charter and Keiller's article names explicitly, and which some of my interlocutors have also used in talking about their groups and practices. In some ways it is connected to, yet different from the Maker Movement, in what I have observed, and in how members of fixing and repair groups talk about their activities as well. Importantly, those involved in Fixers Collectives and Repair Cafés also make the tools available and accessible to a wide range of people interested in their practices. The vast number of Repair Cafés, over 1100 worldwide, speaks to the need, interest, and importance surrounding these reparative practices, particularly among environmentally-conscious European countries in which most Repair Cafés reside.[379]

The micro-tactics of technology waste reclamation might not do much in terms of downsizing the overwhelming waste problem. The co-founder of the Graz Repair Café directly addressed this. He related:

> In my personal opinion, it's more mindset or a social impact. […] In the three years we have existed, we had 1,200 repairs with a 60-70 percent success rate per item. So, 700 fixed things – which is just a bit short of what one shop sells. So it doesn't make any dent in the economic stuff. But people become aware of what the things are worth in relation to time, effort, and resources. And maybe in a year knowledge spreads. People become more

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[378] Charter and Keiller, "Grassroots Innovation," 1.
[379] https://repaircafe.org/en/about.

aware of how to use things – how to save the environment and share this knowledge themselves.[380]

Other fixers and Repair Café volunteers I spoke to agreed with this sentiment – that the real interventions they hoped for were cultural shifts and individual transformations – which included the push for advocacy and legislation. Like the Fixers Collective's involvement in the Fair Use bill legislation, Repair Cafés also gave their support to initiatives in the European Union that advocated for Circular Economy standards to replace linear economic practices, which currently downplay the need for the recovery of post-consumption waste. According to the Repair Café website:

> The European Commission must strive to switch to a circular economy next year. This is what 27 European organisations, including the Repair Café Foundation, wrote in an open letter to the President of the European Commission, Jean-Claude Juncker.[381]

In response to this call from the Repair Café Foundation, among myriad others, in early December 2015 the European Commission announced its adoption of a Circular Economy Package. By initializing a two-pronged approach, from below and from above, efficacy appeared more within reach. Although participants running Repair Cafés factored into the struggle for a Circular Economy, in some ways they were one step beyond. They were working to rethink broken objects after the design and planning stage, giving them a new life post-market and post-consumption. Thus, like the Fixers Collective, Repair Café participants hoped to divert some of the need for larger infrastructure and mechanisms for waste recovery and recycling via practices of upcycling and care.

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[380] A, interview by author, Spektral, Graz, Austria, November 28th, 2016.
[381] https://repaircafe.org/en/about.

Each Repair Café, like makerspaces or hackerspaces, is reflective of and affected by the community in which it exists. For deeper examination of the Repair Café organizational structure and community instantiation, I researched two while living in Graz, Austria – one in Vienna run out of the community-run gallery space Laer and one in Graz run out of the community-run, screen-printing, and metal-working studio Traumwerk. Traumwerk was housed in the cellar of a building, underneath the community center Spektral, and had a large amount of workspace and communal tools to use for repairs. This Repair Café was started by two friends, one of which moved out of Graz, and so was now run primarily by Alex with help from a large number of volunteer fixers. One main fixer, Kristoph, started the Viennese Repair Café and primarily organized their events – although they continued to meet in his absence. Their workspace was small and they used a self-built tool cart to move in and out of backroom storage for each weekly session. All the fixers knew each other and they promoted their meetings via fliers and social media accounts. The Viennese group was more connected to the Repair Café Foundation – demonstrated through their use of their website and official forms for documenting the objects fixed and for taking down demographics of attendees. The culture in Austria and interest in repair was certainly different than in the US. It was more a way of life, which was also reflected by the long and deeply entrenched biking and bike repair culture in Austria, particularly Graz.

In these final two case studies, I analyze the politics of care involved in their practices and organizational dynamics. This was done while keeping in mind that their attention to care did not replace the technical with the more humanistic, but was instead caught up in the bounds of the technical. Even though the fixer groups were similarly

sensitized to values of care in relation to and with technologies, the tactics they employed to enable accessibility, inclusion, and empowerment were very different than both the feminist hacker collectives and library maker programs. Fixing and repair groups focused on the post-consumption stage of technical practice, and thus cultivated a specific community of practice centered on an epistemology of repair and care. Even more so than the other two case studies, they enacted care practices that were an entanglement of relations between environment, people, objects, tools, animals, and organizations.

Accessibility

As with the library makerspaces and the feminist hacker collectives, many different dimensions of accessibility were addressed, or neglected, in fixing and repair groups. More broadly these can be categorized as physical, cultural, social, organizational, and technological. All are tied to different forms and dimensions of comfort for diverse types of people, networks, and things – and often reveal the politics of care and power relations involved in deciding which forms of accessibility are of import. While both the Graz Repair Café and Fixers Collective strove to create a dynamic where all felt welcome, there were some dimensions of accessibility that were not addressed due to infrastructural factors and sometimes the overarching focus of their work. Yet in the patterns of how to accomplish and grapple with accessibility, they also had diverse ways of enacting it, some of which could be put into dialogue with practices used by feminist hacker collectives. Most of the data for this section came from firsthand observations during various site visits and my own involvement with these groups. Some issues were then tied across with topics that came up in interview.

On a mild and wet night in February of 2016, the Fixers Collective gathered at one of their regular meeting spots, the hackerspace Hack Manhattan. After a long drive from Troy, New York to New York City, I was pleasantly surprised to find easy on-street parking across the street. Stepping up to the inconspicuous Hack Manhattan door, I looked for the name of the space listed next to floors and buzzer numbers. It was clear that the people who were going to show up were already well-aware of the event happening inside either via social media, the established newsletter, or word of mouth. After being buzzed in, I stopped at the second floor where both Baby Castles and Hack Manhattan are located hoping I was in the right space, and finding a few signs pointing in the right direction. I was a little early, 6:40 pm for the 7:00 pm session, and I cautiously worked my way down the narrow hallway that connects the two different spaces.

Image 6. 4. Hallway to Hack Manhattan.

Going toward the Hack Manhattan side, this opened up to a room with a big table in the

middle, while tools, projects, and computers were tucked away into various corners.

Image 6. 5. Shelves and materials at Hack Manhattan.

To the right, more tables were set up with 3D printers and soldering stations – and I later found a bathroom further on. Around the corner a little bit to the left, was a small metal and wood-working shop. It was a cluttered space, but from my personal experience the clutter did not detract from accessibility issues. It felt welcoming with a pleasant, casual, and non-intimidating atmosphere.

Later, I noted that the event was attended by newcomers, people curious after reading the article about the Fixers on *The Verge*, committed fixers, and interested researchers and reporters. No one off the street would guess what kinds of activities might be going on inside the hackerspace, or even that there was a hackerspace on the second floor of this building. This experience was in opposition to the fixing session I observed at the Brooklyn Main Library branch, where a decent number of bystanders

stopped by to see what was happening. To invite people into the Skillshare event, a bike

repair group had been set-up in front of the library, right at the top of the steps leading to

the entryway. Although this was not an explicit invitation to the Fixers Collective

session, it implied that there was more of the same inside.

Vincent mentioned to me that he liked moments of this kind, and often hoped to

create what he called "cross-pollination" between groups or the members of established

organizations and infrastructural settings where fixing sessions can take place. It was

something he prefers, and was in part the reason they have tabled consistently at Maker

Faire, at the Brooklyn Public Library SkillShare event, helped at a Club de Reparadores

event at Sure We Can in Brooklyn, and presented at various other venues.

> Interviewer: Do you ever have people who didn't even know that you exist
> come in and observe?
> Vincent: I get that a lot in Maker Faire. I might get that a lot in the public
> library. Sometimes we get that at Hack Manhattan. I am all for what I'm
> going to call cross-pollination – where people who go to another meeting
> nearby can poke their heads in and check us out. I like that.[382]

By utilizing public-oriented infrastructure, such as the library, and demonstrating

the importance or possibility of such practices within maker cultures writ large,

such as at Maker Faire, the Fixers Collective attempted visibility beyond their

monthly meet-ups. While the Maker Faire is still quite self-selecting, in that

participants really have to know it exists or have some kind of a handle of what it

is in order to attend, having a mobile group with easily transportable tools made it

easier for the Fixers Collective to select more externally-facing and accessible

events throughout the year. In their view, it helped them to enact care labor for

publics that they would not be able to reach otherwise. As always, there was a

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[382] VL, interview by author, Dunkin Donuts, New York City, New York, March 19th, 2016.

politics to the spaces and places they chose, and they tended to take part in larger community events that already had a built and large infrastructure.

According to those involved, focusing on mobility comes less out of being sensitized to issues of accessibility, however, than from the standpoint of cross-pollination and wanting recognition for the importance of fixing practices within greater cultural narratives. Their selection of events in relation to their social and personal networks – Vincent pointed out how they got involved in the Brooklyn Public Library Commons event through a friend of the Fixers Collective – demonstrates the possibility for different kinds of alliances that fall along lines of care and familiarity.

The Graz Repair Café is similarly situated in a collectively owned and run space, although it is not a classic hackerspace. On November 25th, 2016, the Repair Café Graz had their 21st session, running all day from 10:00 am until 5:00 pm. Since it was the first day of Advent, and Graz is a cultural and shopping hub for the holidays, the city was booming – people came from surrounding areas (including Slovenia, Italy, and Croatia) to start their holiday shopping. I noted the location of Traumwerk, realizing it was about 5 minutes from my apartment, and made my way to Lendkai Strasse. I came upon a sandwich board strategically placed outside of the event, with an arrow for the Repair Café pointing down to a small cellar door.

Image 6. 6. Entrance to Graz Repair Café.

Image 6. 7. Sign for Graz Repair Café.

The stairwell and ladder leading down were steep and narrow, and I wondered how many people were able to traverse this path, let alone carry their objects for repair. When asked about accessibility during a formal interview, Alex acknowledged the issue. Similar to the Fixers Collective and other DIY-run groups I have talked to which rely on pre-existing infrastructure, he admitted that they did not have much control over wheel-chair or stroller accessibility. He related that there was a back entrance which many elderly participants were advised to use, but that the pathway beyond the door was often crowded with objects in such a way that wheelchairs often could not pass through. Other interlocutors I spoke with cited that there were other places around the city that might be more physically accessible and less cluttered. But Florian, a middle-aged man who had found out about the Repair Café through his daughter, cited how the narrow passage-way had a positive attribute. The small size meant people did not feel encouraged to bring objects like refrigerators or larger items for repair. He also cited that Traumwerk was the best possibility since it was centrally located, free to use, already had many tools on hand, and ample room for all fixers to set up.[383]

Although they claimed everyone was welcome, it was clear from these scenarios, and my own experience, that physical accessibility of the community spaces that the Graz Repair Café and the Fixers Collective used was a difficult dimension for each group. Like the feminist hacker collectives, they were mobile, often at the whim of the standards set forth by hackerspaces and other community centers. While the locations were fine for some dimensions of geographic accessibility, such as public transit and parking, the

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[383] EU, interview by author, Café Weizer, Graz, Austria, April 14th, 2017.

building infrastructures themselves were limiting – which reveals possibly more important values of accessibility for these groups (i.e. Location, cost, tools). Both spaces were not easy to maneuver for wheelchairs, and might have been difficult to traverse for anyone with knee problems, or who had difficulty with tight spaces. However, this had not prevented elderly members or participants from partaking in either group.

These issues highlight the effects that different valuations or definitions of care and comfort had on the accessibility practices across various spaces and group dynamics. Accessibility evaluated as reflective of caring relations has implications for infrastructure, geography, language, comfort, or knowledge sharing. Both groups were also interested in connecting different hubs and networks of repair, recognizing their own resource limitations and hoping to foster a diverse array of mechanisms through which a culture of repair could flourish. For them it was less about being the perfect most accessible group, and more about establishing themselves and helping others so that a proliferation of groups and practices could fill in the various gaps of accessibility.

By bringing their practices to events like various Maker Faires, the Club de Reparadores event, and the SkillShare at the Brooklyn Library Commons, the Fixers Collective hoped to address issues of accessibility – coming to different communities as opposed to expecting community members to make the trek to them. One fixer related how he would like there to be more sessions in more places within New York City to create better accessibility for those who could not make it to Manhattan or Brooklyn – hopefully in Queens. He then acknowledged that he has not had the time to deal with the organizational strain of starting a Queens chapter. Another member related that instead of

being stretched thin, he would love to see other or new fixer and repair groups meet the high demands with which the Fixers Collective was often faced.

Similar issues of demand and accessibility came up in Graz as well, but luckily other Repair Café's already existed to meet some of the demand and in order to reach different communities. The repair sessions in Graz only ran once every two months, but Alex told me that many nearby Repair Cafés within Styria occurred every few weeks. The session in Graz was so popular, that Alex hoped another group would start within the city limits and take some of the burden away or meet the high demand of their sessions. As the main organizer, he could not manage any different Repair Café locations or chapters. He has shared information with groups just starting up, though, and has helped to facilitate one-off sessions with fixers from his group in new locations where there was interest from local tinkerers and fixers to organize their own Repair Café. By taking supporting these other start-ups through the sharing of documentation and an initial hands-on demonstration, the Graz Repair Café demonstrated how a framing of care and collaboration helped to build a movement. It also demonstrated their commitment to making these sessions available to as many people as possible. Recognizing their own limit in capacity in a city that was quite demanding of such services had resulted in their keeping a lower profile than they might have initially. But this was important to ensure they did not burn out as a collective that was running an intense, non-stop service from 10 am until 5 pm. This interest in creating hubs and networked practices reflects the sentiment of Brett, and other mentors, from Maker Jawn who hoped to create more hubs around the city, thus enabling programs particular to the branch and neighborhoods which they served.

From these initial characterizations of infrastructural and organizational accessibility, as with the other groups, comfort came to the fore as an important dimension of accessibility. This tied to their core value of and interest in defining care. As Femhack demonstrated, one practice for increasing accessibility involved offering food. This enabled a "warming" of the space, something which the Graz Repair Café also provided in order to give participants something to partake in while they waited and to sustain the fixers who were volunteering all day. It was an important component of the sessions, and was often a focal point for strangers meeting and sharing stories as they shared food. Alex related that all of this food was obtained through gleaning. They have one particular point person within the Repair Café membership who would source food from shops, farmers, and bakeries. She was also involved in a gleaning group that had established relationships with stores and restaurants, collecting their overflow food for various activist and community gatherings. Not only did this contribute to their mission of decreasing waste, it was an important component for creating a contented and jovial atmosphere.

Image 6. 8. Graz Repair Café with food in foreground and participants waiting.

In observing these sessions, the practices they imparted and their commitment to keeping a local-scale practice, it would seem this Repair Café was potentially developing "tools for conviviality" which Illich theorized as the next step beyond industrialization toward positive community dynamics and a more equitable form of production.

Much like the feminist hacker collectives, the Fixers Collective and Repair Cafés were explicitly interested in creating a welcoming environment and comfortable space for anyone who was new to the group. Those helping to manage the event provided chairs for waiting and made sure everyone had been greeted and felt acknowledged. The moment that an attendee showed up at a Fixers Collective session with a new object or technology, Vincent was ready to greet them, asking "What you got?" If all fixers were busy, the participant was asked to wait patiently and that someone would be right with them. Often, they were at least given space on the table upon which to lay down their object. Within a few minutes someone would stop by to assess what was going on, and

what work might need to be done. He or she would familiarize the participant with tools or get them started unscrewing back panels to get inside the device, such as in image 6.9. Otherwise, the fixer might help them look up schematics and tutorials.

Image 6. 9. A participant using a screw driver to open their object at Hack Manhattan.

At the Graz Repair Café, they restructured how the event was run to ensure more welcoming engagement as participants arrived at a session. When I first arrived at their 21st session, I was greeted by a man and a woman behind a counter to my right. They asked me in German what I had brought. I quickly indicated that I did not know German very well, and they both slipped into English, handing me a form to fill out as well as an English translation of Repair Café guidelines and rules. Something particular to the Repair Café in Graz was their attention to language barriers, knowing that many of their participants were immigrants, refugees, or visitors who did not know German well. I filled out the paperwork, and was directed to relax and wait for my name to be called. As

it turned out, the Repair Café member who knew which fixers had which skills to match to an object was Alex, the co-founder and now organizing manager.

In a later interview, he described having to shift the management of events after one of the most popular sessions recorded – session number fourteen. Someone, whom they did not know, had made a digital advertisement about the Repair Café which was then displayed on outdoor information screens at Jakomini Platz – Graz's major hub for trolley and bus transit. At the time, they did not have a volunteer stationed to welcome participants, and the Repair Café was flooded with more people than they had expected. A line ended up forming all the way down the street, and some 50 or 60 participants had to be turned away. Since the fixers were constantly overwhelmed with fixing tasks, people waited long periods while not being checked in or given any attention. To deal with this, Alex reined in the promotion of the group. But he also changed the setup so that there were two greeters who checked everyone in and then relayed objects via paperwork to one of the twelve fixers on duty. In this shift, Alex also took himself out of the fixer role, something that Vincent had also done as a main organizer to help better manage each Fixers Collective session.

Conviviality and social dynamics extended beyond initial greetings through the practice of fixing as well. Each object often had many different fixers looking at it and consulting, together and with the owner. At Repair Café sessions, it was customary practice to consult other fixers if unsure what to do next, to get tips, and to share tools. More than any other Maker Movement workshop or skill-share which I have observed, the Fixers Collective and Repair Cafés enable accessibility through direct engagement and caring techno-humanistic connections. There were often up to seven fixers at each

session for the Fixers Collective and twelve for the Graz Repair Café, not only actively

engaging with participants to troubleshoot their objects, but with each other to share

knowledge, skills, techniques, and best practices. It was a fully social, informal, and

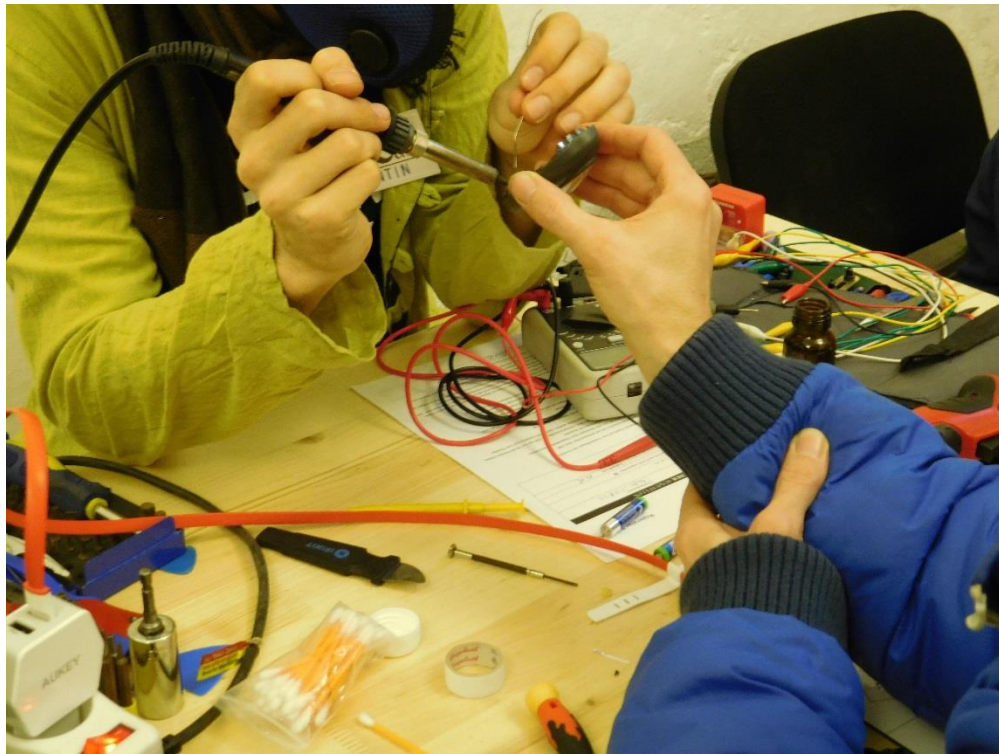engaged atmosphere – mediated through personally meaningful technologies.

Image 6. 10. Fixer and Fixee in Graz working together to fix, with the fixee acting as a "third hand."
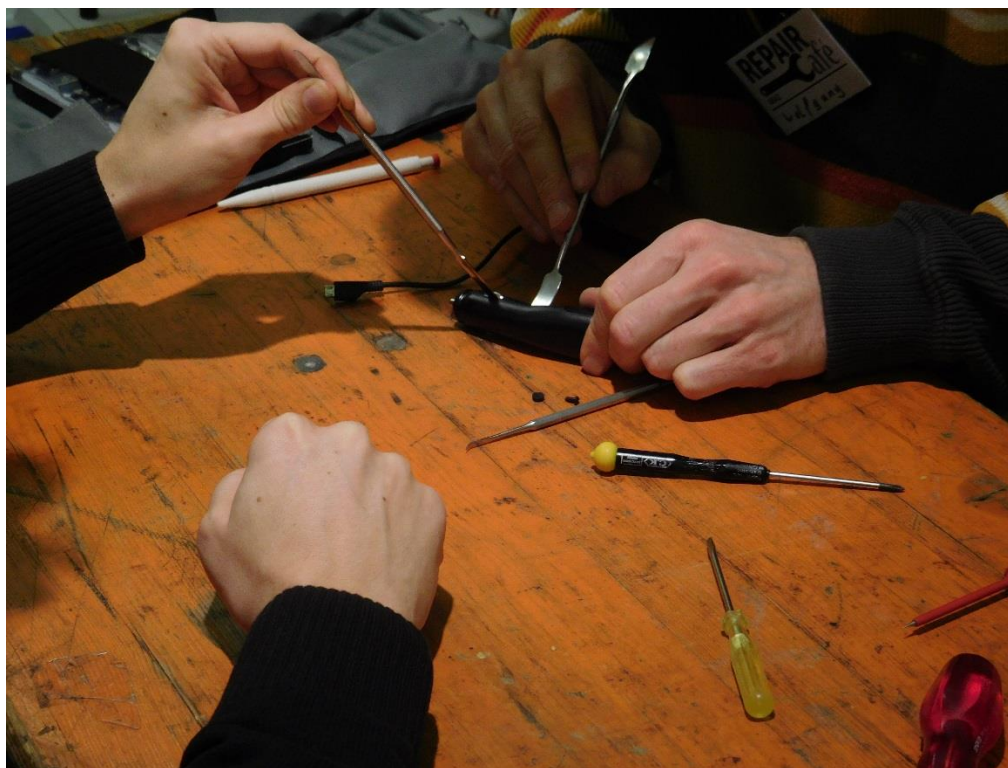
Image 6. 11. Fixer and Fixee at the Graz Repair Café collectively using tools and hands.

Another major dimension of accessibility for fixing groups was in relation to

information – particularly for knowing where and how to acquire tutorials, schematics,

and other information related to fixing an object. Through their collective knowledge of

online resources, fixers hoped to make this information, which could often be obscure or

hard to find, as accessible to the public and owners of devices as possible:

> A lot of the fixing that comes into play […] – MacBook Pro disassembly, Dell PC disassembly, phone disassembly – is available online. We live in a world where we have access to so many resources with YouTube and with informationals. I feel like YouTube and the website iFixit are my Technology Bibles. If I need something fixed technology-wise, I will go there first and then immediately, nine times out of ten, I will find that resource.[384]

These diffused information networks are key for checking possible repair strategies or

diagnosing the issue at hand. Instead of one expert fixer or engineer as holding all the

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[384] IF, interview by author, Skype interview, United States, November 13th, 2016.

knowledge, both groups had communal practices around who had knowledge and how it was shared. This aggregate expertise, or collective situated knowledges, demonstrated that the care was collective – and that there were many different levels and angles in which to help and engage.

Accessibility to information via online resources is an important mechanism, but still has the possibility to prevent some populations from gaining knowledge and being involved. Not everyone has easy access to the internet, or even knows the best places to look for such information. That was a service that a visit to a Fixers Collective session could help provide – not only a device with which to find this information, but the expertise and sharing of collective knowledge regarding how to find repair or schematic information. In a way, the Fixers Collective helped to broker connections to this information, and provided a very important human component that bridged different networks of ideas and forms of knowledge for the participants.

When asked about accessibility and how it was enacted in the Fixers Collective practices, Vincent focused more on access to information and education.

> I think that education is a very, very big and strong part of what we do. Not only […] in terms of repair. […] I want to promote consumer education just as much. Ikea will have what you call the 'tape to a floor' lamp. I might want to get the word out [that] the wire could fray and create a shock because the base is metal. […] there are instances where a lack of education for basic computer skills wound up forcing people to spend money for a new laptop, when they could have fixed it up for a lot cheaper. […] And so education is something we want to promote because it also gives you the opportunity to save money.[385]

Vincent explained how they provide access to obscure knowledge or practices that he believes are important for consumers to have or that creates choice and opportunities. He

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[385] VL, interview by author, Dunkin Donuts, New York City, New York, March 19th, 2016.

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wanted to make the role as conscientious and knowledgeable consumer something accessible to all – so that everyone could make informed and actionable decisions regarding repair, safety, how to save money, and so forth. What he hoped to impart, is an accessibility to a particular culture and knowledge-set for the collective consumer society. Some might consider this comment and the implication behind it as having a neoliberal mindset – that instead of shifting industry-standards, consumers need to take it upon themselves to shift their own knowledges and become experts in everything. However, the Fixers Collective was also invested in transforming production standards via legislation. Rather than categorize their mindset as neo-liberal it is important to highlight the nuances, especially in relation to resource mobilization and the tactics that the Fixers Collective was hoping to enact toward a cultural shift – typically through actions of collective care and support. By informing consumers and bringing them into "a quality over quantity" mindset they had a better chance of mobilizing crowds and voices to pressure changes within the industrial standard.

They sought to instantiate accessibility by connecting publics to the knowledges and practices that would give them the choice of whether or not they wanted to engage technology preservation. One fixer went into detail of how this may play out and how it was connected to specific knowledge, skill-sets, and tool access.

> [W]hen the owners of these items come in, we supply them with the tools and then we provide them with [the] knowledge. It might not be the Apple certified knowledge or it might not be the Dell certified way of doing things, but it's still […] core knowledge. We instruct them: if you're […] unscrewing this, you should definitely wear a static guard or you should have a full work coat on that prevents static shock and damage to your product.[386]

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[386] IF, interview by author, Skype interview, United States, November 13th, 2016.

By providing a human interface to information that is often online or could be done on one's own, the Fixers Collective provided a vital step for some people who wanted to fix and take things apart, but might not know where to even begin or might be too intimidated. Of course, the possibilities for taking part in such practices was conditioned upon a knowledge of the existence of the Fixers Collective, and an interest in garnering technical skills. It also tied to variables of comfort, something which the group tried to enact to the best of their abilities for each participant. How information and skills were imparted could heavily effect who felt they could take part, and what other roles they might play in a repair culture focused on sustaining care for objects.

Connected to this brokerage is the work that fixers attempted to demystify the fixing process. The ability to demystify technology shifts, of course, from group to group and fixer to fixer – as well as in relation to the participant and their object. I found that the Viennese fixers tended to play up their expertise and attention to details. Meanwhile, the Graz Repair Café and Fixers Collective downplayed their own expertise – often citing that they themselves might not know what they are doing. Regardless, all groups were accepting of all skill levels to join in. Before jumping into things with a participant, Dave, who has been working with the Fixers Collective for several years, related that fixers will "try to feel out their level of skill." He described how each fixer sat with attendees very patiently and tried to help them out, involving them as much as they wanted in the fix.

> When you sit someone down and they say, 'I don't know what I'm doing' my first reaction is: well neither do I, but we're going to sit down and we're going to figure it out together. And I think people are surprised that they're not that far off from where […] we were.[387]

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[387] DC, interview by author, Google Hangouts interview, United States, December 6th, 2016.

Through collaboration and the opening of boundaries (instead of solidifying them), fixers attempted to lower barriers to accessibility. It certainly took patience, and reveals a different view of technology – not as fast and smooth, but as slow, clunky, sometimes frustrating, and precarious. Because the fixers were not trying to teach tasks under pressure, and since they took time, a more accessible framework for teaching these skills was established. This particular dynamic came to light by examining care practices and different understandings of urgency.

In contrast, in her work on Low Power FM advocacy, Dunbar-Hester has observed the pressure that social activist urgency, in the practice of barn raising a radio station, can put upon the sharing and teaching of skills.[388] In one story she shared, Prometheus Radio Project strove to create a democratic and participatory technological experience during the building of a local community station. But due to a limited time, a frustrated electrical engineer ends up taking over the soldering work that was meant to be enacted by a female community-member. Feeling distraught, inadequate for the task, and then a failure, the participant ended up in tears. Fixing groups work to avoid such pressured scenarios by focusing on a different kind of efficiency, taking out the pressure of urgency by forewarning the owner of possible failure (and that such failure is permissible) and reading objects through a care for the material goods as well as the owner's psyche. Since fixing groups are also hoping to recruit more fixers and collaborators to take part, there is an emphasis on doing *with* instead of doing *for*. This provides a low-stakes environment that is accessible to different levels of interest and involvement in the fix.

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[388] Christina Dunbar-Hester, *Low Power to the People: Pirates, Protest, and Politics in FM Radio Activism* (Cambridge: MIT Press, 2014).

The Fixers Collective and Repair Cafés also hoped to lower barriers of economic accessibility by only asking for small donations for each repair. They did not turn a fix away if the attendee was lacking in funds. The Fixers Collective also often supplied spare or component parts in order to enable a fix. In a recent meeting post-fixing session for the Graz Repair Café, Florian had also proposed the possibility of having thermal fuses on hand – a component part that needs to be replaced often. Elli of the Fixers Collective expressed this economic inclusion in terms of their practices as community service:

> It's […] a five-dollar donation. They're *asking* for a five-dollar donation, they're not even saying 'you *must* pay five dollars or we're not gonna fix it.' [...] These people come once, twice a month, and do this for people. I mean that's pretty unusual don't you think? Like, people don't *do* that.[389]

It is in part as a community service, but also in part as a community awareness effort – to lower the barriers as much as possible and not intimidate people from coming due to prohibitive costs. This attention to economic barriers was part of the mission for some fixers. As Vincent related, he wanted to create the conscientious consumer who does not waste money or materials on new things they did not need. This practice also helped to waylay accountability if it happened that a broken object was unfixable by the collective. Then the participant felt that they had not lost anything in the transaction. Hopefully, if anything, they gained some knowledge for troubleshooting or fixing their other devices in the future. As an added measure, Repair Cafés had an official waiver form in order to deal with legal issues.

The sentiment of "doing this for people" connects to what Jackson points to within repair groups as an 'ethics of repair' – not just in watching out for one another, but towards material goods as well.

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[389] EF, interview by author, Manhattan, New York, August 1st, 2016.

> Thus the ethics of repair admits of a possibility denied or forgotten by both the crude functionalism of the technology field and a more traditionally humanist ethics (which has mostly ignored technology anyway). What if we care about our technologies, and do so in more than a trivial way?[390]

He points to the interconnected entanglements of technology, technological systems, repair groups, users, technologists, and material objects – all caught up in care work. He also argues that the care of repair goes beyond the humanist versus functional technologist binary, entangling these issues and bringing serious considerations of technology care to the forefront. In this sense, these practices also invoke an instance of 'transcorporeality.' Thus, caring for the technology is recognized not only as one way or the other (humanistic or functionalist), but something altogether different. It provides a different type of world and a different mindset in relation to systems of care and what it means to value care beyond the human-centric or medical care work scenarios. Caring for objects becomes about caring for the environment, your community, yourself, and different organizational structures. It also demonstrates the broad spectrum of effects that the lens of care brings to making, repair, and hacking practices – and possibilities to enact consumer consciousness, material participation, and technological citizenship.

Things are not perfect in these scenarios, though. One issue not considered, was that time is money for many people who worked long hours, or did not have room in their schedules to spend on fixing their objects. It is an unfortunate reality, and something that neither the Fixers Collective, nor the Repair Café fully addressed. Florian of the Graz Repair Café acknowledged it as an issue, while also mentioning that people had to be

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[390] Jackson, "Rethinking Repair."

very intentional to come, and already excited about spending the time. Fixees are required to stay during the fixing of their object, the intention being that they learn new skills, and possibly understand how to take care of the object on their own in the future. This possibly prevented accessibility for people who had busy schedules, had children to take care of, or who may not have had an hour or two of disposable time. What it further highlighted is the importance for societies and cultures to slow down and take time *with* technology. Disparities in terms of gender, race, and class regarding who had the leisure time to slow down with this new relation to technology persisted, often and unfortunately shutting out those who needed the care and slow down time the most. Looking at those who may have not even known the conversation was going on, or did not have a say in the matter, reveals hierarchies, power dynamics and mechanisms for the involvement of different publics when cultivated the conscientious use of various technological systems. It also further reveals the effects of who cares in what ways, and how they are able to care about different aspects of their lives on the enactment of accessibility.

Inclusion

As demonstrated throughout this text, inclusion and exclusion are intertwined with the issues of accessibility. The participants in Fixer Collective and Repair Café events I have attended have been a diverse crowd. As young as fourteen, as old as eighty, and with different backgrounds including artists, social workers, IT specialists, retirees, writers, medical technicians, engineers, business owners, and teachers. Everyone who comes seems to feel fairly welcome, and included – not belittled by any of those taking part. Since the Graz Repair Café is not accessible by wheelchair, there are some explicit exclusions already in play. Some of this is tied into the infrastructure, with other

exclusions being more implicit and caught up in the groups focus and mission. Regardless, as I observed, the attendees of the Repair Café in Graz involved many different people in terms of age, gender, and race, including several participants from the increasingly precarious refugee population. In terms of fixers, they tended toward male, white, and older. This is broken up by the fabric and clothing repair group, which is comprised of several women – in the first event I attended there were two, one in her 20s and the other in her 60s. For the second event there were two different women, and for one it was her first time partaking in helping with fixes, even though she was a regular attendee. She described her reason for coming as the atmosphere, and feeling comfortable and excited about the activities involved.

For some of the fixers involved in the Fixers Collective who I interviewed about inclusion, there was a difference between the degree of inclusion that participants felt, and that which new fixers or even more long-time fixers felt in relation to the socio-cultural mix of the community. Comfort and inclusion were more elusive when talking about the core fixers, as they did not have many organizational meetings, and the structure for becoming accepted to be a part of the "in-group" conversations was quite informal. Although it typically meant an ease with tools, and working knowledge of electronics. More was said or thought about in terms of comfort in relation to making attendees feel comfortable with trying out new skills, gaining knowledge, and acquiring different technical capacities. I should also note, that comfort was repeatedly described as the way to foster inclusion within these groups. In terms of gender dynamics, dimensions of discomfort were also raised.

Elli of the Fixers Collective observed that comfort, which she associated with inclusion, has resulted many times in repeat visits, wherein attendees finalized a fix, or brought another item to repair. "I've seen a couple of people who want their stuff fixed coming back a second time. Which means they do feel comfortable and included in the fixing."[391] In this instance, comfort was not mentioned in the question and was naturally associated with inclusion by Elli. Being comfortable and taking care to ensure such comforts is an aspect of inclusion that the feminist hacker collectives also cultivated for others as well as themselves. The ability to enact it for others and people coming from different cultures or backgrounds is something the fixing and repair groups deal with continually.

Often this dimension of inclusion was tied to how people were acknowledged or brought into an event – in the welcoming. The Fixers Collective took public engagement seriously, because providing welcome space for experimentation was one of the main goals of their group. The last thing they wanted was to drive people away, or get a reputation for harsh attitudes according to skill-level. In my own personal experience, the Fixers Collective created an atmosphere that was not intimidating for newcomers – although there were still issues around demarcations of expertise and possibly difficult gender dynamics among the fixers themselves. One fixer elaborated how welcoming could foster inclusion and lower intimidation barriers. "[…] what we don't want is for people to come in and just stand around and say: hey I need help [and then for nothing to happen]. We want them to feel welcomed, hey if nobody is available, just wait around for a little bit and we'll try to find somebody available."[392] Re-assurance that newcomers

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[391] EF, interview by author, Manhattan, New York, August 1st, 2016.
[392] IF, interview by author, Skype interview, United States, November 13th, 2016.

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were not in the way was important in the high-energy events that a fixing session could sometimes become. Thus, acknowledgement from the moment attendees walked into the fray is important.

Something that was also important for accessibility was making space for different levels of involvement. The Fixers Collective wanted to make sure any level of participation or engagement felt comfortable for the attendee, whether that meant not getting physically involved in fixing their object or even allowing people to just watch without bringing an object for repair.

> Vincent: If we have somebody who expresses high enough level of interest, we'll pair them with somebody who may be able to provide that teachable moment. That's why I tell people all skill levels are welcome, even if you just want to observe, that's great too.
> Interviewer: Like if they don't feel comfortable with taking part.
> Vincent: Yea. We get that a lot and we're good with that.[393]

Making sure this accepting attitude came across was an important aspect of the Fixers Collective, since often attendees just wanted to watch and learn.

Word-of-mouth and personal interest were a large part of how the Fixers Collective included participants. Often this played out by connecting friends of friends to the group, and explicitly reaching out to interested individuals who might not have known about the group. Isaiah related the story of reaching out to an interested individual who might not otherwise have had access to the tools or be comfortable on her own to open up technologies:

> My sister teaches GED-level courses. [She] told me that one of her students was really into computers and wanted to find a way to get into [them]. So I just referred the student to one of the fixing meetings.[394]

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[393] VL, interview by author, Dunkin Donuts, New York City, New York, March 19th, 2016.
[394] IF, interview by author, Skype interview, United States, November 13th, 2016.

He went on to talk about how excited the student was, and that luckily enough someone had come in needing to fix her computer. Isaiah started the two newcomers in on the project, getting them situated, and then the duo – beginner and object-owner – took the rest of the fix into their own hands. This was a palpable success story – to include and usher someone into the possibilities of the fixing community. Such intense interest on the part of the new participant helped to scale what might be high barriers of inclusion. But, in some situations, even this amount of excitement can be quickly deflated by experts or technically advanced tinkerers who guard their knowledge or create boundaries of belonging – as well as by those who tell beginners, as one interlocuter of Femhack related, to "Read The Fucking Manual" (RTFM). By establishing humanistic connections and face-to-face instructions for what might be seemingly simple skills or tacit knowledges, the Fixers Collective adamantly rejected such boundary-setting practices. Instead they hoped to blur, trouble, or disrupt boundaries in regard to technology – even beyond expertise and in relation to how subjectivity, self, and objects were defined. To again invoke Alaimo, care of the object becomes care of complex sociotechnical systems, and in turn care of the self and others – socially and materially. As Jackson also relates, engaging technology through a repair and care narrative adds nuance and more ways of reading technology-based practice or development than just a humanistic versus functionalist model. These entanglements produce differing patterns for how to enact inclusion.

Of course, there were issues of exclusion that naturally occurred by relying on 'word-of-mouth' mechanisms for enrolling new participants, but some saw it as necessary to keep things manageable. One fixer of the Fixers Collective expressed that

there was not enough outreach to identify new fixers within the community, some felt that there was no room for new fixers, and that new chapters should be established if more fixers wanted to get involved. Still others felt that they, as a fixer, were very welcome in their initial visit, and that it was a good environment for both fixers and participants. These differing views also extend to the social media practices of the group. As Elli of the Fixers Collective reflected: "I think they could be more inviting to fixers on the Facebook website."[395] She described a paucity in the return of potential fixers, while also acknowledging her personal bias. "I don't see a lot of people, fixers, coming back a second time. Maybe I'm wrong. I could be wrong about that. Because I'm busy fixing when I'm there, but I'm not sure I see a lot of new people, fixers, coming back."[396] While I was not able to make observations to either support or trouble this claim fully, I noticed that there was a core group of fixers, and typically those members had been involved for quite some time. Also, the outreach and web presence of the Fixers Collective was geared toward participants for bringing broken appliances, not for new fixers to join as members.

Meanwhile, Isaiah related hearing about the group from a personal contact and getting in touch with Vincent – who encouraged him to come to the next meeting.

> I walked in there and was like "hey guys, I like to fix computers; how can I help?" And it just so happened that somebody, that first day, somebody had a lap-top [and] they mentioned the power supply was acting up. So literally it was just showing up and being thrown into it. Which was very exciting.[397]

Even though he did not know the community at all, he felt welcomed and comfortable starting to help fix from day one. There was no judgment on his helping style or his background. There was no test of qualification or barrier towards starting to help.

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395 EF, interview by author, Manhattan, New York, August 1st, 2016.
396 Ibid.
397 IF, interview by author, Skype interview, United States, November 13th, 2016.

Another key point of welcome was Vincent's involvement. As a main organizer, he filled

the role as arbitrator – mediating or managing inclusion. In this particular situation, and

many others, he was explicitly trying to bring outsiders in and attempting to lower the

barriers of involvement. Isaiah went on to relate:

> Initially I felt like I didn't want to step on anybody's toes. Like, "hey am I allowed to do this?" or "am I allowed to do that?" But […] Vincent explained to me, if the individual, or the fixee, [is] OK with it, then by all means offer help wherever possible.[398]

Vincent acted as gatekeeper. It is possible that the invitations to become a fixer were not

so explicit because he wanted to recruit repair enthusiasts who could sustain a particular

dynamic for attendees. The situation with the Graz Repair Café seemed less about gate-

keeping and invitation. As several of my interlocutors related, they initially came to a

session to get something fixed, and kept coming back until they felt comfortable to take a

seat with the other fixers. Some, such as Vlad and Edmund, had no experience with

fixing beforehand – but they were familiar with general tools and taking things apart.

As a main organizer, Vincent grappled with and understood the Fixers Collective

flaws, or at least its tensions, regarding problems of inclusion, particularly within the core

fixer members. For him this exhibited most clearly in terms of skill type. He ruminated

on the inclusion of skills that were culturally gendered as 'feminine,' such as mending

and fixing clothes. But he hoped that boundaries could be blurred and that such stark

demarcations regarding gender and skill could be troubled.

> Vincent: We do have fabric mending. It doesn't happen often. […] I always love people who express something incongruous with traditional gender roles. Like that guy who was stitching leather, or a woman who is using a power-tool.
> Interviewer: Blending, blurring those borders.

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[398] Ibid.

Vincent: Bending or breaking, yea.[399]

Along with his personal desire to see gender-bending or to include different genders in the core fixer group and to break up 'boys' club' mentalities, came the admonition that Vincent could not force or push these scenarios or prerogatives. Like Akhe from Femhack, he was concerned with tokenism, and did not want to target certain populations. In fact, the lone female-identifying fixer had her own issues with feeling fully comfortable doing things right away – *imposter syndrome* that she blamed on being a woman and the cultural bias regarding technical skill and gender which she grew up with and which relates to themes brought up by the feminist hacker collectives. Before each session, she questioned her own repair abilities even though she had been working in the electrical field her whole life. According to her, this was her own internal dialogue affected by experiences in the field, but not due to any actions by the other fixers. She loved the group and saw it as unique. When she discovered the group, she had been scoping out other groups to join, and in her experience, none had openness and camaraderie at the level of the Fixers Collective.

Alex of the Graz Repair Café explained that inclusion, particularly regarding gender, and attempts to trouble typical gender roles around technology was not a major concern or mission of the Repair Café. In this sense, they were not trying to force anyone to do anything, but instead allowing them to take part in whichever way they wanted. This sentiment was a bit similar to Vincent's when he cited not wanting to actively recruit female fixers for fear of creating token members to fit a particular quota. Vincent still made clear that he tried to foster or was happy to see 'gender-bending' when it did

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[399] VL, interview by author, Dunkin Donuts, New York City, New York, March 19th, 2016.

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occur. He also noted that there have been welcome scholarly and practical discussions amongst the fixers and some academic scholars, such as Daniela K Rosner, in explorations of how different skills and repair practices (i.e. mending fabrics versus fixing electronics) are gendered or marginalized.

In the Vienna Repair Café, gender dynamics also played a role – but again were not the main concern of the group. A smaller group of about five or six main fixers which included the founder Kristoph, the atmosphere was very jovial. They met in a smaller space than the Graz Repair Café, every week on Thursday from 2 pm until 6pm. All the main fixers were male, but a fifth person, Helena, helped to greet and orient attendees – classically feminine roles – although she also had some fixing expertise. Helena downplayed her own expertise in the shadow of the electrical experts such as Igor, Kristoph, Felix, Cyril, and Michel, but she played a very helpful role in keeping things organized by having attendees fill out paperwork about their item and a waiver regarding a non-guarantee of the item being fixed or remaining fixed. She enjoyed this role, interacting with attendees and helping in a way with which she felt most comfortable.

Kristoph organized the group as well as the events. One fixer even referred to him as "the boss," but he did not act as the greeter during sessions. Regardless of age, gender, and race, the fixers in these groups were accommodating to different levels of expertise, teaching skills, and getting the participants involved in whichever way they wanted – on the terms of the participant. Typically, this resulted in the participants unscrewing back-panels of their objects. Fixers also explained what they were doing and often had the fixee clean the object on their own.

In one situation in Vienna, a couple arrived with their child and an electric stovetop for which one of the burners was not responding to control inputs. Right away, the woman was handed the paperwork to fill out, and the man was handed a screwdriver for getting involved in the repair. Things were not so simple, though, and did not continue down such a starkly gendered route. The woman did all the cooking in the household, and so she held the most expertise in terms of how the appliance functioned, how to turn it on, and what was not working. All pictures of how the appliance was plugged in and installed before they brought it to Laer were on her phone. Her knowledge of the device became apparent as the fix progressed. Initially the couple's child sat on the woman's lap as she looked on, deeply engaged in seeing the stovetop taken part, as the surface was removed to reveal the electrical workings beneath. Eventually, she was the one helping to test the stovetop, sharing the images on her phone, and getting more involved with the repair. While there was no resistance to her deeper involvement, the initial demarcation of roles might have discouraged other attendees from claiming their knowledge or expertise. Within this community of practice, there may not be explicit moves to lower barriers, but the fixers worked to meet participants at their current levels and take their knowledge or expertise seriously. In the three times I visited the space, I did not witness any downplaying of other non-technical forms of expertise such as experiential, artistic, or user-based knowledge an owner might have of their object.

In varying capacities, reflexivity regarding issues of gender and skill inclusion and attunement to experiential knowledge is something I have observed amongst participants of all groups I studied, yet it is a discourse or narrative that is lacking in the Maker Movement's core rhetoric. As Eliasoph points out, it is possible that such debates,

tensions, or inconsistencies may be relegated to the 'in-talk' of maker practices and more

private conversations within makerspaces – I have even observed this on the back-

channels of what one might consider a more 'traditional' makerspace. But in order to

garner funding and demonstrate their importance in the public and economic sphere,

these moments of reflexivity or grappling with issues of power dynamics may stay

behind closed doors. Meanwhile, the out-talk will continue to portray maker cultures and

spaces as a driving force in innovation, economic stability, and as fully open, accessible,

and empowering to all. The Fixers Collective engages in many different public spheres

and meaningful contexts through which to demonstrate their sentiments. As Eliasoph

argues – some such sentiments are "easier to feel, discuss, and act upon"[400] within

different contexts and expectations, and the civic practice through which citizens produce

the context is itself meaningful. The ways in which these groups create their

environment, sustain their practices, and bring in newcomers demonstrates their

commitment to a new way of designing technology use, interventions, and engagement.

Vincent shared that many different types of people with varying levels of skills

got involved, including participants who already knew what they are doing and just

needed a little advice or the right tools.

> I'm always happy to see the self-starters. Like last Wednesday was the first
> time that I saw a few people who were just fine on their own. One guy was
> stitching his leather […] bag. Red thread, straight line, even stitching. I
> couldn't do that.[401]

Vincent's example also indicates the inclusion of diverse types of repair – mending and

mechanical fixes, not everything just electrical. I had also seen people repair umbrellas,

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[400] Eliasoph "Making a Fragile Public."
[401] VL, interview by author, Dunkin Donuts, New York City, New York, March 19th, 2016.

binoculars, coats, and watchbands. Vincent talked about bags, boots, and adding a mechanical crank to a paper shredder – bringing it from the automatic into the manual. This fix highlighted the repair standpoint of engaging technology in different ways and in conversation with the device and materials available. For the fixers, there was no 'right' or 'one' way to do a fix – but many different scenarios according to numerous variables including the participant user, the tools at hand, the parts at hand, the device to be fixed, and the distributed expertise within the room and beyond. 'Faster' or more 'efficient' may not always be better. And in fixing, fixers wanted to take time, to breath, to instill patience – which is less in line with a production regime and more in line with exploring the politics of care in relation to craft cultures.

Inclusion through one-on-one engagement was a tactic which fixing groups did well. They worked *with* participants to lower barriers to technology use and understanding – sometimes even through redefining technical knowledge. They recognized and included different experiences of technology, listening to the participants to reach joint experiences and knowledge about the device. They welcomed the backstory of each device and encouraged storytelling as a means toward experiencing and understanding technology.

> As far as showing them, I personally like to try to understand an issue first. And then once I understand what could be causing the problem, then before I even touch it, I'll explain to them. Well, first I'll listen to what they say is the issue, and then I'll try to understand it in my head, and then I'll explain my understanding of it so that we're both on the same page. What I suspect could be causing their problem, and having them understand […] how that's the case.[402]

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[402] IF, interview by author, Skype interview, United States, November 13th, 2016.

Working through diagnostics together, it becomes a collaborative endeavor. Fixers wanted to hear the story of the object, what it meant to the participant, where it came from, their lived experience of the object, and how it came to stop working. When asked about his favorite fix during a Repair Café, Vlad described his favorite as not the most tricky or intricate or unusual – but as the one that made the owner the happiest. To bring joy and relief to an attendee and garner appreciation was something he welcomed and by establishing a caring relation between object, fixer, and owner a multi-faceted inclusive practice was established.

Including participants in the fix was touched upon within the accessibility section, but it also involves inclusionary practices. This doing with instead of for is predominant in the Graz and Viennese Repair Cafés, and is fostered by the presence and inclusion of the participant in the fix. Participants often showed up with their own technical specs and research that the fixers incorporated into diagnostics and worked through with the fixee. In Vienna, fixers refuse to repair an object, unless the owner has time to remain and better understand what is wrong, help to clean out dust, and do fixing practices of which they are capable. When first diagnosing an object, fixers will first hand a screw-driver to the owner and give them the opportunity to open it, instructing them in best practice so as not to wear down the threading. These groups are not just service providers, but educational and collegial endeavors. Particular parts of the fix that the fixer thinks might help in the future or that are a good entry-level hands-on engagement are explained to the participant. This includes internal cleaning of electronics unscrewing, and help with testing the circuit. It also involves putting the object back together.

Meanwhile, in Graz this tactic comes through the telling of stories, or a certain experience of an object from the owner. Although one fixer, Florian, admits that he often starts right into a fix without asking or checking in with the owner. He has to watch himself and be mindful of this tendency. The doing with instead of for comes out most clearly in the following images and analysis of the hands – both of owners and of fixers working together. Visually, this is represented in the physical handling and collective fixing of objects.

Florian also described alternate moments of having a woman keep part of an appliance open while he soldered to fix something, and of him and another man getting a physical work-out fixing a 30-year-old corn mill. He was happiest when sharing these moments as he identified the ways in which collaboration was full-on, these convivial anecdotes with technology, objects, fixers, and owners creating a sociotechnical dynamic that cultivated collective care and expertise. There were different levels of engagement, a spectrum of how intimately or intricately participants could be involved with the care-work, and different levels can be read differently in the realms of inclusion as well as empowerment. All levels, however, were enacted through an ethics of care and repair.
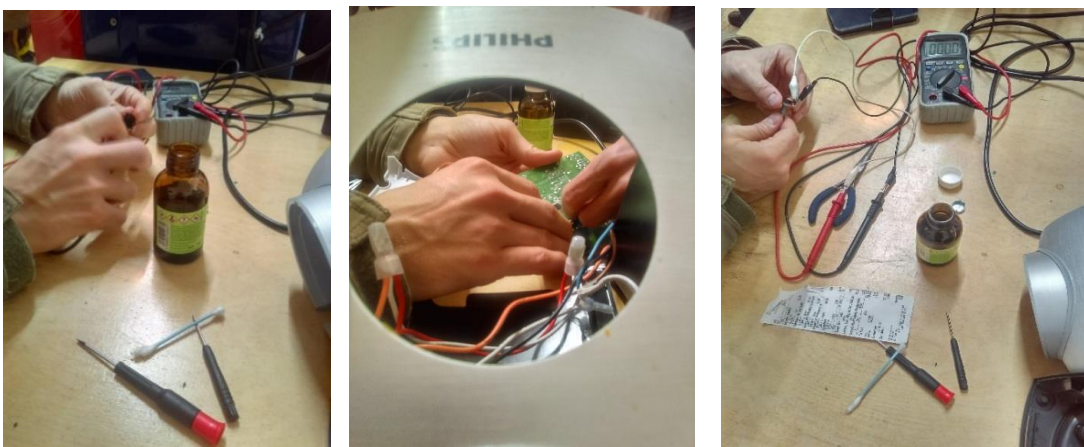

Image 6. 12. Repair Café participant (a) disassembling (b) cleaning, and (c) testing a blender potentiometer.

One intricate fix I observed in Vienna was the cleaning of a potentiometer by the owner of the object. I then worked with the owner to put his blender back together. The fixer he was working with would oversee his work for a bit, then check in on another object-attendee repair. Instantiating collective care and troubleshooting together creates a convivial and caring community dynamic that allowed for discussions, story-telling, and the display of different knowledges or experiences of technology.

Empowerment

As described in both the feminist hacker collective chapter and the library makerspace chapter, empowerment is a tricky and slippery concept. When asked about empowerment, most fixers spoke about its possibilities in relation to empowering others, and not so much themselves. They felt strongly that through their direct actions and capacity-building they achieved empowerment practices. They felt they had shifted the ways in which people engage and manipulate technology – resulting in a comfort to go deeper with such interactions and with technical knowledge. However, Elli of the Fixers Collective deflected talking about empowerment more so than her male counterparts. During our first informal interview, when I asked if she saw the practices as empowering – she interpreted my question to mean in relation to her personally. And evaded the question a bit. Yet in a deeper interview, she expanded upon this, explaining how she was committed to opening this world up to other interested female-identifying participants. She later talked about actionable empowerment with women, showing them things and wanting to create an atmosphere of positive reinforcement – something she had never

received in the industry. This sentiment may reflect Elli's personal experience as a woman in a male dominated field.

Other male-identifying members were quite emphatic about the possibilities for empowerment through the Fixers Collective. This included different dimensions such as through the acquisition of knowledge, demystification of technology, or even just cultivating choice toward consumer practices. Some interlocutors of both the Fixers Collective and the Graz Repair Café related that this empowerment came from the ability to take care of one's own things – to break full reliance upon other experts to solve the problems of their technologies.

> Interviewer: Do you see the practices of the Fixers Collective as empowering for yourself or others?
> Isaiah: Absolutely. I feel that a lot of times people will not fix their own devices because they think that […] the geniuses at the Apple store are the only ones that can do it.[403]

While the question may have been leading, I often prefaced the inquiry with the acknowledgement that empowerment means different things to different communities and individuals – and that the interviewee was welcome to trouble this characterization of the practices in which they were part. Several of my interviewees did trouble the narrative, but many felt positively about the empowering possibilities of technology manipulations. According to fixers, the barrier of entry into technological manipulation through mystification and broken warranty warnings worked to discourage repair and care by the owners of objects. By reclaiming the ability to manipulate, and open up technology to see what is within, fixers hoped to demonstrate that the inner workings of

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[403] IF, interview by author, Skype interview, United States, November 13th, 2016.

things like lamps are not so complicated, and that complex devices can be safely and often easily repaired.

Like the Fixers Collective, Repair Cafés hoped to foster confidence-building in sharing knowledge and skills. Alex from the Graz Repair Café felt positively in how their practices were empowering, and he defined empowerment as ways in which "people are brought to the point of doing things for themselves rather than others doing it for them."[404] This simple definition revealed some of the intention behind the practices of the Graz instantiation of Repair Café. It also implied power dynamics and feelings about who held the knowledge in these scenarios, and who was learning through these collaborative efforts – it involved a process of changing relations and interaction. However, empowerment would not be achieved if the attendee did not want to take part. They had agency over how much they did or did not do, and that choice alone gave them power to collaborate and affect the outcome of the repair.

According to Alex, empowerment is enacted through building confidence and through the informal sharing of knowledge. It was also connected to having control over objects that participants owned and cared for. Thus, the Graz Repair Café strove to **"**give visitors the mindset of being able to reuse their stuff […] which [has] failed, and also [to] make them more self-confident in picking up a screwdriver and trying themselves."[405] This connects to what I observed in both Fixers Collective and Repair Café events, as participants are brought into helping take apart their devices, to see how the device is diagnosed, and fix according to how comfortable they feel or how much they want to learn. This involves soldering, taking out and cleaning potentiometers, identifying broken

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[404] AL, interview by author, Spektral, Graz, Austria, February 15th, 2017.
[405] Ibid.

parts to be acquired at a shop for the next step of repair, and so forth. As described in the section about inclusionary practices, fixers create teachable moments by often leading the participant through the repair, explaining the inner workings of the technology, having them clean or maintain the object, and take apart as well as put the device back together. In these teachable moments, fixers try to instill 'best practices' by showing participants how to set aside screws and repair safely.

Some of the more empowering moments are cultivated by instantiating an active role for the participants – whether that be through their physical engagement or intellectual engagement with the process at hand. "Sharing that [repair] knowledge helps them feel a lot more comfortable with taking apart these items and fixing their own things. And then they feel so much better because they had an active role in repairing their own product and understanding how it works."[406] Having an active role, or so fixers hoped, did not stop at the session in which participants took part. Now that they had experience taking apart and fixing the device under supervision and instruction, fixers intended for them to take this knowledge and keep it for future use.

> And that I feel is the most important, the most beneficial aspect of it. Let's say he runs into this issue again, or something similar. He'll know how to handle it on his own. Obviously, each piece of electronic hardware is different in their own way, but for the most part you run into a similar theme when dealing with electronics overall.[407]

Embedded within this is the building up of confidence, which comes through encouragement and careful instruction on the part of the fixer. Several fixers related individual stories about knowledge transferred, and an increase in confidence, knowledge acquisition, and claims of expertise in their participants. Isaiah relates:

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[406] IF, interview by author, Skype interview, United States, November 13th, 2016.
[407] Ibid.

> And she actually came back I would say a month later, and we were able to take it apart again, just to put the battery in. And this time she felt a lot more confident in actually taking apart the screws herself and using the right tools, placing it on the mat, and putting the battery in herself.[408]

Care and attention is given to the development of skills, and how the participants feel when engaging the technologies. Isaiah surmises that beyond access to knowledge of how to fix an object, it may be that the owners of broken objects do not have the specialized toolset needed to take part in more deeply examining their devices. "The other part of it is having access to the tools. Because a lot of the owners of their products, they don't have the screw-drivers needed, or they don't have the pliers or tweezers or specific tools."[409] Rarely did users have a full work coat that could prevent static shock or a static guard on hand unless they were deep in the world of fixing electronics. So, having the knowledge of how to fix and what needs to be checked or done was just one aspect of empowerment that went with access to repair tools and equipment.

Once these needs were met, Isaiah related that getting participants involved, or seeing that there was nothing special about having this knowledge, lowered the barrier to technological citizenship and engagement. The Fixers Collective hoped to empower by scaling down the intimidation factor connected to getting hands "dirty" in the inner workings of the objects participants owned. Repair Cafés worked to foster a similar dynamic, and in some instances, they have had repeat visitors become themselves part of the fixing group. Alex explained how the Repair Café and their skill-sharing practices have had long-term effects on some attendees. "I know a few people who, after they visited the Repair Café, tried to repair other broken stuff at home themselves."[410] One

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[408] Ibid.
[409] IF, interview by author, Skype interview, United States, November 13th, 2016.
[410] AL, interview by author, TU campus, Graz, Austria, February 15th, 2017.

case involved not only skill acquisition, but also esoteric knowledge on the Internet and knowing where to acquire parts within Graz.

> One woman I know from Graz […] began fixing her mobile phones herself. Just because she saw it here – […] that she can look up the instructions on the internet and YouTube herself. She knows where to find the replacement parts in Graz. It's the same place where we send our visitors to, to get the replacement screens and buttons and cases. And she just tried and succeeded.[411]

Other success stories include participants who later became more deeply embedded in the Repair Café community to become fixers. "We have a few. It's not the majority but I think 15-20 percent or so."[412] Even just this small number was larger than either the Repair Café in Vienna or the Fixers Collective in New York City, where the fixers are people in the local community who have been tinkering and fixing their whole lives.

When establishing empowerment practices, fixers have to be careful about the nuance of different expertise and capabilities in attainment or interest in particular knowledges. Attempting to articulate how empowerment comes from knowing how to bring together tools and knowledge, Isaiah stated: "but outside of that, there's nothing *special* about just having that knowledge. Of how to fix it. Having the tools needed, and understanding how to combine those to actually fix your problem, that is the most empowering part."[413] Empowerment comes through knowing how to use different sets of knowledge in relation to one another. The issue remains, however, that the ways in which each fixer teaches the knowledge and demonstrates how to use the tools affects the ease of access or possibilities of empowerment for different users taking part. Any background knowledge or experience users might have with tools or the objects they own also affect

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[411] AL, interview by author, TU campus, Graz, Austria, February 15th, 2017.
[412] Ibid.
[413] IF, interview by author, Skype interview, United States, November 13th, 2016.

this greatly. Making it seem simple, or downplaying the numerous variables involved to get the knowledge and gain access to the tools, erases the power structures involved in expertise and previous familiarity with tools. Thus, it is important to fixers to introduce this narrative in a nuanced and sensitive manner – more in terms of "I have this expertise and you can have your own too – let me help you get there" rather than "this knowledge is not hard." From my observations, members lean toward the former rather than the latter dynamic, involving participants by explaining things in plain terms while fixing alongside one another.

By creating a collective and community atmosphere to tackle these issues, these repair groups make a unique contribution to how we deal with skill-sharing and care of objects. Instead of telling participants to go figure it out at home via YouTube, and to buy their own tool-set, the Fixers Collective and Repair Cafés create a social environment, or *community of practice*, through which to gain knowledge and feel supported in such endeavors. Often a fix will take more than one set of hands, or more than one head, to complete. In one instance, unscrewing a broken part required not only a screwdriver, but a stronger grip, and finally the effort of two people. "So it took us maybe 3 or 4 tries, and we found a solution where maybe one of the fixers was holding the tools with a vice grip and then I was holding the table leg with another grip and then by force we were able to separate the screw inside it."[414] These moments demonstrate the very social and convivial moments that are essential to the fixing sessions.

Members of the Fixers Collective also impart a meta-knowledge about how devices move in the world and their relationship to the participant, the acquisition of

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[414] IF, interview by author, Skype interview, United States, November 13th, 2016.

which they also view as empowering. Vincent cites that sharing knowledge which opens

up choice and informs decision-making practices in how to care for or dispose of objects

is a goal for the group.

> I think empowerment gives you the ability to decide on your own terms how
> you want or do not want to use an item. Like this Playstation 3 here under
> my arm with the sign "As Is" could have been donated by somebody who
> really, really wanted the latest and greatest stuff and maybe bought a PS4.
> OK, that's great. Somebody else who is maybe a PS3 fan […] may want to
> hold onto it, and preserve it as long as they can. So, if they knew how to fix
> it, take it apart, and diagnose it, that gives them the chance to extend the life
> of their items.[415]

The ability to extend the life of an object connects to this form of empowerment, having

personal control over this rather than at the whim of engineered planned obsolescence.

But empowerment also comes in deciding how to use an object and when to fix it for

continued use. This involves the ability to decide if it is worth the effort, time and energy-

wise, to fix an object in relation to one's life situation and attachment to the object.

This meta-knowledge of the situation and context that factors into owning a

device also connects to knowing how things work. And that was an attribute that fixers

had in common – their curiosity in exploring the inner workings and function of devices,

and, in turn, how these objects and devices related to the greater world. Imparting

knowledge gained from this interest, or the meta-knowledge of being able to discern and

find out how something works, was another dimension of empowerment that fixers

identified as important in their interactions with participants. As one fixer, Darin, related,

they were interested in "empowering owners of technology to know how their devices

truly work. Understanding how to make it work for them, and when it doesn't work, how

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[415] VL, interview by author, Dunkin Donuts, New York City, New York, March 19th, 2016.

to make sure it does."[416] Not everyone wanted to get deeply involved in the fixing, and

fixers recognized this. They hoped to at least make that world more available and

accessible to their participants, empowering them to decide how much they did or did not

get involved in maintenance work for the objects they own.

> The tension between wanting to empower but not enforce participation, was

brought up by Isaiah as he talked about helping a session attendee.

> the second time was just teaching her – hey this is your computer, you own
> this device. […] Not that you should be able to fix it because by no means
> do we expect everybody to know how to fix something that they own, but
> if they're willing to learn, […] we'll help them with it.[417]

This attitude was key for the Fixers Collectives and Repair Cafés – that they did

not expect, demand, or require everyone to know how to fix the object that they

brought. They did not belittle or talk down to people who were anxious to use

tools and physically engage the fixing process.

> Vincent talked about giving agency back to the consumer to decide what happens

with their device, but he also touched on the agency of the device as well – its role within

the participant's life and in relation to staying in use.

> […] because there is a lot of manufacturing and design energy put into it.
> The thing is, when you shred this [device], a lot of stuff can't be recovered
> anyway.[418]

The Fixers Collective worked to create awareness about the agency that objects have in

the world, and that their demise or 'shredding' affected the waste stream and had more

implications than we might realize in the moment of tossing or recycling. They

highlighted how technologies, their manufacturing standards and the resulting e-waste,

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[416] DC, interview by author, Google Hangouts interview, United States, December 6th, 2016.
[417] IF, interview by author, Skype interview, United States, November 13th, 2016.
[418] VL, interview by author, Dunkin Donuts, New York City, New York, March 19th, 2016.

had the capability to 'bite back.'[419] By acknowledging this ability for technology to have

such negative agency, fixers and repair groups opened up different narratives for

remediating or lessening the impact of this bite. This sentiment connects to the

scholarship of feminist new materialists, who argue for greater attention to how matter

comes to matter. In a very real sense, the Fixers Collective wanted to work *with* the

objects, not against them. This is illustrated by many of the fixes enacted, but especially

by fixing an electronic paper shredder with a mechanical crank. It assumed more effort

and labor from the person operating the paper shredder, and demonstrated a certain type

of socio-material improvisation that values different variables other than speed as

efficiency and the best instantiation of technology.

Conclusion: The Struggle for Cultural Shift through Multi-level Resistance

The main goals of the Fixers Collective and Repair Cafés were to create awareness and a

cadre of repair enthusiasts as a means toward shifting mindsets about technology

production, use, and maintenance. Their practices were entangled with objects,

community, environment, consumer needs, and their abilities to enact accessibility,

inclusion, and empowerment through cultivation of care practices within and extended

through object-owner relations. Their goals were socio-culturally, infrastructurally,

legislatively, and technologically focused on establishing an epistemic culture that

reframed how society related to technology production and use. This came out in how

fixers embraced an apprentice-type relation to technical knowledge, enabling person-to-

person or person-to-group social learning dynamics. They were also committed to

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[419] Zsuzsa, "From Risk to Waste."

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broadening engagements through the incorporation of different skill-sets and means for involvement. Via the focus of their practices on fixing, they tapped into lowering barriers for participation in technology-based cultures in ways more accessible than the encouragement to fabricate. Everyone at some point in their lives has a broken object; whereas not everyone has an idea, project, or desire to innovate via makerspace facilities.

Through joint educational measures, repair and fixing groups hoped to cultivate an active technological citizenship, even if that only entailed taking and establishing a decision-making process for the user in relation to the device and not physical engagement. According to Vincent and other fixers, informed decisions helped the consumer, but also the environment, and helped to spread awareness about how the system could, and should, shift in relation to consumer cultural practices. Their co-optation of resources associated with the dominant discourse, such as hackerspaces and promotion via Maker Faires, highlights how fixing and repair groups engaged the dominant discourse. This also demonstrated how they enacted a multi-institutional approach at the meso-level, which is further demonstrated through macro-level engagements in their hope to "scale-up" practices toward policy and legislative reform.

These convictions connect to Marres' call for material participation on various scales, as well as Frankenfeld's technological citizenship wherein citizens and community members have more involvement in technological change, adoption, and innovation.[420] It also reflects Slade's call to action for consumers to start acting accountable for their practices in this regard. Material participation, technological citizenship, and accountability all lead back to the question of care: how do we care for

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[420] Frankenfeld "Technological Citizenship."

objects and for the environment out of which they came and to which they will go back? Who is affected in the long-run? And how can consumers and citizens take a more active or hands-on approach to questioning the norms in these regards, as not only a "Matter of Concern," but as a "Matter of Care." In theorizing Matters of Care in dialogue with Latour's Matters of Concern, Puig de la Bellacosa astutely points to accountability and responsibility. And while she is talking about a specific example, that of the SUV and caring for transport systems, it maps well onto the practices of the fixers.

> This version of caring for technology carries well the double significance of care as an everyday labour of maintenance that is also an ethical obligation: we must take care of things in order to remain responsible for their becomings.[421]

This responsibility, and how it plays out in the collective educational practices of fixing and repair communities, is an instantiation of Boler's "collective witnessing" toward critically engaged pedagogical approaches. In this sense, participants are made to acknowledge their own positionality and how they are accountable to certain cultural norms around technology use and development, while at the same time seeing these positionalities as collective and formulated in concert with other people, objects, devices, practices, and ideologies.

On the local scale, repair groups want to establish a community of people who are comfortable using commonly or readily available materials and tools to enact care for the objects they own. In turn, they hope these enthusiasts will teach others to open up their technology black boxes, creating a multitude of communities in the maker network who supported repair rather than acquisition of the "next new thing." Reframing cultures of

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[421] Maria Puig de la Bellacasa, "Matters of Care in Technoscience: Assembling Neglected Things," *Social Studies of Science* 41, no. 1 (2011): 85-106.

consumption, not only do they hope to set the tone through public awareness, but they also want industrial standards to change. In these efforts, the Fixers Collective and Repair Cafés worked toward more sustainable manufacturing practices on a larger scale. Through consciousness-raising techniques, community-building, and workshops, they hoped that core interest could be built, in turn putting policy and legislative initiatives to reduce consumer waste at the corporate level within reach.

Their multi-institutional approach to mobilization efforts also reveals dynamic patterns of engagement, demonstrating a wholly different way to engage technology than typical Maker Movement fabrication leanings. However, they are not trying to replace or downplay other narratives within the mix. Instead they are interested in cultivating heterogeneous narratives, demonstrating how their practices are an important part of maker discourse – both in dialogue and in a critically engaged stance of dominant fabrication endeavors. Instead of competitively replacing and completely setting the tone of the field, they hope to work collaboratively with the Maker Movement, presenting at Maker Faire and other such events – symbiotically enrolling their resources and participants to take part in their own collective actions.

An epistemology of repair is built and enacted through fixer communities of practice, which demonstrate their politics through action and through education. Yet the boundaries of these communities are permeable. In their practices, they work alongside and with participants, constructing an experience of the object and a form of knowledge that is particular to relations between themselves, the participant, and the artifact. They take seriously the implications of electronic waste, and possibilities for technological citizenship to lessen such issues. However, more than making great impact on the waste

stream and reclamation of objects in their sessions, they are hoping for a cultural shift. They want to build consumer awareness of fixing practices, the efficacy in repairing devices, and the possibilities of legislation through the Right to Repair. Instantiating a community of practice that values care they enable asset recovery, bricolage, making do, and slowing down in an accelerated world. Thus, fixer groups reveal an epistemic culture different from typical production and innovation-centric technology development. Yet they are still highly invested in possibilities for innovation and shifts within the realm of technology production.

While legislation is important for proliferating and shifting practices of how to deal with e-waste reclamation, another goal of the Repair Association is to connect like-minded small business owners, fixers, repair collectives, and repair enthusiasts pushing for an aggregate shift in consciousness of consumer asset recovery. The ability for fixing and repair groups to successfully lobby and argue the case for shifts in sociocultural and industrial production practices may depend more upon their own ability to claim a unified front as a social movement while trying to shift policy and are starting to engage the political sphere. Focusing on the sociocultural impacts of specific groups within their ranks at the local level, I argue that fixers, much like feminist hacker collectives and library makerspaces, instantiate a social movement not by targeting the state and proposing shifts in legislation, but mainly by targeting sociocultural practices. This entails cultivating awareness through workshops, social media accounts, public demonstrations, and appropriating interests in the Maker Movement trend to talk about the negative sides of production and industrial waste negligence worldwide.

Fixers embody a standpoint epistemology of repair, demonstrating "how collective actors work or how cooperation and competition between collective actors actually structures fields."[422] At the level of technical practice, skill-sharing, and knowledge production, repair and fixing groups demonstrate how knowledge-making strategies shape collective action. Since the Fixers Movement specifically, and the Maker Movement tangentially, is based upon producing and sharing knowledge, fixers demonstrate what Jamison and Eyerman call hybridization of new roles toward new organizational forms for technical change that "bring […] together . . . social roles and forms of knowledge that were previously separated for one reason or another."[423] Fixers bring together citizen consumers, repair enthusiasts, technologists, and critical consumers to create a new hybrid public that aims to make broader cultural shifts by intervening in corporate consumerism.

Like my other two other case studies, fixers and repair groups focus on various issues regarding technology-based knowledge, skill, education, and awareness. When they focused on specific power dynamics or sociotechnical problems, they were not always concerned with accessibility, inclusion, or empowerment. But by creating alliances and networks to connect across difference, these heterogeneous narratives could flourish and help to instantiate different forms of accessibility, inclusion, and empowerment for different needs and publics. As Coburn demonstrates in his book *Street Science,* focusing on local environmental issues brought many different Brooklyn publics with various skills, knowledge, goals, and ideologies into conversation with one

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[422] Fligstein and McAdam. "Toward a General Theory," 19.
[423] Andrew Jamison, "Social Movements and Science: Cultural Appropriations of Cognitive Praxis." *Science as Culture* 15, no. 1 (2006): 45–59.

another.[424] They worked past differences and used their various expertise, experiences, and resources to build alliances and support one another toward shifting policy, mindsets, and industrial toxic pollutant practices.

Similarly, DiSalvo and Lukens explore collaboration across difference and the recognition of different knowledges or experiences of technology by creating a framework for critical technical practice and technical fluency. They demonstrate that different experiences factor heavily into design practices of technological systems, which need to take into account discussions of policy, legislation, lived experience, and regulation. With their design experiment Lukens and DiSalvo observed positive reactions from their participants:

> [T]hey exhibited an engagement with and a developing understanding of the social practices of technology development as a heterogeneous process involving multiple actors and skills.[425]

Fixing and repair groups do not answer feminist concerns or the concerns of librarians running makerspaces, and do not necessarily need to do so.

The more immediately tangible successes of these fixing groups in comparison to the feminist hacker collectives and library makerspaces, reflects how the normalized STEAM or innovation register is better supported than other alternative narratives such as feminist or communalist registers. Regardless of their hope to disrupt the dominant discourse and structures of material production, systems of power and domination, of hierarchy, still exist, and can still reproduce. This is also reflected in how the Philadelphia Maker Jawn struggles to continually garner funding with a more humanistic approach to their programming, but the DCPL Fab Lab – which is much more

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[424] Corburn, *Street Science.*
[425] DiSalvo and Lukens. "Towards a Critical Technological Fluency," 5.

technology-oriented – is more well-funded. Broader participation in fixing and repair

communities may also be due to how ubiquitous the problem of broken devices is within

society, and the growing awareness of how objects are being designed towards planned

obsolescence.

However, when examining the practices of fixer groups in relation to care, a

techno-liberal narrative is obscured to reveal productive mechanisms of accessibility,

inclusion, and empowerment related to care and maintenance. By enacting accessibility

through the creation of a "social learning environment," the Fixers Collective and Repair

Cafés demonstrate that community and social dynamics are just as important as the tools,

knowledges, skills, and physical infrastructure, to create a welcoming educational

experience within maker and hacker cultures. Lave and Wenger explain that immersion

into the sociocultural environment is imperative:

> A person's intentions to learn are engaged and the meaning of learning is
> configured through the process of becoming a full participant in a
> sociocultural practice. This social process includes, indeed it subsumes, the
> learning of knowledgeable skills.[426]

If there was any moment of being pushed out of the sociocultural environment,

participants would shut down, and might resist learning experiences. By focusing on

personal interactions, as well as material interactions of care, storytelling and concern,

fixers fore-fronted the social and cultural entanglements of technology.

Working to demystify the role of Apple geniuses as expert, fixers hoped to lessen

barriers which information technology elites often reinforce. Yet in other ways their

ideological frame, and the epistemic culture that it constructs, reinforced this narrative;

one reason some fixers participate is to foster playful tinkering practices and technology-

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[426] Lave and Wenger. *Situated Learning,* 29.

based experimentation that will eventually lead to globally competitive engineering and innovation practices within the US through the creation of credentialed workers. For many fixers, their goal still came down to helping their community's sociocultural positionality – and they saw waste reclamation as the forefront of the innovation landscape. They argued that the path toward innovation was not just one of making, but that fixing and repair, especially for the understanding of technology. If people were not exposed to repair cultures, fixers viewed it as a loss for future engineers and technologists. One way to interpret this tension may be to recognize fixers as enacting what Scott calls "everyday forms of resistance."[427] In this sense, those caught in a systemic oppressive power structure that they cannot escape might use the dominant script to make a subversive critique.

These repair communities are creating a space for interventions on a small scale, employing tactics that involve fixes which work around the proprietary nature of certain technologies. They attempted change at the macro-level of legislature, but often big businesses, such as Apple, have intervened and prevented change at a higher level. This is where the importance of a multi-institutional approach to keep such communities and movements active became clear – and the importance of everyday resistances and tactics toward sustaining heterogenous narratives was elucidated. By keeping strong at the grassroots level, fixer and repair groups demonstrated the importance of micro-actions to enact awareness and change. As Scott theorizes in *Weapons of the Weak*, it is not the huge uprisings and revolts that have moved worlds, but instead the small incursions and

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[427] James C. Scott, J.C. *Weapons of the weak: Everyday Forms of Resistance.* New Haven and London, Yale University Press, 1985.

jabs used to critique and subvert the hegemonic and oppressive systems in which everyone is caught.

CHAPTER SEVEN: CONCLUSION

In this concluding chapter, I address my research inquiries, discuss the implications that the politics of care might have for the Maker Movement as well as greater cultural narratives, and describe how my dissertation contributes to the field of STS. Within my third chapter and throughout my dissertation I have worked to answer the question, *in what ways do groups on the margins of the Maker Movement formulate narratives about technology development and how do they position themselves in relation to the dominant discourse in technology-based cultures?* While the third chapter provided an overview of the dominant frame against which my participants within my research sites developed their own practices, their dialogue with the dominant discourse is addressed throughout my empirical chapters. In each group, I have identified various mechanisms through which they trouble the typical Maker Movement or hacker culture narratives that prioritize technology and the "next new thing" above all other aspects. They reveal this as an impossible priority, demonstrating that the social interactions within their collectives, their environmental design as well as their design of skill-sharing, are always already caught up in their technology use, development, and framing. Thus, the culture of the space, and its community of practice, will affect the kinds of things and relationships produced.

By focusing on the politics of how these groups enact care, I reveal tactics to unsettle or rethink technology-based practice, and the power relations involved in care practices. Unsettling care considers how actions in its name might produce negative effects, or uneven power relations – tied up in the comforts as well as discomfort of technical expertise. The groups I characterize in this dissertation enacted practices of care

and tactics to disrupt the dominant discourse. This unsettling led to heterogeneous

narratives undergirded by different epistemic cultures related to technology. I use the

term heterogeneity here since it establishes diversity and difference, and a landscape of

which the dominant discourse is still part. It implicates the possibility for multiple

narratives with differing levels of interaction or influence rather than a mono-culture or

hegemonic technology culture. Not a this or that, but multiple experiences that can exist

at the same time, can be entangled, and are part of the same technosocial landscape.

A focus on epistemic cultures reveals the material, discursive, and organizational

forms that allow for diverse modes of knowledge practices. By characterizing the

machineries of knowledge construction and knowledge sharing that attend to care in

various ways, I reveal that an epistemic plurality exists which the dominant Maker

Movement discourse often tries to control. In varied ways that connect to the cultures in

which these groups are situated, alternative maker epistemes entail diverse tools,

practices, platforms, and mechanisms through which to enact the knowledge of "making"

– a process they in turn hope will enable accessibility, inclusion, and empowerment. I

observed how heterogeneous narratives were established through different forms of

collective action which participants performed to stake their claims of democratic

material participation – in a move to establish equity for people with diverse types of

knowledge and cultural backgrounds so that they might shift power dynamics in

technology production and development – however local that scale might have been.[428]

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[428] The question of whether 'material participation' was relevant to my work was addressed by Dr. Carl
DiSalvo in my dissertation defense. His thoughts were that my exploration of tactics and local actions to
create heterogenous narratives of technology was in fact at odds with the concept of 'material
participation.' Or at least in the way it is currently theorized by Marres and others as a taking over or
changing the dominant frame and larger institutions rather than employing tactical and local measures.
Thus, Marres' 'material participation' is in reference to large-scale policy and the democratization of
technology production and use more broadly. It seeks mechanisms to be put in place for broader

There were typically two ways in which each group dealt with the dominant discourse of STEM-centric maker rhetoric. In the case of library maker programming and repair groups, they often co-opted maker rhetoric to garner funding, to promote awareness regarding their practices of innovation and entrepreneurial-focused technology cultures, and to establish relevancy – while in fact critiquing the dominant discourse and establishing new cultures of technology development and use. Meanwhile, feminist hacker collectives worked to establish themselves outside hacker and maker cultures, developing different narratives and physical infrastructures. They hoped to build alternative technology-based cultures with practices that provided visibility and voice for marginalized communities such as female-identifying people, people of color, and those with different knowledge sets. They leveraged exclusionary practices, such as creating female-identifying exclusive gatherings, to establish stability before re-engaging the dominant discourse. Both sets of practices within these groups, however, worked toward redefining technology and technical practice.

My second research question – *How do inclusion, exclusion, and empowerment manifest differently among alternative maker and hacker groups on the margins of the Maker Movement?* – arose from my search for alternative narratives of making and hacking, and the tactics through which they enacted local material participation. In my first case, by talking to, observing, and thinking with my informants about what makes a hacker or maker collectivity at its core *feminist*, I delineated how their practices were

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participation. My own work explicates practices that are more disruptive and insurgent, and which do not necessarily want to scale up or overtake the greater narrative at hand. For some, particularly feminist hackerspaces, scaling up would be antithetical to how they are structured, or their end-goals. Such a correlation might make more sense, however, for repair and fixing communities. I am still grappling with this point and what it might mean to refocus, let go of this concept, or work to redefine its bounds.

affected by their positionality within the greater Maker Movement as well as at the margins of dominant technology cultures. This included attention to the politics of care in technology-based practices; an acute attention to comforts and discomforts within the design of their spaces and programming – physically, emotionally, and culturally – and a recognition of and interest in cultivating alternative narratives about what counts as technology, what it ought to be and do, and how it moves in the world. The ways in which these groups conceptualized and operationalized accessibility, inclusion, and empowerment practices resulted in alternate conceptions of the types of knowledges, skills, and capacities that inflect and are in turn constructed by technology-based cultures. Feminist hacker groups demonstrated a type of "for us by us" mentality, but with the hope that others beyond their small groups might garner inspiration or be able to utilize their projects, practices, and theorizations. They also established a feminist standpoint epistemology approach that affected the methods they employed and the resulting capacities for inclusion, accessibility, and empowerment for different people.

Meanwhile, the library makerspaces cultivated a standpoint rooted in outreach to an external community via the work of volunteers and staff – who are really a hybrid of educators, social workers, community activists, fabrication technologists, librarians, and information technologists. In their super hybridity, which integrated so many roles, those running and involved with library makerspaces remain bound both to the traditional conception of a library and to new instantiations that inflect the kind of maker programming that happens in their spaces. The common rule of access to information and broad participation within the US public library system affected the ways in which they spoke about inclusion and accessibility, and the ways they enacted such rhetoric inflected

their own definitions and valuations of care. Often, such mechanisms were built into the design of their programming. Technoliberalism still dominated as the major framing device for arguing the relevancy of such programming to the library institution and society at large. However, by analyzing organizational and sociocultural dynamics tied to care, I found an alternative narrative of how staff and librarians enacted tactics to reframe maker programming within bureaucratic institutions.

In a similar co-optation, the Fixers Collective and Repair Cafés used technocentric discourse, inflected by different valuations of care, to shift perspectives on technology and the skills involved in technology use or development. They also used the resources, events, and participants of the Maker Movement to promote their own actions. Like the library programs, they provided a service, but this was also caught up in sharing knowledge, recognizing different forms of knowledge, accepting the knowledge held by attendees, and the addressing the effects that objects and materiality had on knowledge production, acquisition, and dissemination. In this sense, they de-centered the individual toward collective knowledge sharing and practice. They established communities of practice tied to diverse material cultures and maintenance instead of fabrication.

In my analysis of all groups, I observed different enactments of care as a centering force that shaped the practices, feelings, and mindsets of group members in relation to technology. I found that by analyzing the politics of care, I could characterize a different narrative regarding instantiations of accessibility, inclusion, and empowerment. I explored myriad dimensions of the differences across groups. This involved following micro-interactions and knowledge-production as well as knowledge-sharing mechanisms which characterized the epistemic culture of each group. Some

dimensions that I examined included varying resources, resource management, obdurate infrastructures, types of technologies used, specific locations, alternative narratives of knowledge development and acquisition, as well as the reflexivity that the groups cultivated in their relations with one another. I explored how these cultures played out as inclusionary, exclusionary, and respondent to the diverse cultures that current or future participants might come from, and further cultivate through the group or space.

Through interview and observation, I identified a variety of practices including sharing of food; "warming the space;" attending to cleanliness and organization; making knowledge available in different forms; having a dedicated greeter to enact the sense of welcome; recognizing non-technical skills and knowledges as important to the collective dynamics. I also observed how all groups created an atmosphere of aggregate expertise where knowledge is collective, cumulative, dynamic, and not something held tightly by autonomous individuals – allowing people to cultivate diverse reasons for which to engage the technologies within and without the space. These practices made way for an understanding that different populations have unique needs or reasons for enacting maker, hacker, or fixer practices, and established a willingness to work across differences. In their own ways, each site focused on the participants' situations, stories, contexts, and connections to others and greater society.

At the same time, their practices were also particular to their locations and the established discourse and cultures of libraries, repair communities, and feminist activists. According to these dynamics, the practices of each group revealed different politics of care in relation to technosocial landscapes. I explored politics by looking at the types of technologies associated with each group, and the subsequent knowledge and skill sets

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required to engage with these technologies. I noted that power relations were often reproduced due to a focus on digital fabrication, but some groups troubled digital and technocentric power relations by recognizing the interest in and importance of other technology endeavors such as fiber arts, wood-working, sound recording, screen-printing, cooking, and video production. Thus, some technology practices and associated skill-sharing helped to foster a different kind of inclusive, accessible, and empowering dynamic. These types of technologies and diverse ways of employing technology were most prevalent among the Philadelphia Maker Jawn initiative and feminist hacker collectives. Other groups appeared to raise barriers of participation via digital measures regarding interest, digital tools for signing up for courses, and a focus on CNC machines for both digital and material fabrication. Yet, technology use, tools, and cultures shifted over time, especially at the DCPL Fab Lab and Albany Made, where staff began to recognize the interest in and importance of the fiber arts within the communities they served. After assessing the internal dynamics of these groups by observing micro-interactions and analyzing interviews, my final inquiry scaled out to observe shifts in the greater mechanisms that each epistemic culture or internal dynamics might provoke – which I attend to in my implications section.

Toward Hetereogeneous Narratives of the Maker Movement

The possibilities for making as caring, and the politics of care enacted through making and hacking, offer compelling alternatives to dominant narratives surrounding what making is and how it works. To examine these alternative narratives, and demonstrate the heterogeneity of the field, I sensitized my data analysis to the politics of care enacted with attention to comfort and discomfort. In doing so, I noted how each group dealt

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differently with accessibility, inclusion, and empowerment in terms of human relations and the interactions among humans, infrastructures, and technologies. All three case studies also took on various positions relative to the dominant discourse of the Maker Movement – they appropriated, broke with, or otherwise subverted the dominant technology-centric discourse.

In my research, I paid attention to different forms of collective action taken by my participants. The actions, and the technologies, communities, individuals, and ideologies that groups on the margins of the Maker Movement cared for revealed the dynamics of power entangled with hoped for democratic participation. Working at many levels, library maker programming and repair groups employed a multi-institutional approach toward movement building. At the micro and meso levels, these groups transferred critically-engaged skills to groups and individuals while also sharing resources with similarly-aligned communities. They also strategized to shift institutional and corporate mindsets regarding their technology development practices through the push for legislation and funding opportunities. Meanwhile, feminist hacker collectives worked to establish alternative infrastructure on the micro and meso levels, self-organizing events and spaces while also creating extended networks toward building a cultural movement that embraced and redefined technology-based cultures. In this sense, they worked toward a reconstructivist, and not just critical, approach to technology practices.

Makers in all three case studies leveraged their own resources to help other individuals, hubs, or groups within their networks flourish. This was accomplished not only by sharing best practices, but through personal engagements and contacts, the running of collective workshops, sharing of space, and engaging in ongoing dialogues

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about technology and sociocultural practices. In these spaces, my analysis of the politics involved in comfort and discomfort as well as inclusion, accessibility, and empowerment practices revealed power relations embedded in who was enabled to care in what ways, for what, and towards what ends – as well as who stood to gain and lose out in these caring relations.

Collaborations across difference toward fostering accessibility were leveraged by library maker programs and fixer communities, but were a hard dimension for feminist hacker collectives to establish. Even though fixers and library maker programs engaged and encouraged marginalized communities such as those from different socio-economic classes and older generations, implicit barriers to participation persisted regarding gender and race – and sometimes socio-economic class – due to a focus on specific definitions of technology and "making." There is potential for dialogue and collaboration between marginalized communities, but such dynamics need to be more actively encouraged and established. One way cultivated by fixers and feminist hacker collectives was to employ a critical pedagogy focused on different forms of and experiences with technology.

As I further examined how each group established different care practices, I found that many of them hoped to establish empowerment through collaboration and collective care – particularly the feminist hacker collectives, the Philadelphia Maker Jawn initiative, and the fixing and repair groups. They also confronted personal and group discomforts regarding collaboration or technical practice instead of glossing over them for a smooth or non-disruptive engagement. Through collective practice, many of the groups established that different forms of expertise were diffused and sometimes circulated among the community members, that no one person held all the knowledge, and that no

one skill was better than any other. Collective practice also fostered a setting where it was acceptable to fail, to not know anything technical, and to thus have different or collective experiences and feelings associated with technology-based practice. Room was given for uncertainty, frustration, non-belonging, and doubt. Giving space for failure and historically contingent subject-formations of not only people but technologies and objects demonstrates space for Boler's pedagogy of discomfort in these alternative narratives of technology.

As I argued in the conclusion of each chapter, alternative technology cultures have differing intentions and needs. Feminist hacker collectives sought care of self and connective communities in relation to technology as well as autonomous technology infrastructures such as feminist servers. Library makerspaces emphasized care of patrons, care of the communities to which they belonged, and care to sustain the library institution. Fixing and repair groups pursued collective care of object-human relations, the development of practices to help others help themselves and their artifacts, and a desire to remake material cultures in a way that values care and maintenance. All enacted care of systems, objects, people, and the environment.

Broader Implications

My cases show that attention to care need not be grounded in everyone feeling safe and comfortable all the time. In fact, my analysis draws attention to the uneven power relations involved in care and how such framings are established. There is discomfort and witnessing involved as well as comfort. The specifics of who cares, what for, and why reveals power relations that, if openly talked about in relation to the Maker Movement,

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could help to identify practices toward de-centering dominant narratives instead of reproducing systemic power structures. As Bellacosa argues, a focus on 'Matters of Care' pushes for something beyond 'Matters of Concern' – which up until now I would claim has been the general practice for research on the Maker Movement.[429] It often comes up as a fascination, something of interest to take note of, something to be critiqued, but less so something to proactively engage in as a reconstructivist project.

With a shift toward a 'Matter of Care,' I would like to establish a more engaged practice in relation to the Maker Movement. This makes room for the practices of my informants who are invested in the cultivation of possibilities beyond the blatant technocentric and technoliberal downfalls therein. Instead, they are working to establish a third narrative beyond the tension recently pointed to by Lindtner, Bardzell, and Bardzell:

> We can pursue making as an avenue to increase participation and democracy in technology use and design, if we take what has been criticized as a naïve technosolutionist stance. Or we can take a critical stance and thereby risk abdicating our agency in contributing towards making's sociopolitical potentials.[430]

To say, "this is nothing different" does injustice to the interventionist and democratizing potential of different maker movements to open up technology-based practice. By providing an analysis which establishes the possibilities for moving forward with new framings of technology, care practices, and democratic participation, this dissertation reframes the Maker Movement from a going concern to an entanglement of "Matters of Care." Social movements should not reject "making" as a co-opted or problematic practice, but rather work to make cultural change through *care-ful* "making." As

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[429] De la Bellacosa, "Matters of Care in Technoscience."

[430] Silvia Lindtner, Shaowen Bardzell, and Jeffrey Bardzell, "Reconstituting the Utopian Vision of Making: HCI after Technosolutionism," in *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* 1390-1402 (New York: ACM, 2016).

implicated by my research, that means a *care-fulness* attuned to discomforts tied up in technology-based practice and highlighting the power relations in different practices of "making" – the intention being to shift those relations and create new space for various informal technology-based practices, pedagogies, and development.

In focusing on different dimensions of care and technology-based cultures, less-liberatory impulses, or ways in which these groups solidified, instead of broke with, hierarchies and inequities, also came to light. It is these issues to which scholarship and the Maker Movement should be more attuned when engaging any democratizing and liberatory possibilities in these spaces to achieve more nuanced and reparative analyses. As it stands, while barriers to material participation are lowered for some women, among library patrons, and for local communities interested in waste reclamation, the current lack of critical care mechanisms and deeper community engagement within these groups can entrench and reproduce dominant and oppressive technology cultures. This is reflected in fixing and repair groups admitting that the same participants repeatedly attend their sessions; the inability of many feminist hacker collectives to attract participation by other members of communities marginalized in ways other than gender inequity; and the STEM-centric, entrepreneurial, and digital literacy narratives with which library maker programs contend. By revealing systemic reproductions of power and establishing a dynamic of collective witnessing, maker groups on the margins may begin to address issues of inequity in relation to technology use and development.

Attending to the mechanisms by which these groups negotiated their place relative to the larger Maker Movement may open conversations for bringing their practices into other spaces, including informal educational settings and civic or citizen

science actions such as citizen sensing and social entrepreneurship. Such attention may even have implications for the transformation of more formal engineering education and technology design infrastructures. By having a core value that pays attention to the politics of care practices when instantiating inclusion, accessibility, and empowerment (whether that be through the set-up of physical infrastructure, social dynamics, how technology is defined, organizational structure, programming, or educational practices), both informal collectives as well as formal institutions might create a more heterogeneous and liberatory technological landscape.

Through this dissertation, I argue for the possibility of maker cultures, and technology cultures more broadly, to accommodate culturally responsive social justice endeavors while reflecting on the politics of care embedded in their practices. These effects are felt most at the local level, but through collaboration across extended networks, they could have farther-reaching impacts. This analysis of their work does not signify an all-encompassing shift, but instead a glimpse into 'what could be' and what technology development could achieve. These groups make the case that by framing their work as social justice, it is possible to rethink what technology development includes, could look and feel like, and what it could do. It is also a broader characterization of how informal community groups function and what their roles might be in relation to technology-based cultures and discourses, specifically regarding accessibility, inclusion, and empowerment.

Contributions

One of the main contributions of this study is to scholarship in the field of feminist technoscience and the politics of care. Most studies that use this framing examine

healthcare practices, the labor of care-work, and agriculture.[431] Thus, by looking at the

political implications of care as it is instantiated in the technology-based culture of the

Maker Movement, particularly groups at its margins, I extend this theoretical work. I

reveal narratives of not only comfort and caring practices, but also discomfort and the

power dynamics embedded within the preference for certain technologies, ideologies, and

social dynamics over others. Analysis attuned to the politics of care demonstrates how

different communities contend with the politics tied up in comfort, discomfort, and

difference in relation to accessibility, inclusion, and empowerment. Engaging this

feminist technoscientific approach, I contribute to ways in which such studies can

develop a reconstructivist dimension to STS research.

By using Knorr-Cetina's concept of epistemic cultures in the context of informal

public engagements of technology, I have extended the use of her work to case studies

beyond science studies and scientific practice. Knorr-Cetina has argued that such

extension is possible, but leaves that as work for other scholars to develop (her example

being the epistemic culture of banks). As related in my introductory chapter, Knorr-

Cetina defines epistemic cultures as "those amalgams of arrangements and mechanisms --

bonded through affinity, necessity, and historical coincidence -- which, in a given field,

make up *how we know what we know*."[432] While they do this with more colloquial

knowledge, such as how to use a screw driver or how to clean a headphone jack, I have

argued that the communities I studied exhibit epistemic cultures based on specific

mechanisms, skill-sharing techniques, tools for learning and making, and in turn stabilize

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[431] See Martin, Myers, and Viseu, "Politics of Care in Technoscience."
[432] Knorr-Cetina *Epistemic Cultures*, 1.

how knowledge is known and shared internal to their groups. This results in particular forms of accessibility, inclusion, and empowerment.

Broadly, all groups demonstrate an epistemic culture which shapes informal knowledge practice tied to the Maker Movement and which value care, local needs, community development, and situated collective knowledges. Specifically, each has an epistemic culture rooted in the affinities of the communities and participants which it encompasses. In this sense, the previously established cultures of libraries, feminists, and repair enthusiasts affect technology-based knowledge development and production, further inflected by participants who are also involved in various arts, academic, technology, hobbyist, literary, music, and engineering communities.

Each of my case studies demonstrate the ways in which the pedagogical practice of skill-sharing can shape the politics of inclusion and accessibility when a group is focused around varying dimensions of knowledge production, such as humanistic endeavors, social justice needs, maintenance, entrepreneurial endeavors, or technology development. There can be a mixture of these dimensions. As one example demonstrates, by focusing on humanistic endeavors, groups like the Maker Jawn initiative can focus on interpersonal dynamics and creative personal growth, developing collaborative and collective programs and technology-based practice toward shifting of power relations through creative practice. Overall, by bringing diverse kinds of maker groups into conversation, I looked at how makerspace creators are negotiating on-the-ground condensations of accessibility, inclusion, and empowerment into technology and knowledge practices.

I have also demonstrated how accessibility, inclusion, and empowerment are prefigured in the dominant discourse for a certain able-bodied, confident, and individualistic imaginary in advertisements and business promotions. Focused on autonomy, optimization, and personal growth, this configuration makes it difficult for nearly anyone to feel that they fit the maker stereotype, and does not reflect the actual nature of the people and groups involved in the Maker Movement. It promotes a lone hero narrative with a politics of no politics or a structure of no structure. This discourse erases the more diverse collectivities that comprise the fabric of maker and hacker cultures, and the focus on community development and sustainable growth without which these groups would not be possible.

In the proposition of universalism displayed in the "Everyone a maker" mentality, these projects present themselves as beyond time, place, and culture – and yet they are highly specific in the demographics of the users to whom they appeal. Typically, such branding tells the story of one-off projects with a "god's eye view" of culture and no connection to long-term projects that might connect to a particular need, community, or situation. Indeed, my research reveals that the open dynamics of such groups rarely consider how their physical and organizational structures do in fact create exclusion or marginalization in some regard. Claims of accessibility and inclusion are also negatively affected by the often technocentric focus within many spaces and groups – creating assumptions about which knowledges, populations, or forms of expertise have a stake in the development of the technological landscape.

While the issues regarding universalizing claims and a "culture of no culture" mentality have been explored in ethnographies of laboratory scientists conducted by

Sharon Traweek and Donna Haraway, I have demonstrated that framing technology and science as devoid of politics is a power move that also shapes informal education and skill-sharing settings.[433] This often results in deleterious consequences that are normalized and brushed aside as inconsequential because that is "just the way things are" – such as the experience of female-identifying community members in spaces such as Noisebridge and Foulab. By analyzing accessibility, inclusionary, and empowerment practices and the politics of care involved, I saw how my case studies both reproduced and troubled this dominant discourse.

My research was driven by a desire to disrupt this framing of DIY maker culture as techno-centric and apolitical, thus I chose to examine maker communities and groups that appeared from initial observations and research to have more socially-engaged practices and social justice priorities. As demonstrated in the theoretical section of my first chapter and throughout the empirical case studies, this project was directly influenced by and in conversation with Gibson-Graham's work toward a post-capitalistic economic theory, which specifically involves reading heterogeneity within a supposedly hegemonic system. Gibson-Graham argue that "… recontextualizing capitalism in a discourse of economic plurality destabilizes its presumptive hegemony."[434] They poke holes in the all-encompassing power that the discourse of capitalism entails by pointing to specific case studies and moments in which capitalism has failed and does not work. In so doing, Gibson-Graham hope to relay that Capitalism as a system is broken and that different economic structures are at play within and without its reach. As they describe

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[433] See chapter four for an in-depth description of Traweek's work and Haraway's extension of her conceptualization of a "culture of no culture."
[434] Gibson-Graham, *The End of Capitalism,* 15.

the aim of their book, I am reminded of my own parallel aim within this dissertation and

my research:

> In the hierarchal relation of capitalism to noncapitalism lies (entrapped) the
> possibility of theorizing economic difference, of supplanting the discourse
> of capitalist hegemony with a plurality and heterogeneity of economic
> forms. Liberating that possibility is an anti-essentialist project, and perhaps
> the principal aim of this book.[435]

While I am not proposing alternative economies, I argue that there are alternative

ecologies and epistemic cultures of knowledge production practices already at

work at the margins of the Maker Movement.

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[435] Gibson-Graham, *The End of Capitalism*, 11.

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