Power Up! Learning in a Hackerspace

Alex Megelas

A Thesis

in

The Department

of

Education

Presented in Partial Fulfilment of the Requirements

For the Degree of Master of Arts (Educational Studies) at

Concordia University

Montreal, Quebec, Canada

July 2014

CONCORDIA UNIVERSITY
School of Graduate Studies

This is to certify that the thesis prepared

By: Alex Megelas

Entitled: Power Up! Learning in a Hackerspace

and submitted in partial fulfillment of the requirements for the degree of

M.A. (Educational Studies)

complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by the final examining committee:

Prof. Ailie Cleghorn	Chair
Prof. Arpi Hamalian	Examiner
Prof. Ayaz Naseem	Examiner
Prof. David Waddington	Supervisor

Approved by _____
Prof. Richard Schmid, Chair of Department of Education

_____
Dean André Roy, Faculty of Arts and Science

Date _____

ABSTRACT

Power Up! Learning in a Hackerspace

Alex Megelas

This qualitative research project considers the acquisition of technological literacy in the lived, physical context of the Foulab hackerspace, a community of practice located in Montreal, Quebec.

Hackerspaces are an offshoot of hacker culture. They are physical sites (garages, lofts) where individuals who sometimes self-identify as hackers come together to share tools and knowledge, and collaborate on projects of a technological nature. As educational communities, hackerspaces are member-led and member-funded. Initiatives stemming from hackerspaces including computer programming, electrical design and small electronics projects.

Power Up! participants were six individuals, including the lead researcher, who all identified themselves as having experienced barriers to engaging with technology. The research objective was to see how (if) Foulab would contribute to participants overcoming their reluctances, successfully complete a project and in so doing, acquire mastery over the tools and knowledge required.

Participants were required to design and build a bicycle-powered electricity generator with the support of the Foulab membership, facilities and tools.

While the project was successfully completed, there were clashes between the lab and Power Up! project which prevented the project from being fully integrated into Foulab. The research project documents this and how, as a result, Power Up! grew into its own peer-based learning community.

Participants met at Foulab weekly for ten weeks. At the onset of the project, participants were asked to take part in a written reflection and a group conversation in order to consider their prior and current engagement with technology.

Participants then began to develop a methodology for working together that first saw them engage in research into the theoretical fundamentals of electrical conductivity and electrical project design. They then came up with a design for the bicycle-powered generator and gathered the tools and parts necessary to assemble it.

This process, and the participants' engagement with each other and with Foulab, was documented in field notes by the lead researcher. At the conclusion of the project, participants took part in a group discussion to reflect on the experience.

ACKNOWLEDGEMENTS

There are many people to whom I am indebted for their immensely kind and encouraging contributions to my educational journey.

I'd like to first recognize Heather Stephens and everyone at the Thomas More Institute for leading me to realize I was mistaken when I had thought that higher education wasn't for me after all.

Thanks, also, to Shirley Roburn for this talk we had way back when during which you asked me those questions that helped me come up with some core concepts that have stayed with me since. And to Elizabeth Hunt for sitting down for coffee years ago and valuing my thoughts and voices over the course of all these messy University of the Streets conversations over the years.

Thank you also to my committee members Prof. David Waddington, Prof. Ayaz Naseem and Prof. Arpi Hamalian, for their time and feedback. I'd especially like to express my gratitude to Prof. Hamalian for getting me to move past the imposter syndrome I couldn't quite shake at the onset and for encouraging me to stick with it and engage in research these past few years since.

To my supervisor, Dr. Waddington, thank you for encouraging me to apply to the program in the first place and for putting up with my sometimes lack of reliability.

Shout out to Jim, Andrew and Max for being rad and being my friends and being so inspiring with your very lives. I pretty much got into this whole project because of you

And lastly, thanks to Foulab and all its current and prior member for having created this incredible space and for having letting me engage with you these past few years.

DEDICATION

To Ana, my love, my people.

TABLE OF CONTENTS

TABLES

Introduction

The concept of power often has evil connotations, especially when it is used to characterize social relations. In the sense of directing and aligning energy, however, power is neither inherently evil, nor necessarily conflictual (though it can be both in specific cases). It is a condition for the possibility of socially organized action. (Wenger 2000, 180)

Power is used to create an effect – whether that effect be physical or otherwise. One person can be said to have power over another. To empower people is to increase their access to social or political power. It also refers to electrical current. To power-up in a computer game is to get an immediate increase in the abilities of your character.

In July of 2008, my friends the Avocado, Clever Duster and Jonesey[1] headed down to the Last HOPE conference.[2,i] All three of them like to build all sorts of different contraptions and have picked up this affinity and connected skills "along the way" without necessarily relying on formal education. Since the HOPE conference covers a great many of these related skills (from soldering to computer programming), it made sense for the three of them to head down and check it out.[3] While there though, they were introduced to *hackerspaces*, a significant and new development in hacker culture.

---

[1] Members of hacker culture often use handles when identifying themselves (i.e., on Internet bulletin boards). Handles are short nicknames that help hide one's identity while nevertheless allowing for individual distinction. Marco Deseriis (2011) writes about the significances of online aliases that allow for anonymity: "On the one hand, improper names empower a subaltern social group by providing anonymity and a medium for mutual recognition to its users". Except for project participants who consented to my using their real identities, I've changed the names and handles of all those we came into contact to whom I refer to herein.

[2] HOPE stands for Hackers on Planet Earth.

[3] I was initially going to head down as well, but then I went through a breakup and had to stay in town to move apartments and generally get my life in order.

Hackerspaces are physical sites in which individuals, who self-identify as hackers congregate to share tools, collaborate on projects, hold workshops and learn from each other. When my friends came back from NYC, they and some of the Montrealers they met while there, decided, along with some others,[4] to start up Foulab,[ii] a hackerspace.

Foulab was one of the first ten or so hackerspaces in North America although since then, hundreds of others have opened up. They are dynamic, fiercely autonomous communities, which allow for a wide variety of learning experiences and technological innovations. They are garages and lofts, chaotically filled with all sort of tools, discarded technology, and in-progress projects with varying degrees of usefulness and applicability. They are communities of practice and educational sites and as a social phenomenon, they are new in North America, and were widely popularized through the HOPE conference.[5,iii]

Forward two years. It's July 2010 and I was on a train with the Avocado and his seven-year-old son. They were on their way down to the Next HOPE conference and this time, since I had some vacation coming, I figured I would go with them. Though I didn't know much about technology, there were a lot of workshops at the Next HOPE that I was interested in and which both looked at hacker culture from a

---

4 According to Clever Duster, in an email exchange dated June 24, 2014, "Foulab wasn't so much started by 4 people that met at HOPE as by 4 people who attended HOPE (2 of whom met there—Hugo and max) and 6 others who responded to a series of emails and posts to mtl tech forums and blogs seeking help in organizing a hackerspace."

5 See Gui Cavalcanti's "Is it a Hackerspace, Makerspace, Techshop or Fablab?" for a breakdown of the history of hackerspaces, its emergence as a European movement and its eventual introduction to North America.

theoretical lens or considered its applications in a wider context.[6] I ended up having a great time of it; I learned how to solder[7] and pick locks and spent some time getting to know the Foulab members in attendance.

On the second day of HOPE, I saw in the programming guide that there was a keynote address by Julian Assange, the editor-in-chief of Wikileaks.[iv] Although this was months before Wikileaks' release of American diplomatic cables, there was nevertheless a lot of talk about them on account of their recent release of videos of air-to-ground attacks by American Apache helicopters on civilians. Julian Assange was sought by the American government and his appearance at the Next HOPE was cause for significant stirring. Expectedly, the room was packed and there was a palpable tension as a young man stepped up to the mike: "I want to start by addressing the representatives of Homeland Security at the front and the back of the room. I am not Julian Assange and I have no knowledge of his whereabouts. I am speaking on his behalf however. The only thing I have on me is my driver's license, some cash and a copy of the Bill of Rights" (Applebaum 2010). It turned out that the man was Jacob Applebaum.[8] Also involved with Wikileaks, he spoke passionately for over an hour about the hacker movement, stressing the need to recognize the political significance of hacker culture and to connect hacker resources and spaces to overarching social issues. It left me realizing that there is much more than

---

6 Amongst others, I attended a workshop on scientific considerations in cooking, on human rights abuse at the Vancouver Olympics and on hacking a classroom's educational environment.

7 I learn how to solder by assembling a drawdio: a very simple synthesizer invented by hacker and maker Jay Silver. It creates a sound based on the length of graphite in a drawn line.

8 Jacob Applebaum is also a co-founder of the San Francisco hackerspace Noisebridge.

pranskterism and tech-geekery in hacker culture. Later, when I discovered Etienne Wenger's work on *communities of practice*, I would come to understand my motivation as stemming from a recognition that the technological engagement that occurs in the hacker community connects directly to a wide array of contemporary social issues: "Communities of practice should not be reduced to purely instrumental purposes. They are about knowing, but also about being together, living meaningfully, developing a satisfying identity and altogether being human" (2000, 134). It was while in NYC that I decided that I would join Foulab.

The goal of Power Up! was to allow me and a small group of other people to learn 1) about electrical conductivity, 2) how to build a bike-powered generator[9] and as such gain greater confidence in using power tools and 3) from and with a hackerspace community where a wide variety of projects are being developed. In addition to these preliminary objectives, and as a result of repeated challenges in establishing ties between Power Up! and Foulab's membership, the project also documented the difficulties involved in negotiating the cultural boundaries of this community of practice. In the case of this project, these challenges would ultimately prevent us from fully integrating Foulab and led to Power Up! becoming its own community of practice. This emergence, and the gradual development of our group identity and a peer-to-peer support amongst the participants, is also documented in this project.

In this thesis, I will first describe Foulab: its space, membership and history. I will then provide a review of the literature pertaining to hacker culture and the educational mandate of

---

[9] A bike-powered generator, in its simplest definition, is a bicycle on a fixed stand that can generate electricity (power).

hackerspaces and will describe the theoretical framework that has informed my interest in this topic. I will then present the Power Up! project and the various steps that made it up as well as the conclusions it has led me to. My goal with this study is to shed light on the nature of technological literacy in the co-learning context of a hackerspace. I also hope that this study will contribute to introducing hackerspaces to a wider body of academic research interest.

For the sake of transparency, I want to mention that interest in this project stems from a direct and frequent connection with Foulab since its inception.[10]

Chapter 1: Research Objectives and Context

In this section, I provide an overview of my research objectives and the context in which it is situated: the hacker community in general and most specifically the Montreal hackerspaces Foulab. In that regard, I will provide an overview of what I mean by the terms hackers and hackerspaces and will describe the physical space, membership and culture of the Foulab hackerspace.

[10] In 2008, when my friends came back from the HOPE conference in NYC, they began to meet weekly at Café Chaos with other interested individuals. My first time connecting with what would emerge as Foulab was as part of my work with the Center for Community Organizations. I met on a recurrent basis with Foulab members to review with them the steps involved in starting a non-profit organization.

Power Up!: Research Objectives and Structure

My goal with this project was to consider the sort of learning that occurs in hackerspaces – a sort of learning that is socially and politically situated, collaborative and innovative. I was also interested in considering how I would personally change and grow (empower myself?) as a result of connecting with the hacker community. I therefore decided to act as both researcher and active participant and envisioned this as an ethnomethodology project driven by the personal narratives of the participants as they relate to their experience of the world and understanding of the role of technology within it.

During this project I aimed to consider how co-learning on a technological project can occur in a hackerspace. Power Up! was a case study of a co-learning cohort of which I was a member, as it designed and built a bike-powered generator in the greater context (physical, value-based) of a hackerspace.

My interest was related to wanting to learn about examples of community spaces and the extent to which they can facilitate personal development and social investment. As such, in Power Up!, I was curious to know how people from outside of hacker culture could interact with this model and could learn from (in) it through working on a collaborative project. I was also interested in using this project to acquire technological skills that I did not have before and hung on to the notion of "empowerment" - as a recognition that I would gain familiarity (power[11] over) with the tools I learned

[11] Power in this case is a reference to both social/personal power and electrical power.

to use while at Foulab and the technological notions that I would become familiar with. Given the predominantly male makeup of hackerspaces, and as the project evolved, I also became interested in considering issues of power and gender in the context of a gender-mixed learning community.

Most significantly, however, I was interested in delving into Foulab, a membership-driven environment which I have perceived as significant for its committed engagement with technology. Since first getting involved at Foulab, I've come to witness the significance of hackerspaces not only for the technological innovations they spearhead but also for the social relevance of their activities. While their primary purpose is to facilitate links between people and promote a sharing of tools and knowledge, they are also part of a social movement: a hacker culture that has a rich history of critical social engagement and anti-authoritarianism. The politically charged aspects of hacker culture contribute to further enriching what is a fascinating and complex learning environment. Ultimately, I see Foulab members as engaged in an attempt to make-sense of, and re-appropriate, technology as an increasingly complex and pervasive social force. I see their work as incredibly current and important.

Thematically speaking, my research deals with notions of power: social power and electrical conductivity and allowed the members of a learning community to learn about electricity, small-project engineering, co-learning and hackerspace culture. Although I did not have the knowledge to explore technology until recently, I have been interested in computers since I started playing videogames at the

age of 8 on a Commodore 64 computer. As such, I've decided to title my research Power Up! as a tip of the hat to early computer-game culture.[12]

Power Up! took the form of a case study of a co-learning cohort of six members (including me), as it got together every week for eleven weeks at Foulab to design and build the bike-powered generator. The members of the group initially selected were Anna, Zinta, Phil, Jennifer and Niomi. Jennifer left the project at its onset and was replaced by Alissa. As research investigator, I documented our process in terms of the exchanges between the participants and between them and the Foulab membership, as well as in terms of knowledge acquired and progress made on the bike-powered generator. This was done by observing and taking notes on the spot that I would later expand on in an online journal. Wenger's community of practice theory informed my methodology, as well as the use of learning circles in an educational context[13] and finally my own previous experiences in using various group facilitation techniques as part of my work. My goal in this project was to create a community of practitioners around a common goal: building a generator and to witness this process once they had been provided with the space and tools to complete this objective. In so doing, I was hoping to witness

---

[12] Powering up occurs in all sorts of classic video games such as Mario Brothers, Pacman and Mega Man.

[13] Susan Birden (2002) considers how learning circles can be a powerful means of allowing for participant empowerment in "Collective Transformations, Collective Theories: What Adult Educators Most Can Learn from the Boston Women's Health Book Collective." Birden references Paolo Freire and highlights the way in which learning circle participants who had gathered with the goal of mounting community projects, experienced significant personal shifts via their participation. Two organizations that promote the use of learning circles as a means of promoting reflections on social change are the Berkana Institute and the North Carolina–based Heirs Project. Berkana ground their work in the need for stronger communities and promote the exchange of practices amongst organizers from around the world. Heirs promotes the recognition and documenting of community organizing stories and organize co-learning circles that promote leadership amongst community organizers. While this form of co-learning is not related to the acquisition of technological skills, it is nevertheless collaborative in approach and recognizes the importance of relating learning back to social issues.

the solidification of ties amongst the Power Up! participants and their growing interaction with and hopefully reliance on, the Foulab community of practice.

At the onset of the project, all participants took part in a life-history interview. Questions asked were related to their previous experiences and perceived hurdles and enabling agents in interacting with technology – these themes were further addressed and recorded during a taped facilitated group discussion. After this, we worked weekly on the bike-powered generator for nine weeks and by the end, managed to successfully complete the project and build the generator. The participants met in December 2012 to take part in a conversation to reflect on what the experience had meant to us. We met again in January 2013 to discuss a workshop that we had agreed to hold to share our knowledge upon the completion of the project. This workshop was then held at Foulab on February 23, 2013 to introduce the project to the general public.[14]

Hackers and Hackerspaces - A Note on the Use of Terminology

The necessity of the clarification of terms such as hackers and hackerspaces is grounded in the fact that they are diversely interpreted by a wide array of social actors. In that regard, through using the term hackers, I refer to individuals who, through their actions and through their own documentation of their commitment, engage inquisitively and critically with technology. In so doing, I am interested in expanding on the simplistic and arguably biased representation of the hacker strictly as a social

[14] Appendix 2 shows a flyer designed by Zinta to promote the workshop.

malfeasant. My frame of reference in defining this hacker community is through my own engagement with a number of institutions including hacker publications, hacker conferences and through the conversations and correspondences I've had with members of hackerspaces and others who self-identify as hackers. "If you can't open it,[15] you don't own it" is a standard derivative of the Hacker Manifesto[v] written by a hacker known as The Mentor[16] (1986) and used by Foulab members to describe their purpose and which, in the simplest way, effectively summarizes a core commitment of hackers to understanding technology.

In using the term hackerspaces, I refer to spaces that purposely identify as such. According to Hackerspaces.org, a website "for anyone and everyone who wants to share their hackerspace stories and questions with the global hackerspaces community," hackerspaces are "community-operated physical places, where people can meet and work on their projects." Frequently, these projects will be technological in nature and may relate to: computer-technology, programming, electronics, electrical design or science. There are currently more than five hundred hackerspaces around the world[vi] and though they are largely autonomous, sites which identify as hackerspaces are arguably part of a global community (Tweney, 2009) and are as such wholly different from other named spaces with a technological literacy mandate such as makerspaces,[17,vii] fab labs,[18,viii] technologically-oriented

---

15 Presumably to play around in it, repair or learn about it.

16 Written in the 1980s, it proposes that hacking is a way to learn directly connected to frustrations hackers feel about the limitation of society and alienation they feel from it.

17 Defined simply as "community centers with tools."

18 The fab labs were first developed at the Massachusetts Institute for Technology as a means of exploring technological innovation at a grassroots-community level.

community groups, media arts collectives or cooperative garages.[19] These various institutions all have their own particular purpose, their own specific identities oftentimes developed in relation to the purposes of other similar sites. In that respect, hackerspaces are NOT markerspaces, are NOT fab labs. In an article on the Make Magazine website, Cavalcanti (2013) explores these varying identities and describes the differences between hackerspaces and makerspace by presenting Maker Media CEO's Dale Dougherty's vision of what makerspaces would come to represent:

> Dale Dougherty summed up the difference between making and hacking best for me during his keynote presentation at our How to Make a Makerspace event this past February; he said that before he founded MAKE Magazine, his original intention was to call the magazine HACK. When he presented the idea to his daughter, however, she told him no – hacking didn't sound good, and she didn't like it. Dale tried to explain that hacking didn't have to just mean programming, but she wasn't buying any of his arguments. She suggested he call the magazine MAKE instead, because "everyone likes making things."
>
> Dale's anecdote sums up how I feel about the term "hacking." To me, "hacking" and "hacker" are fundamentally exclusionary; whether they refer to the traditional act of programming to defeat or circumvent existing systems, or the act of working with physical parts, there's a basic understanding that "hacking" refers to a specific subset of activities that involve making existing objects do something unexpected. No amount of cajoling on my part will get a professional artist or craftsman unfamiliar with the terms to call themselves a "hacker," or their vocation "hacking"; in fact, if I were to say "I like how you hacked that lumber together into that table" to a professional woodworker at Artisan's Asylum, I would run the significant risk of insulting them.

[19] Any community may also contain numerous other spaces who explore this commitment in varying ways. In Montreal, for instance, we can also find a number of other spaces such as the fab lab initiated by the Communautique non-profit organization, the Anarchist Tech Support Collective working group of the Concordia University Quebec Public Interest Research Group, the Technoculture, Art and Games research group at Concordia University, artist-run centers with a technological mandate such as Eastern Bloc and Studio XX and the Koumbit collective which works with the Drupal open source programming language.

Evidently, different named spaces are named differently for a reason. They have different politics, purposes and memberships. And though these spaces (makerspaces, fab labs, etc.) are not hackerspaces, I argue that they are nevertheless all part of a somewhat cohesive whole. Frequently participants in one space will be participants in, or at least aware of, other spaces. And although the goal of this paper is not to pursue this reflection, all of these groups, networks and project can be said to be part of a greater, overarching hacker-maker social movement with a unique social commitment.[20]

Outside of their shared label and association with hacker culture, hackerspaces do not necessarily share a unifying set of characteristics and their work is not coordinated. As such, hackerspaces will likely differ from one another including in the affiliation of their respective members with political issues, their fee structure, their governance, whether or not they are registered non-profits, whether they are affiliated with academic institutions, etc.

Foulab - Its Space, Members and History

Foulab is located in a large, four story brick building in St Henri, a residential neighborhood, a few minutes southwest of the Montreal downtown core. From the outside, it's not much to look at – a

[20] When I think of Foulab, its history and its connection to an overarching technological social movement, I picture a Venn diagram. This helps me understand the extent to which this is an organic, member-driven community, whose members are in turn connected to a wide array of other projects, initiatives and structures who share overlapping concerns and strategies. If this Venn diagram were actually drawn, it would be highly complex – connecting to many organizations at best informal in structure and membership.

large, brick building showing some signs of disrepair. The building houses a variety of small-scale industrial workshops: woodworking studios, print shops and other small-entrepreneurial or artist lofts. Inside, there are brick walls and hardwood floors painted a utilitarian gray. It is somewhat dirty and there's a smell of dust in the air. Foulab is two flights of stairs up; Foulab stickers and black arrows drawn on the wall in marker ink show the way.

The first thing you typically see when you walk down the hall towards Foulab is an electrical sign with an arrow on it. It is a large, bright red, audibly clicking, blinking sign, hung across the hallway and pointing diagonally downwards towards the lab's double metal doors. When you open these doors and step inside the lab, you're usually engulfed in overwhelming chaos.

Inside the doors, right in front of you when you walk in, is a large, open area where people tend to gather at a rectangular amalgamation of four long tables around which upwards of a dozen people are sometimes sitting, typically working on computer projects – either typing away on laptop keyboards or tinkering inside opened computers.

If, from this point, you were to make your way in a clockwise fashion around the lab, you would first see, immediately to the left and adjacent to the lab's front door, several piles of empty Foubeer[21] bottles in varying states of orderliness – some are in cardboard boxes, many are not. Brand selection tends towards the cheap. When the stack of empties gets inconvenient enough to get around,

[21] Beer that is purchased by lab funds at the convenience store down the street and then sold for two dollars. When enough empties accumulate, they're returned to the store for the refund.

they'll be returned to the nearby convenience store and more Foubeer will be bought and will then be available for $2 to members and visitors alike.

Right to the left of the pile of empty Foubeer bottles, adjacent to the large central table and up against the far left wall are storage shelves, filled with miscellaneous computer parts and other discarded equipment and further along clockwise past that, the "Casse Populaire," a free-for-all grab-pile of discarded stuff – lengths of cables, empty computer casings, stereo-system components, etc. Next to that, further along the left-hand wall in the corner is a soldering station where lab members or visitors can be found hunched over small electronics projects, peering intently through magnifying lenses, surrounded by solder fumes.

Behind the lab's open area, opposite the front door and past the large central table, there is another table, this time stacked with desktop computer stations, 3-D printers[22] and assorted successful and aborted 3-D plastic creations such as glow-in-the-dark busts of Yoda, Foulab logos and random discarded masses of melted resin. Behind this, furthest away from the lab's front door and along the lab's back wall are visually impressive oscilloscopes, another 3-D printer and a CNC mill[23] used for 3-D etching.

---

[22] 3-D printing: literally the printing of objects on three axes using quick-hardening polymers. While 3-D printing has been a part of design engineering for some time, it is technology that is just now becoming financially and logistically accessible to the general public. I'm curious to see how hackerspaces will adapt and innovate on 3-D printing technology and combine it with open-source technology.

[23] Computer Numerical Control. An etching mill where the etching of wood or metal surfaces into computer-designed shapes is controlled through a computer interface.

To the right of the 3-D printers, in the right-most corner of the lab away from the front door, is a tools section, replete with another worktable, assorted power tools such as a band saw, a drill press and a grinder, storage shelves, lockers and hand tools and supplies.

Clockwise below the tools area is the lab's only closed off area, a lounge filled with sofas, chairs and car seats set up around cable spools repurposed as tables. Christmas lights and a disco ball light up when you turn on the lights and a stereo system is up against the right wall. Sometimes (but not always), a projector is set up.

Immediately to the right of the lab's front door is a refrigerator filled with Foubeer and next to it, a small, portable kitchenette. A few years ago, one member would sometimes hold weekly vegan feasts, but now it's mainly used by members who occasionally cook up late-night snacks. To the right of the kitchenette is a resource library of books primarily related to computer programming or technology. To the left of the kitchenette, and adjacent to the lab lounge is the lab's museum – a collection of old computers such as Commodores or early Apples.

Beyond the physical layout of the space, what stands out the most about the lab is the strong sense of "use": it is a dirty, lived-in and dusty space filled with projects in various states of progress or disarray. Surfaces are liberally covered with empty beer cans, beer caps, discarded plastic snack containers, pizza boxes and random technologically oriented items or construction materials. There is frequently music playing - oftentimes upbeat techno or punk rock. There are stickers and posters on the wall, and random visually stimulating projects hanging here and there.

If you're there on a Tuesday night, people in the lab range the gamut between intently staring at a computer screen while typing away and laughing loudly, telling jokes while drinking beer and eating pizza.

Foulab feels like the kind of space where if you inadvertently let something fall crashing to the floor or if you were to light something on fire by mistake, it wouldn't matter in the least. It doesn't feel like a "lab" in any traditional, sanitized and orderly sense of the world – it feels like a clubhouse, a gang hideout or a pirate cove.

Beyond its physical space, Foulab is also made up of 1) a website with the lab's coordinates, a description of its tools and resources and a list of upcoming projects and events that will be organized by lab members, 2) a lab wiki with information on lab projects and minutes of lab membership meetings, 3) an email list for lab users that acts as an important discussion platform for lab members, 4) an IRC channel[24] and 5) a social media presence on Facebook and Twitter. Frequently new initiatives are discussed on IRC and the email list that also sometimes acts as primary space for lab members to communicate with one another around coordinated projects, sharing of information or the airing of grievances. Co-learning at Foulab is sometimes loaded with tensions. I once witnessed an exchange on the email list between two members of the lab. It got heated fairly quickly and words were exchanged. Other members were conscious of this conflict and to varying degrees, attempted to help resolve it and while all members were aware of the tension, it did not overly affect anyone's capacity to work at the lab. On the few instances when I was present at Foulab when the two members were both there, there

[24] IRC is Internet Relay Chat – online protocols which allow for online chatting in virtual conference (chat) rooms.

didn't seem to be any significant tension and I saw the two of them having (admittedly brief) exchanges over lab issues. Presumably, such conflicts are part of the lab culture and we can assume that lab members despite these tensions see participating in the environment as advantageous.

Non-members interested in the lab typically get in touch using one of these communication methods, at which point a lab member will write back – either addressing the request or inviting the individual to come visit the lab and meet the membership on one of the Tuesday open-house nights.

The Tuesday evening open house is an important way in which Foulab extends the boundaries of its membership outwards, blurring them slightly to include interested parties in the outside world. This is interesting from the standpoint of communities of practice, a concept that I will discuss in more detail in Chapter 6.

> Communities of practice can connect with the rest of the world by providing peripheral experiences – of the kind I argued newcomers need – to people who are not on a trajectory to become full members. The idea is to offer them various forms of casual but legitimate access to a practice without subjecting them to the demands of full membership. This kind of peripherality can include observation, but it can also go beyond mere observation and involve actual forms of engagement. The periphery of a practice is thus a region that is neither fully inside nor fully outside, and surrounds the practice with a degree of permeability. . . . The ability to have multiple levels of involvement is an important characteristic of communities of practice, one that presents opportunities for learning both for outsiders and for communities. (Wenger 1998, 117)

I had initially hoped that Power Up! could play such a role and allow for a way-in for people to explore possible membership in the lab. However, as I would discover, the boundaries of a community are intricately linked to its identities. In our case, this would ultimately play a factor in preventing our full integration.

Despite the space's informal disposition, there are nevertheless clear delineations amongst the participants in the Foulab space. The Foulab bylaws name the organization as not-for-profit[25] and defines both lab users and members. Lab Members pay a monthly fee of seventy-five dollars and are given a key to the lab. They are also allowed to vote on organizational issues when regular meetings are held. Lab Members need to have their membership approved by the existing lab Members – which typically occurs via voting on the email list only after someone has contributed regularly to the space. A lab user pays a monthly fee of $50 and can come in to use lab resources whenever lab members are present. They are not allowed a vote during meetings, however. Some individuals are also allowed regular access to the lab under a "struggling hacker" reduced fee membership category primarily based on a per-case basis. In my past interactions with Foulab, I have witnessed a variety of discussions as to the merits or disadvantages of these approaches to membership and periodically, additional tiers of membership are discussed.

In addition to the membership categories defined by bylaw requirements, there are the lab members who are annually elected by the membership to hold executive positions on the lab board. These individuals are typically regular lab members who are frequent contributors to the space and whose participation as a board executive implies some amount of deeper and ongoing investment in the lab's affairs.

---

[25] While some hackerspaces in Canada and the US are strictly informal spaces, others are constituted bodies structured as non-profit organization – which then allows hackerspaces some leeway in their operational logistics such as the collection and management of membership fees in a bank account, obtaining liability insurance or signing commercial leases.

Beyond this, there are various other individuals who are implicitly part of Foulab – regular visitors to the Tuesday evening open house, lab founders who remain in contact through occasional visits or through discussions on the email list, former members as well as friends of the lab. This can include members of other hackerspaces or of other technological communities in Montreal and across the world with whom the lab has occasional contact and who may on occasion call on Foulab for support or collaboration.

Although Foulab members are individually connected to a wide and diverse array of groups and cultures that are all part of the hacker and maker communities, the Foulab extended membership is largely homogeneous. Over the course of the years that I've connected to Foulab, the large majority of the members I met were white, male and heterosexual-identified.[26] I mention this for the extent to which gender ended up playing an important part in how the Power Up! project interacted with Foulab.

Chapter 2: Literature Review and Theoretical Framework

In this section, I present an overview of the literature that documents the technological commitment and educational purpose of the hacker community and hackerspaces as well as the body of literature that has informed my understanding of the educational legitimacy of hackerspaces.

---

[26] Over the course of my involvement, I have seen Foulab engage in several discussions on the gendered nature of its space and whether, or how, to change in order to become more welcoming. Sometimes these discussions were instigated by a member-driven grievance, sometimes by a complaint from a visitor as a result of a negative interaction with a lab member or after witnessing an offensive gendered aspect of the lab such as, for example, sexist stickers. A first response to these grievances is frequently that the lab is for "everybody." The default position on the part of lab members is frequently that it is the responsibility of outsiders to get involved if they want to see the space change.

Literature Review

Research into hacker culture has been conducted by a wide array of researchers stemming from a wide variety of academic fields. Blankwater (2010) acknowledges the cultural importance of hackerspaces and focuses his work on challenging the "common depiction of hackers today … as thieves, criminals and event terrorists" (1). He supports this by citing the various examples of technological innovations that have been spearheaded by hackers and the similarities they share with critical and progressive social movements and most notably Do It Yourself (DIY) and graffiti culture. In fact, the representation of the hacker as a technological explorer and innovator is a recurrent aspect of the body of literature emanating from hacker culture. This self-perception of the hacker as an inventor and creator, someone who engages critically with technology primarily for the sake of personal betterment, is a constant in foundational hacker documents such as the publication *2600*, a key rallying point for hackers over the past 20 years is the publication *2600.*[27] The representation of hacker culture as promoting free and collaborative technology as a viable alternative to copyright and its legal backbone is further explored in *Free Culture,* by academic and activist Lawrence Lessig (2005).

Notably, this representation of hackers as creators and technological innovators and hackerspaces as sites for technological incubation is prevalent in the body of research into hacker

---

[27] In addition to publishing its quarterly publication, *2600* also organizes the HOPE conference and has promoted the holding of regular monthly *2600* meetings in different cities throughout the world where hackers get together to share knowledge during workshops and lectures. *2600* has also produced the documentary film *Freedom Downtime* about computer hacker Kevin Mitnick.

culture. Research conducted into hacker culture and hackerspaces has been conducted from a wide variety of academic fields and spans the gamut from the history of hacker culture and its connection to other movements of tinkerers and explorers (Moilanen 2012), the ethics of hacker culture across the world (Kera 2012; Lindtner 2012), the technological innovation of hackerspaces and the extent to which hackerspaces allow for developments in a variety of scientific and technological fields (Kera 2014).

Amongst research conducted which proposes a nuanced portrayal of hackers, Robertson (2010) proposes that hackerspaces are significant for the extent to which they facilitate the development of innovations in clear opposition to the predominant social discourse around consumerism: “They transform the passive consumptive habits of society into an active, critical interaction with consumer products. Hacker spaces foster a culture which is constantly discovering something new” (6). The predominant media representation of the hacker as an infiltrator is further challenged by Holt (2014).

Raison (2010) stresses the egalitarian aspects of hackerspace learning that occurs autonomously from traditional education. “Hackerspaces ... stand out as successful realizations of public sphere spaces where a coercion-free, or deliberative discourse as imagined by Habermas, is possible, and, again, to some length, also practiced” (3). Winn (2012) explores this commitment in a website entry and considers the parallels and possible links between the university's educational mandate and the technological innovations occurring in hackerspaces:

> I’d like to see an academic programme led by experienced software craftsmen with reputations to match, where students from different disciplines spend their degree in

> a university space that resembles a hackerspace or dojo, working together on ideas of their own under the guidance of more experienced staff, leading to potential angel investment at any point in their degree. Those that don't get funded, leave with a degree, a valuable experience and a network of alumni contacts. Those that do get funded are given the support they need to develop their work into a real product or service. Sometimes, it might be one that the university would use itself, but not always. Over time, successful alumni would help attract more students to the programme, developing a culture of hackers and successful startups attached to the degree programme.

Lastly, the educational mandate of hackerspaces and links between technological hands-on learning and universities are also described by Gallant and Groenendyk (2013) who write about the implementation of 3-D printing technology at the Dalhousie University Library.

Theoretical Framework

Over the course of my research, I have considered texts which acknowledge the political underpinnings of an educational experience[28] and which recognize the significance of autonomous education – that which occurs for its own sake, typically in horizontally structured environments developed for and by their participants. In that regard, I have framed Power Up! in relation to Jean Lave and Etienne Wenger's *Situated Learning: Legitimate Peripheral Participation* (1991) and Wenger's *Communities of Practice: Learning, Meaning, and Identity* (1998). Wenger and Lave's works were useful frames of reference that allowed me to better understand my project and the extent

[28] Particularly, my research has been informed by the works of critical pedagogy theorists whose work have led me to an appreciation of the extent to which the educational is the undeniably political. In the context of this research, I see education, and the spaces it occurs in, as contributing to a critical becoming into the world on the part of its participants.

to which both Foulab, and eventually Power Up! as it emerged, presented the characteristics of communities of practice. Both Foulab and Power Up! were sites with an educational mandate that was wholly their own, wholly defined for and by their members.

A central concept for Lave and Wenger is communities of practice that Wenger summarizes as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Wenger 1998, 1). In defining communities of practice, Wenger outlines three key aspects: domain, community, and practice (ibid., 1–2)

A community of practice's *domain* refers to its field of emphasis – the nature of the work conducted there. In the case of Foulab, the domain of the community is technological literacy: "A community of practice is not merely a club of friends or a network of connections between people. It has an identity defined by a shared domain of interest. Membership therefore implies a commitment to the domain, and therefore a shared competence that distinguishes members from other people" (Wenger 1998, 1).

Community refers to the environments where people come together to engage in collective exploration and in doing so, commit to building relationships and a shared commitment to engagement. To Wenger, "in pursuing their interest in their domain, members engage in joint activities and discussions, help each other, and share information. They build relationships that enable them to learn from each other" (ibid.).

Practice relates to the fact that participants aim to move beyond a casual affinity into a deepened process involving a sustained commitment towards skills acquisition or the development of new perspectives. According to Wenger, "community of practice is not merely a community of

interest. . . . Members of a community of practice are practitioners. They develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems—in short a shared practice. This takes time and sustained interaction" (ibid., 2)

To Lave and Wenger, the process of gradual engagement, from the outside in, is captured in the concept of legitimate peripheral participation: "By this we mean to draw attention to the point that learners inevitably participate in communities of practitioners and that the mastery of knowledge and skill requires newcomers to move toward full participation in the sociocultural practice of a community" (1991, 29). The entry point to a community, defined according to its purpose, membership and aims, is its periphery. And although these communities of practice are not necessarily physical, just as is the case in a physical community (say, a village), there are clear points of entry. It is there, through gradual, practice-based engagement on the margins of a community of practice that newcomers come to integrate and move towards full participation. For Foulab, two frequent points of entry are the general email listserv and the Tuesday night open house.

A community of practice is a lived environment, one in which a joint investment allows learners to engage in co-creation with others (Lave and Wenger 1991, 52–54). The structural and social components of the space and its history and culture are part-and-parcel of the educational experience. It is by engaging with others in a purposed, joint-investment in the space, that learning occurs. Lave and Wenger present various examples of communities of practice. These are midwife communities; traditional tailor groups and alcoholics anonymous support groups which all present a learner-driven community reliant on notions of peer-to-peer sharing and apprenticeship (ibid., 61).

Of notable significance is the extent to which communities of practice allow for educational pursuits that are not reliant on, and indeed occur primarily outside of, formal schooling (ibid., 62). In that regard, communities of practice are largely autonomous sites defined in relation to the sometimes highly specific needs of their members. There are all sorts of communities of practice that engage in the promotion of a wide array of educational pursuits. In these communities, members are afforded the opportunity to explore a particular skill set or personal interests while developing mastery or engaging in a collective reflection. Relationships require commonalities, and as mastery is acquired, so do learners experience a direct shift in personal identity, being afforded the opportunity to perceive themselves as increasingly competent and as worthy of deeper participation in the community of practice: “Thus identity, knowing, and social membership entail one another” (ibid., 53).

In attempting to understand Foulab's educational makeup via Lave and Wenger’s theories on communities of practice, I am particularly interested in 1) The educational characteristics of communities of practice themselves - as autonomous peer-to-peer spaces and 2) What is involved in becoming a member of a community of practice and the process of moving past the cultural boundaries that define them.

From inside looking out: peer-to-peer interactions in communities of practice

One of the first things that has struck me as noteworthy when considering the educational experience at Foulab, is how radically different the lab was from the way I understood education to work. In that regard, the lab is clearly autonomous from the educational system. It isn’t connected to

formal schooling; it isn't funded or recognized by the government. The lab exists primarily to further the needs of its membership.

In that respect, it is important to consider the lab itself as a physical site and how its open layout facilitates the educational pursuits of its members. The learning that occurs there is a learning that is tactile, chaotic and politicized; a learning that hinges on an acquired mastery over computer language and what could either be obscure technological trash or on-the-cusp innovations. In all these notable aspects, it is an educational experience that is wholly autonomous – an experience that belongs primarily to its members.

Lave and Wenger define educational autonomy as an "implied emphasis on comprehensive understanding involving the whole person rather than 'receiving' a body of factual knowledge on the world; on activity in and with the world; and on the view that agent, activity, and the world mutually constitute each other" (1991, 33). The educational experience of a community of practice is a hands-on and direct experience that acknowledges and responds to the potential complexity of individual makeup and subjective imperatives of members.

In all of the spaces considered by Lave and Wenger, co-creation occurs and allows the learner, as an active and engaged participant, to understand the social ramifications of the role of the community. Learning by doing is directly connected to the social environment that surrounds the learning: "Such participation shapes not only what we do, but also who we are and how we interpret what we do" (Wenger 1998, 4). In that regard, from the perspective of critical pedagogy, this approach

to education can be seen as emancipatory – a revolutionary act through which one acquires an awareness that, according to Lave and Wenger (1991, 49), can then lead to transformative action.

In making a clear distinction between the sort of learning that occurs in schools and more public spaces, Edward Taylor defines these communities using the concept of third places:

> As learners visit these institutions, seeking greater understanding of specific narratives and local knowledge, they also participate in third places, or commons, sites that focus on the need to connect with others in settings that are neither home nor work. Generally informal locations, third places serve the increasingly important function of community building within a democracy. (2010, 9)

Many of the communities of practice described by Lave and Wenger (1991, 61–87) are such examples of "third places." Taylor also asks the question, "Whose story does the institution tell?" (2010, 10). In the case of many communities of practice such as Foulab, a by-and-for educational space, the story told is that of the lab's membership. Wenger stresses the need to come together and create spaces and exchanges that allow members to understand their role in the world. "What does look promising are inventive ways of engaging students in meaningful practices, of providing access to resources that enhance their participation, of opening their horizons so they can put themselves on learning trajectories they can identify with, and of involving them in actions, discussions, and reflections that make a different to the communities they value" (1998, 10).

The values and politics of communities of practice are defined first and foremost by their membership. In that regard, the learning that occurs in hackerspaces is not abstract, it is socially situated and responds very directly to the role which technology has in furthering power relations. In considering peer-to-peer exchanges amongst educators and the importance of critical consciousness in

peer-communities, Aaron Chubb and Elizabeth Lange support Lave and Wenger by pointing out the extent to which "evidence is widespread that nonformal environmental education for adults is continuing to take place in widely dispersed sites and sectors" (2009, 64). The importance of these sites is further supported by Taylor who proposes the notion of non-formal peer-to-peer education which "often takes place in public places, which generally results in a greater participation than found in more formal settings. Concepts that help shed light on learning in these institutions include informal learning, self-directed learning and free choice" (2010, 31).

For instance, in addition to using the space as a means of collaborating on technological projects, members of a hackerspace use it to store tools and projects that would otherwise be kept at home or at work. And though the affinities and knowledge sought at the lab could be found at work or home,[29] the opportunity to engage with others in a shared environment moulded by its members and their respective and overlapping interests is seen as beneficial. For many of the lab members, the skills and knowledge acquired at the lab reflect a wide variety of personal life interests. Lab members often do projects "just because" and oftentimes there are no obvious applications to what is learned (i.e., connecting a pre-dot-matrix printer to a continuous live tweeter feed, launching a hot-air balloon into space or making a robot out of a plastic coconut shell). To Wenger, this is part and parcel of the community of practice experience that positions it as a unique alternative to classroom-based learning:

---

[29] Oftentimes, it is. Members of hobbyist cultures such as hackers tend not to regiment the pursuits of their interests. In all likelihood, members of the lab will tinker or surf the web for information at home and will find ways to connect their interest to their professional pursuits. Though the Avocado used to come to the lab, he also had a small home work-bench. In his work, Jonesey works with the open source software Drupal.

> This learner-driven approach allows for a broader array of engagement with members than would otherwise be afforded in traditional schooling. From this perspective, the school is not the privileged locus of learning. It is not a self-contained, closed world in which students acquire knowledge to be applied outside, but a part of a broader learning system. The class is not the primary learning event. It is life itself that is the main learning event. Schools, classrooms, and training sessions still have a role to play in this vision, but they have to be in the service of the learning that happens in the world. (2012, 5)

If there are no direct applications to the knowledge acquired, than the only explanation for it is that it is acquired for its own sake: because it is fun and life-affirming.[30]

From outside looking in: negotiating boundaries towards membership

Communities of practice will frequently have palpable, cultural identities in relation to which established members and newcomers must position themselves: "Learning thus implies becoming a different person with respect to the possibilities enabled by these systems of relations" (Lave, Wenger 1991, 53). It is in relation to these boundaries that community outsiders must frame their hopeful membership – through a process of gradual investment and increasing trust.

I initially saw Lave and Wenger's work as an important framework to consider given that the initial goal of Power Up! was to explore what would be involved in maneuvering the boundaries of a peer-to-peer community and integrating a group of non-members to Foulab. It was from this

[30] We could also make the point that the educational environment at Foulab is "immature" in the pejorative sense. The general environment feels like a boys' club and the importance of play over productivity is sometimes stressed. Nevertheless, we can say that this is in turn a very valid response to living in a world where careerism and productivity are overwhelmingly emphasized.

perspective of integration, which stemmed from my own excitement at Foulab, that I was interested in documenting the progressive integration of a group of outsiders into Foulab and the extent to which they would adopt aspects of its culture and in turn affect the community.

Lave and Wenger describe the process of becoming fully immersed members of communities of practice, first from the perspective of novice outsiders and eventually through the experiences of seasoned community veterans who have integrated their community of practice and continue to grow as a result of this enduring connection. Communities of practice are named spaces with strong associated values. This allows their members to directly associate themselves and their own identities, with that of the community. In that regard, Lave and Wenger present the example of Alcoholics Anonymous as an organization which permits the "reconstruction of identity, through the process of constructing personal life stories, and with them, the meaning of the teller's past and future action in the world" (1991, 80). Communities of practice permit, through reflection and collaborative action, an evolved self-perception to emerge. Just as it is for members of Foulab, participants in traditional weaver guilds and for members of Alcoholics Anonymous, participation in the community of practice affords an opportunity to grow one's understanding of the world and, through engagement with others, one's place in it.

At Foulab, the community identity is immediately palpable. Even before engaging with lab members or attempting to understand the work that occurs at Foulab, it is possible to perceive certain cues from the clutter of technology interspersed by beer empties and pizza boxes, by the kinds of posters and stickers that adorn the walls and the music played through the speakers – the space itself speaks to a community of individuals with very specific interests. The space is designed in a way which is appealing *to* its members.

To Lave and Wenger, engaging in peripheral learning implies an “emphasis on comprehensive understanding involving the whole person rather than 'receiving' a body of factual knowledge about the world; on activity in and with the world' and on the view that agent, activity, and the world mutually constitute each other” (1991, 33). Growth can occur through simply doing, without relying on informational hierarchies in which learning is acquired through the presentation of information in factual forms to learners who engage with it passively. This is a perfect summary of the Foulab environment and its reliance on a highly social, but ultimately very informal hands-on environment. Just as is the case in the communities described by Lave and Wenger, Foulab ultimately relies on the shared investment of its members.

It is through the gradual and continued engagement of membership that individuals deepen their mastery of skills and develop investment in the spaces. Becoming increasingly competent affords members the possibility of eventually becoming mentors to newcomers just as they too, had the role of newcomers upon first being accepted by the community. In that regard, a community of practice challenges reliance on formality and hierarchy in education:

> The concept of practice connotes doing, but not just doing in and of itself. It is doing in a historical and social context that gives structure and meaning to what we do. In this sense, practice is always social practice. Such a concept of practice includes both the explicit and the tacit. It includes what is said and what is left unsaid; what is represented and what is assumed. It includes the language, tools, documents, images, symbols, well-defined roles, specified criteria, codified procedures, regulations, and contracts that various practices make explicit for a variety of purposes. But it also includes all the implicit relations, tacit conventions, subtle cues, untold rules of thumb, recognizable intuitions, specific perceptions, well-tuned sensitivities, embodied understandings, underlying assumptions, and shared world-views. Most of these may never be articulated, yet they are unmistakable signs of membership in communities of practice and are crucial to the success of their enterprise. (Wenger 1998, 47)

Wenger further explores the makeup of communities of practice, their social role, the boundaries which newcomers must cross before accessing them and the complex interconnected relationships that eventually form between their participants (1998, 103–21). Outsiders are outsiders for a reason and integration occurs gradually, through occasional or peripheral participation, which ultimately confirms commonalities between the hopeful new member and the community itself. To Wenger, this exploration of commonalities frequently implies recognition of "explicit markers of membership, such as titles, dress, tattoos, degrees, or initiation rites. . . . The nuances and the jargon of a professional group distinguish the inside from the outside as much as certificates" (ibid., 104). Eventually, through a confirmation process with varying levels of formality, the newcomer can draw towards the middle and begin to integrate the community itself.

At Foulab, this integration typically occurs first via the lab's email list and eventually the open-house Tuesday night when outsiders can come to the lab to visit and work on projects. It is then that first conversations occur during which commonalities can be explored. These conversations are frequently codified, during which familiarity with technology is conveyed through the use of specific vocabulary. Having demonstrated themselves worthy of participation in the space, newcomers will continue to visit and ultimately, will apply to be considered for membership. The standing lab members then get to vote and confirm integration, at which point involvement continues through the ongoing personal or collaborative projects that are part-and-parcel of the purpose of the lab. In the case of Power Up!, it is through this progressive engagement from the outside, looking in, that it became evident that we would not be successful in joining Foulab. To put it simply, we failed at the process of legitimate peripheral participation.

Chapter 3: Power Up!

In this section, I describe the Power Up! project itself – an overview of my evolving relationship with Foulab leading to my interest in carrying out this project, the methodology I used, the steps involved in the research project as well as the emergence of the process. In so doing, I will provide an overview of the approaches that informed my work, I will draw on my field notes and I will summarize my observations.

Research Background

In this section I describe the prior connections which I had with Foulab and its members as well as what led me to become interested in studying Foulab as part of this project.

I began to get involved with Foulab soon after its inception. From its early beginnings, when it was located on Chemin Bates in Montreal North, I found the lab to be an exciting and intriguing place to visit. The friendly and welcoming atmosphere contributed to my recognizing many of my own limitations and fears in engaging with technology. The fact that my friends were lab co-founders certainly helped make it an accessible and appealing place to get involved in but beyond that, the appeal also lay in the lab's largely experiential atmosphere. This was a space that was clearly a lot of fun to its members and the fun was infectious. I remember going by the lab early on in its history – members were oftentimes hanging around drinking beer, eating pizza and laughing while they worked on projects that were (and frequently still are) largely incomprehensible to me. But comprehension isn't necessarily a requirement for appreciation and I could sense the large awesome potential and the

esoteric coolness that was being worked on around me. I was particularly fascinated by the concept of repurposing – instilling new life into a piece of technology - by coming up with a new purpose for it.[31,ix] Further, I felt that there was something very special in Foulab as a community of people whose commonality lay in collective creation. It felt like a very concrete exploration of the creative potential of peer-to-peer communities, what I later discovered through Wenger as a commitment to membership:

> The first characteristic of practice as the source of coherence of a community of practice is the mutual engagement of participants. Practice does not exist in the abstract. It exists because people are engaged in actions whose meaning they negotiate with one another. . . . Membership in a community of practice is therefore a matter of mutual engagement. (1998, 73)

At the beginning, my participation in Foulab was strictly casual – I began to attend workshops and eventually decided to involve myself in the lab. I took part in an introductory course in the Ubuntu open-source computer system; I held a public conversation on ethics and computer-gaming and moderated a conversation at Foulab on the concept of repurposing, as part of the University of the Streets Café program of Concordia University. The Avocado and I also collaborated at Foulab on a large-scale installation of found objects called the Project of the Planets.[32] Outside of that, I would come by to hang out, drink Foubeer and generally take in the space.

I eventually became a dues-paying member of the lab in the fall of 2010, following my participation at the Last HOPE conference. During the course of my membership, I would pay my

---

[31] This is explored very effectively in the short documentary *Repurpose* by Jack Oatmon.

[32] The Project of the Planets attempted to create a scaled version of the solar system out of found objects. The distance between each planet was going to be consistent to the size of the planets themselves. In other words, with a sun sized at three meters across, Pluto was going to be the size of a golf ball and the whole solar system was going to span the island of Montreal. We were going to place the planets in public spaces and then circle them on our bikes. We got through about half of all the planets but then life caught up and we gave up.

dues, I would come out to weekly meetings and I would work on projects and organize workshops. Amongst other things, I worked on a Spoke POV[33] project that had me learning about soldering; I low-teck-POV'd[34] the wheels of my bicycle with painted aluminum foil,[35] I facilitated a mustard-making workshop and the Avocado and I co-led a series of craft-and-talk get-togethers on Wikileaks and the state response to its release of classified US government diplomatic cables. I pushed for the solidification of the group's organizational structure, for the development of links between Foulab and Montreal's activist community. I occasionally acted as resource person to the lab in relation to its non-profit status[36] and worked on obtaining liability and board insurance for the lab.

In the fall of 2011 however, I let my membership lapse. For one, my hours at work were reduced and I couldn't afford it. For another, my friends the Avocado, Clever Duster and Jonesey weren't participating in the lab as much as they used to. I was also investing myself in other projects and didn't see the need to stay involved with Foulab at the time.

---

[33] POV stands for Persistence of Vision. A Spoke POV is a series of three motherboards that are mounted along the spokes of a bicycle wheel. Rows of Light-emitting diodes (small light-bulbs of varying color) are soldered and connected to a microcontroller – a small computer. An image is programmed into the microcontroller and when the wheels turn, an animated image appears – in full, bright colour, filling the surface of the wheel.

[34] I use the expression low-teck to reflect the fact that this second POV had no electronic components.

[35] I completed this project after seeing a documentary on the Oakland-based Scraper Bike Team.

[36] At the time, my work with the Center for Community Organizations included working with non-profit organizations on the solidification of their structure.

Research methodology

The methodology I used in this research project combined aspects of community-based action research, ethnomethodology (Garfinkel 1967) and autoethnographic qualitative research. My approach was also significantly informed by my experiences as a popular educator and community organizer – including as a result of my work with the Center for Community Organizations through which I designed and implemented group interventions in Quebec community groups using tools such as appreciative inquiry, group coaching and Open Space Technology.

I came to the conclusion that qualitative research and personal life narratives were well suited research strategies to use in this context given the small participant sample size I would be working with and which would limit the potential for extensive large scale extrapolation. I was also conscious that the theme of the research project relied highly on notions of personal identity and social power that were also well suited to a qualitative inquiry.

This project was ultimately about the specificities of the Foulab space which, though grounded in hacker culture, is wholly its own in terms of educational makeup and as such, it seemed most important to concentrate on creating approaches that would effectively capture the intricacies of the lab and the evolving individual narratives of my project participants. One qualitative research project that I kept thinking about when designing Power Up! was Clark's "What You Can Learn from Applesauce" (1990), an effective illustration of the potential depth and richness of qualitative research in which he considers a group of grade schoolers engaged in making applesauce, illustrating in so doing the impact on the educational experience by the social interactions of small-group dynamics.

The decision to name myself as a participant-observer was first driven by an admittedly selfish interest on my part in taking part in the project itself, mitigated somewhat by the extent to which (second) I believed that this was an approach ultimately well suited to the context.

First, Power Up! was constructed in large part from components derived from my personal life. Foulab is a site that I've been involved in for years and I am extremely interested in what hackerspaces represent; the project's core reflections on social activism, energy creation and environmental sustainability are things that I am interested in; and many of the individuals connected to Power Up! – either members of project participants or members or founders of Foulab are part of my personal network. If I had not conceived this research project, it would have been one that I would have wanted to take part in.

Second, one of the aspects to communities of practice that particularly interested me was the extent to which they allow for a shared and gradually deepening investment on the part of strangers in a joint project. As a result, it was important to me that the research project parameters reflect this – and that the endeavor and the boundaries of the physical environment be the primary determinant of the evolution of relationships amongst the participants. As such, I attempted to limit the ways in which participants might feel monitored and the extent to which I would be imposing parameters beyond those initially provided. It seemed to me that the most efficient way to achieve this was to remove some of the impartiality that can be part of the role of researcher. As such and rather than stand by as an observer, I chose to become involved in the project, sharing my own vulnerabilities, offering suggestions and taking part in the work – while I also kept a small notebook on hand in which I took down hurried notes. I suspected that given that ours was a small community, that interpersonal

dynamics would quickly emerge as a primary driving component. In that respect, I believed that my direct participation allowed for a more natural maneuvering around some of the observation and notes keeping required as part of my research responsibilities.[37]

I also hoped that naming myself as a project participant would contribute to creating an egalitarian research experience in which I (as researcher) and the participants were all engaged, together, in the process of learning. I so doing I aimed to integrate critical pedagogy principles in acknowledging the significance of power relations in learning. In so doing, I was particularly inspired by Freire (1970):

> Authentic education is not carried on by "A" for "B" or by "A" about "B," but rather by "A" with "B," mediated by the world – a world which impresses and challenges both parties, giving rise to views or opinions about it. These views, impregnated with anxieties, doubts, hopes, or hopelessness, imply significant themes on the basis of which the program content of education can be built. (93)

In choosing the data collection strategies of this project, I was interested in placing primary emphasis on documenting and understanding the personal narratives of the participants as it related to their established and evolving view of technology in the world. In developing a research project that relied heavily on the lived experiences of its participants – through personal narratives and observations of group interactions, I aimed to develop a process that would recognize Wenger's proposal that "the process of engaging in practice always involves the whole person, both acting and knowing at once"

---

[37] And as much as I tried to be as discreet as possible with my notes keeping, participants were nevertheless clearly aware of it and frequently, participants would comment when I would write down notes as a result of an interaction we may have been having.

(1998, 47–48). I therefore believed that it was important to recognize the extent to which the experiences that drove participant interest were likely to be highly personal in nature.

My data collection took place before, during and after the project using a variety of tools.

First, in preparation for the project itself through a series of personal reflections I requested from the participants. The first contact participants had with the project was a request on my part that they submit a letter of interest expressing their motivation for taking part in Power Up! This was followed by a series of life-history questions on their prior connections to technology and their understanding of its role in the world. My questions were developing in part through using the Heirs Project principles that recognize the importance of personal narratives in considering social justice struggles. We collectively considered our responses to these questions during a facilitated group discussion.

During the course of Power Up!, I documented in field notes both the project's emergence as well as the shifts in interpersonal relationships between participants and between us and Foulab and its members. I expanded on my field notes in an on-line journal and attributed code categories that were expanded on and revised over the course of the project.

Lastly, at the conclusion of the project, participants debriefed the experience during a facilitated group conversation. Not all of the participants were there at each of these sessions but rather than view this as a hindrance, I believed that it allowed for unexpected insights resulting from shifts in the interpersonal dynamics. Participants were afforded another opportunity to reflect on the project

during a workshop we held at Foulab where we showed attendees the steps involved in building a bike-powered generator.

Table 1 below summarizes the various steps that made up this research project.

Table 1: Research steps

Date	Step	Notes
Tuesday August 14, 2012 (email) Tuesday August 21, 2012 (open night)	Confirming Foulab's interest in project	I first attempted to establish Foulab's interest by writing the lab listserv and engaging in direct conversations with some of its members over email and in person. I then announced that I would visit the space during a Tuesday open-night and then addressed their concerns and questions. The lab's interest in taking part in the project was decided by its membership as part of its weekly meeting, was voted on and the approval was documented in meeting minutes.
Friday August 24, 2012	Recruitment of learning cohort	I recruited my participants by sending an email to a wide variety of contacts. The email included a detailed description of the project and of hackerspaces in general.
Tuesday September 11, 2012	Letters of candidatures submitted by individuals interested in the project	I selected my participants based on letters of candidature that were submitted. I then followed up with candidates, informing them of the selection and letting them know about the process involved in the research project.
Tuesday September 18, 2012	Life-history reflections submitted by the selected project participants,	A first step to the project was a life-history reflection which I designed using the Heirs Project principles.[38]

[38] The Heirs Project Grounding Principles are: 1. Speak Your Truth, 2. Deepen Analysis, Gain New Knowledge, Engage with Theories of Social Change & Liberation, 3. Bring Your Full Self: Body, Mind & Soul, 4. Develop Your Humanity,

	considering their relationship to technology	
Monday September 24, 2012	A facilitated group discussion at Foulab	I facilitated the discussion that was recorded and later transcribed. A lab member who observed the discussion took notes that were later submitted. The lab member and I also debriefed the conversation afterwards.
Monday September 24 – Tuesday December 2, 2012	Ten group-work sessions with the project participants held at and near Foulab	During this period, the group developed its project timeline and objectives. Throughout I acted as a participant observer, taking abbreviated notes in a journal in which I identified: which participants were in attendance, which other individuals were in attendance with whom the group members interacted, what events occurred during the work session, what transpired during those events and what preliminary coding I thought about assigning to those events (interacting with Foulab, gender and race, beer, friendship and co-learning) I would then reflect on and elaborates on these notes and store them in a googledocs folder which my research supervisor had access to.
Monday November 8 and Saturday November 10, 2012	Two work sessions on weekends that occurred in addition to our weekly sessions	These two sessions were attended by some of the participants – usually one or two – in order to complete a particular piece of work.
Ongoing	Errands and research carried-out by the participants outside of group meetings	This included purchasing needed equipment, conducting online research and documenting the project on the Power Up! wiki.[x]
Tuesday December 11, 2012	A facilitated group discussion at Anna's loft	I facilitated the discussion that was recorded and later transcribed.

5. Confront Oppression and Privilege, 6. Community Organizing for Social Justice, 7. Analyze, Dialogue, Reflect, Organize, Act. Repeat and 8. Be an Heir to a Fighting Tradition.

		Participants were asked to reflect on this experience and the extent to which they believed that new skills had been acquired and whether they felt that their introduction to a hackerspace and co-learning was valuable.
Saturday March 23, 2013	A workshop organized by the Power Up! Participants	Project participants reflected on their experience in the context of a workshop we held at Foulab that presented our learning outcomes, showed others how to build a bike-powered generator and introduced outsiders to the hackerspace. This further allowed participants to experience closure on this project.

Confirmation of Foulab interest

I reconnected with Foulab in August 2012 when I began to work on Power Up! Over the previous year, I had gotten increasingly interested in the educational aspects of hacker and maker culture and I decided to situate Power Up! at Foulab. I knew however that there might be challenges associated with getting lab membership to support the project. In my time as a lab member, I had seen Foulab sometimes express resistance to projects that fell outside of its primary framework. At the very least, when it comes to decision-making, Foulab can be an unwieldy and sometimes inconsistent beast. Sometimes decisions are made by members with little consultation of the general membership.[39] Sometimes issues are viewed as contentious and require more consultation.[40]

---

[39] The Cleanup, which will be described later, is an example of this. It was driven by one member and spontaneously initiated by whoever was in attendance during an open-house evening. Yet, it impacted the lab as a whole for weeks afterwards.

[40] During the fall of 2010, various lab members and I put forth a proposition to the lab membership that Foulab should apply to become a member group of the Quebec Public Interest Research Group (Q-PIRG) chapter at Concordia

Back when I was an active lab member, decision-making tended to occur during the weekly open-house nights during which we would hold meetings. Minutes were kept on the lab wiki and motions would be brought forward and voted on by members. A lot of the lab's reliance on this organizational infrastructure has since diminished. Decision-making at Foulab now seems to occurs in a variety of ways: as a result of the personal initiative of a particular lab member who feels strongly about a project; as a result of a few members deciding that they want to see something done or as a result of conversations having taken place on the lab email list or IRC channel.

When I was ready to move ahead, it was important that Foulab and its members be well informed and supportive of Power Up! For one, I wanted to reinstate my membership so that I could have access to a set of keys with which I could access the lab and its resources. For another, I wanted to openly be able to document the Power Up! group interactions with the lab and its membership. Lastly, I wanted to be able to be able to solicit the lab membership for assistance. I also didn't want any surprises or objections to come up during the course of the project.

University. The argument put forth was that becoming an affiliated group of the PIRG would allow the lab to connect to a broader population of students and activists, who, though they may not have identified with the technological makeup of hacker culture, may have been interested in the lab's activities and could have contributed a different, albeit differently engaged perspective. Other members of the lab felt that becoming a PIRG member group may have resulted in state monitoring of the lab and its membership. It was also felt by some that such an affiliation would bring the lab into contact with Concordia University – something seen as a potential violation of Foulab's autonomy. Long discussions ensued on the lab's email list and during the lab's weekly meetings and in the end, a narrowly passed vote decided that the lab would apply for solidarity group membership at the PIRG but would decline to ask for financial support derived from the University. In the end however, and though the reflections introduced notions of political engagement to the hackerspace, Q-PIRG Concordia declined Foulab's application on the basis that the lab's activities were not seen as being of a political nature.

I started by emailing the members mailing list a short description of the project, my research goals and my hopes in getting their support:

> Hi Foulab - I have a project I'd like to undertake at the lab and was wondering if there might be folks willing to lend a hand or who'd have suggestions on resources I should check out. As part of my MA in Educational Studies at Concordia, I want to do a research project on technology and how people learn about it informally and organically outside of educational systems. I'd like to look at this through building a bike-powered generator with a group of 4-5 people who would come together once a week at the lab for 6-8 weeks to talk about tek, look for parts and put the bike-powered generator together and generally reflect on the experience. In the context of this project, the bike-powered generator would be used to power-up a computer with which we could play computer games. Afterwards, I'd like us to hold a workshop on building a bike-powered generator for anyone who'd like to learn about it. Unless folks think otherwise, I'd like to revive my lab membership and would like to start holding regular meetings in early September with this small group at the lab. This could either be on Tuesday nights during open nights or on a night when there's less people. I'm also wondering if another lab member with experience in this sort of project would be into being a resource person during this project. Let me know what y'all think of this. (Foulab listserv, personal communication, August 14, 2012)

I didn't receive much in the way of a response. One member wrote asking if I already had participants selected. Another emailed to say that though he was currently living abroad, he would be happy to answer any questions I might have – which I appreciated, since I knew him to be knowledgeable about electrical conductivity. I had nevertheless hoped for an on-line group exchange on the email list on the project and asked a friend and lab member if he could weigh in, so as to generate a discussion– which he did, though it did not do much in terms of validating or challenging the project. Another friend and a co-founders, offered some perspective, though again, this failed to generate a discussion amongst the membership as to the merits of the project. Ultimately, I had hoped that my previous connections with the lab would allow me to bridge the cultural gaps and convince the lab membership of the inherent value in opening itself up to outsiders.

Some of this work and my prior relationships did pay off however and I eventually received an email from Raptor, another lab member, expressing interest and offering support. I wrote again to the Foulab members list saying that I would stop by the lab during a Tuesday evening open house to discuss the project with the lab membership. Before the meeting, I met with Raptor to discuss my project and to solicit her support. In terms of approaching the lab with the project, Raptor suggested that I just inform them and then just do it as opposed to asking the lab's membership for permission on email or in meetings, which she felt could result in lengthy, counter-productive discussions.

On the evening of Tuesday August 21, 2012 night, Foulab was bustling. It was one of those late summer evening where it is easy and fun to get around Montreal. Many lab members were in attendance and there were a lot of projects being worked on and visitors to the space were being given tours of the lab. I walked in and greeted the members I knew. Raptor was there, speaking with representatives from the Montreal Maker Faire who were there soliciting Foulab's participation. After a while, I announced that I was hoping to talk with folks about the Power Up! project. A few said they would come and join in and it was evident that some members were also interested in having a meeting to discuss other issues as well. Eventually, five lab members came together and I explained the project and its aims. I mentioned that I was soliciting Foulab's approval since I wanted to properly document the experience and be transparent about its taking place at Foulab. I explained what my methodology would be and asked how I should go about treating it and my intent to once again become a paying member. I explained that I was hoping that at least one lab member to act as a resource person. We discussed it and one member raised concerns about participant selection, that it would be important for the participants to be fully aware of the nature of Foulab and that they be respectful of the technology.

We discussed the lab's insurance policy, which I am knowledgeable about since I had handled its application, and whether the lab could be held liable if any of the Power Up! participants were to injure themselves while on site.[41] I explained what the selection process would be like – that I would ask participants to write letters of intent, that I would interview participants and eventually ask them to sign letters of consent that described what Foulab was like.

I asked if there was a lab member who would be interested in joining the project as primary supporter, lending assistance and guidance on an ongoing basis. None immediately volunteered but a few said that they could help by providing occasional workshops or presentations on aspects related to the project or by being available if we had questions. Since two others had both offered over email, after my message to the lab membership, to help in this manner, we discussed how these five people could each hold one workshop or info session and that we could approach them all as need be once the project began and we had a clearer sense of its direction and our need. Raptor also offered to stay connected to the project if I wished to discuss research methodology or if I needed help during discussion groups.

All the lab members present agreed to the project taking place at Foulab, that my membership should be reinstated and that I should be granted access to a set of lab keys. The approval was recorded

[41] For the record, and as was discussed that evening, it doesn't. Quebec liability insurance only provides coverage in the case of "unreasonable" pursuits. In all cases, it is the ultimate responsibility of a space to properly inform its occupants on the nature of potential danger and how to avoid it. In short, in order to be safe from liability via its insurance policy, Foulab must still (and does) follow a process whereas it orients people to its space and required safety procedures.

in the meeting minutes and it was agreed that I'd get keys from the Avocado who needed to return his anyway. After spending a few more moments discussing with some of the members, I left.

Participant recruitment

With the lab's approval, I set about recruiting participants. As this began, I saw myself getting increasingly enthusiastic about the project. I would discuss it with people and would be rewarded by their interest. As such, I became increasingly excited at having decided to situate myself squarely in the project as a participant observer. Initially, when I had developed my research proposal, I had wanted to escape the implicit hierarchy of the researcher-subject relationship but the more I discussed Power Up! with others, the more I became genuinely excited at the educational growth which the project offered and I looked forwarded to learning about and from the technology we would be working with, as well as about and from the other participants in the project. The more I reflected on this, the more I wanted to make the project fun and to convey the excitement I was feeling. It became increasingly important for me to see this project as a direct extension of the kinds of community building that I explore in my personal life.

I sent out my call for participants to an email list of personal contacts, asking them to help by putting the word out. The email, followed by a more detailed call for candidature, was playful and reflected my enthusiasm for Power Up!

> Hi all, I'm buckling down on my MA research project (called Power Up!) and I desperately need some research participants. That's where YOU come in. I'm hereby commencing campaign *Power Up! Research Participants Gatheringness. Yeah*. The deets for my research are below.

> It'll be all kinds of awesome and will include: time spent at the Foulab hackerspace, making new buds, learning about electricity, stuff with bikes, workshops on Science!, eating snacks, working with tools and afterwards being able to play computer games when the apocalypse hits. I need 5 participants. In all likelihood, I'll also be able to pay them a modest $$ honorarium for their time. Maybe YOU're interested? Or YOU know someone who might be? If you help me find participants before Sept 11th (see deets below), I'll invite you to a special *Power Up! Research Participants Gatheringness. Yeah*. campaign party where I'll cook you food and my cats will entertain you. Thanks for helping / putting the werd out. Now go! - Alex. (Personal communication, August 24, 2012)

In addition to sending this appeal to my personal contacts, I created a Facebook event for the project, listing the information included on the call for participants and the deadline for application submissions. I mentioned the project on a few occasions on my Facebook profile and listed it in some of the Facebook groups that I belong to.[42]

Participant selection

When I initially presented my project for review, one of the members of my committee encouraged me to consider how gender would be a factor in the project – either in how the participants would engage with one another, with the lab or with the technology they would be interacting with. Surprisingly, this was a strong theme right from the offset of the project and the selection of candidates.

Below is a representation and summary of gender as it pertained to participant selection. Table 2 below presents a breakdown of candidate interest.

[42] I listed my callout on these Facebook groups: The Concordia University Educational Studies Students Association, The Concordia University Graduate Students Association, Foulab, the Montreal Anarchist Soccer group and the Geek Montreal group.

Table 2: Summary of candidate interest

Gender	Expressed interest	People who did not write back after receiving info	Assumed participation	Submitted letters of candidature
Male-identified	7	3	3	1
Female-identified	10	1	0	7

Expressed interest: Seventeen people contacted me directly about Power Up! as a result of my call-outs – either prior to the deadline or immediately after. Out of those ten were female-identified.[43]

Assumed participation: Three of the male-identified individuals who initially expressed interest did so presuming their participation even though the call-out clearly stated that letters of interest needed to be submitted before selection would even occur. For example, "I don't mind participating to help you out," and "I won't be able to take you up on your offer" even though no offer of participation was actually extended.

Submitted letters of interest: Out of the eight people who actually submitted letters of interest, seven were female-identified. Most of the letters were lengthy - detailing the individual's interest in the project and technology in general as well as their perceived barriers to engaging with it.

Based on this, and although this is too small a pool to really draw significant conclusions, I

[43] For the purpose of identifying a gender-pattern during the application process, I assumed that the individual's gender matched the traditional gender-affiliation of their first name.

would nevertheless be tempted to attribute the gender differences in the responses as stemming from male comfort in engaging with technologically-oriented environments.

After receiving the letters of interest, I set about reviewing them in order to select the participants.

I initially felt uncomfortable with the fact that most of these letters came from people that I knew – either that I was friends with, or had at least worked with before. In the end, I chose to base myself on the strength of the letters submitted and picked participants who had written compelling submissions filled with evocative and rich narratives of their attempts at engaging with technology in the past. The one candidature that I did not consider in the end, was my then-roommate Shanna's. Shanna had written a strong letter but after consideration I came to the conclusion that integrating the project into my home life had the potential to introduce a level of complexity to the project that I was not prepared for.

The five participants who were initially selected were Anna, Zinta, Niomi, Jennifer and Phil. Zinta and I are friends and I knew Phil, Anna and Niomi casually - we had played anarchist soccer[44] together a few times in the past. Jennifer was someone I had met a few times through my work.[45]

---

[44] Anarchist soccer games are played in cities throughout the world by people who want to take part in non-competitive sports environment that also acknowledges, and attempts to redress, the perpetuation of competitiveness and oppression that routinely occurs in sports: body-shaming, sexism, homophobia. I began to organize anarchist soccer games in Montreal in 2004.

[45] I work at the McGill University School of Continuing Studies where I am responsible for directing the Personal and Cultural Enrichment program (PACE). I first met Jennifer at a workshop we held – a Deep Listening Intensive seminar led by American improvisational musician Pauline Oliveros.

Introduction meeting

Our first meeting as a learning cohort was on Tuesday September 18, 2012 during an open house night. The goal of the get together was to present the project to the selected participants, give them a tour of the lab, introduce them to some of the members and go over the documents required for research purposes. All the participants except for Jennifer were in attendance. The lab was busy that night. As participants walked in, they were greeted by lab members and assorted guests who were busy working on various project – both on laptops on the central table, in the tools and soldering areas and on projects involving the 3-D printers and CNC mill. Visitors from abroad were being given a tour by a lab member and Power Up! participants joined in, visibly enthused at the space and its chaotic and lively nature.

Afterwards, we sat in the lounge and spoke amongst ourselves about the project while Justine, a regular participant in activities at Foulab (though not a member) listened in while working on a laptop computer, becoming visibly interested in our conversation. I described Power Up! and briefly presented my interest in hackerspaces and the different steps of the project as well as the life history narratives which participants would be required to hand in next and the facilitated discussion which would occur at our next meeting.

After this presentation, Justine looked up from her laptop and started to ask questions about the project – wanting to know whether or not there was still time to submit a letter of candidature, and drawing parallels between Power Up! and a project she was involved in starting – FouFem, a women-

only regular evening at the lab. Participants in Power Up! Were clearly interested in speaking with Justine and some exchanged coordinates with her.

Over the course of the discussion that ensued, I began to take notes and subsequently noticed the frequency of gender as a recurrent thematic. Over the course of this first informal exchange between the participants and the lab and its members - which lasted approximately an hour and a half of a two-hour evening, following the lab visit and project presentation, I noted ten different instances with a gender-based theme – in comparison with two instances with a theme of technological literacy, one instance with a theme of race and one instance with a theme of self-sufficiency. Four of these gender-themed instances came up in direct relation to Foulab or its members:

- At one point, Zinta overheard the word "bitch" used in a conversion taking place in another part of the lab and she shared with us an instance when she had heard the same word used at a bike-in movie night and how she had called out that the word was inappropriate – to the then approval of attendees.

- On a regular basis, male lab members came into the meeting room while we were engaged in our discussion. At one point, Griffon, a lab member, came in and sat down to listen in and take part in the conversation. Nevertheless, he was friendly and contributed respectfully to the conversation without taking over.

- At another point, Niomi asked about the bathroom and a discussion ensued between her, Anna, Griffon and I about the cleanliness of the building bathrooms – which, as was discussed during

this exchange, are horrendously filthy, smell very strongly of urine and haven't been cleaned in years.

In the case of the other instances, gender was discussed amongst the participants in relation to their personal lives. Anna shared that she hasn't often identified with gender-based discrimination and that in her case it more often takes place in relation to race and culture. Phil related gender to religion and talked about having been excommunicated from his church and his parents having traditional gender expectations of him and his partner.

This first get-together at the lab ended with participants discussing possible tie-ins for the project – including the possibility of creating a short documentary, which the Concordia University Television group could help us with. We eventually left in high spirits, Anna going back to her artist loft down the hall and the rest of us biking home in the same direction and eventually splitting off along the way.

In hindsight, I felt quite positive about this first get together, particularly for the extent to which it allowed the participants to explore commonalities: the shared characteristics that stemmed from their individual expressed vulnerabilities and interest in taking part in this project. To Wenger, this is a crucial aspect of the process of becoming a community:

> In the process of sustaining a practice, we become invested in what we do as well as in each other and our shared history. Our identities become anchored in each other and what we do together. As a result, it is not easy to become a radically new person in the same community of practice. Conversely, it is not easy to transform oneself without the support of a community. (1998, 89)

Life-history reflections

As a next step to Power Up!, I requested that the participants submit life history reflections in preparation for our first meeting together, where we would collectively discuss the project. My intention with this questionnaire was to encourage participants to reflect broadly about the social implications of engaging critically with technology, about their personal history with it, their current comfort level and what they could envision as potential applications or next steps to consider outside of the boundaries of Power Up!. The questions asked of the participants were the following:

1. What, in your opinion, is the purpose of technology?

2. What is a specific, significant, childhood memory of a difficulty you had in engaging with technology (e.g., helping an adult with a project, fixing something)?

3. What, in your opinion, were contributing factors to those difficulties?

4. What are the specific aspects about engaging with technology that feel challenging to you as an adult? Please provide examples.

5. What, in your opinion, are contributing factors to those challenges?

6. What do you see as appealing in knowing how to engage with technology?

It is soon after I had sent out the questions to the group participants that Jennifer left the project. Her answers to the life-history reflection were very brief and when I asked her for more information, she submitted lengthier answers but then soon after wrote in again to briefly say that she would not be able to continue. As such, I asked Alissa, a friend who had written a compelling letter of

candidature, to take her place. As a first step to her involvement, Alissa agreed to also submit a life-history reflection.

Below is a summary of the life-history reflections provided by the participants.[46] These were submitted by email over the course of the week prior to our September 24 meeting.

1. What, in your opinion, is the purpose of technology? Answers provided by the participants related to the purpose of technology were varied. All five participants mentioned to various extents that it allowed aspects of our lives to be made easier. According to Anna, "It is used to improve the quality of life for someone or something, by making a difficult task require less effort and energy expenditure." Other responses were diverse; highlighting the complex range of interactions we are likely to have with technology and the diverse ways in which people interpret it and react to it.

Niomi, who identifies as a transhumanist,[47] also brought up the significance of ease making, "the purpose of technology is to facilitate and hopefully one day achieve human enlightenment, which is to say, ascension. This is the long term goal, assuming we don't self-destruct before achieving ascension (hence 'hopefully')."

In addition to the extent to which technology improves our lives, two participants mentioned the importance of play. According to Phil, "While historically it [technology] is connected with work,

---

[46] Even though they were handed in, for the sake of consistency the summary included herein does not include Jennifer's reflections.

[47] Transhumanism is a movement that aims to transform and improve humanity through the melding of the physical, intellectual and emotional self and various technology.

today it is often also connected with play and amusement. Video games, for instance, have been some of the most important forces driving the development of powerful GPUs. "[48] Alissa considered the future applications of technology in relation to play: "[Technology] provide[s] entertainment or a new possibility for play. Google Goggles[49] provides an augmented reality, almost like an annotated book, but doesn't necessarily provide critical information necessary to accomplishing a task. Arduino microcontrollers[50] can be used to create limitless projects."

In addition to the ease that it allows in life, Zinta highlighted the political connotations of technology and the ways in which it allows for the perpetuation of power hegemonies:

> Technology development is usually seen as "progress" and using technology or having access to it as a sign of power and of having attained a certain standard of living (usually high). This view is very urban - /"modern-" /western-world-centric. . . . People living in societies with a high level of access to technology [are led] to believe that they are superior or better off than other societies that have evolved differently (see Colonialism, see how people living in first world countries/the global north think they need to "rescue" third world countries/the global south. Of course these things also require a dose of racism and aren't just attributed to differences in technology). I think if one wields technology and the idea of progress without humility it's going to fuck with their humanity and the possibility of experiencing life deeply. So I think we need to be careful with technology, how we use it, and what we think it's supposed to achieve in general and for us. We need to be careful not to use it as an excuse to have power over others.

---

[48] GPU stands for Graphics Processing Unit. It is a piece of electronic circuitry which facilitates the production of high-resolution computer-generated imagery – such as that which would be found in computer games.

[49] Google Goggles is a piece of image-recognition software created by Google for smart phones. It allows the introduction of on-the-spot information feeds on whatever object the device is pointed at, i.e., pointing a device at an in-store product could grant access to customer reviews or additional consumption information.

[50] Microcontrollers such as those manufactured by the Arduino project, are easily modified, imbedded computer circuits that allow highly specific computerized functions in a wide array of electronic objects. Examples of tasks that can be programmed could be an automatic reaction in an object to a particular outside stimulus or a relatively simple degree of task autonomy.

2. What is a specific, significant, childhood memory of a difficulty you had in engaging with technology (ex: helping an adult with a project, fixing something) and what, in your opinion, were contributing factors to those difficulties? Childhood memories shared by the participants were descriptive and evocative. Oftentimes, the experiences described significant challenges that were experienced by the individuals.

For Anna, the challenge identified was related to the intrinsic difficulty of engaging with technology when attempting to learn a new skill-set. Anna mentions attempting to write a computer program and feeling bored and sad when it did not work. She writes, "When I was very small, say 6 or 7, I wanted to test if I was a genius, so I decided a good test would be if I took apart an old wind-up alarm clock by myself and then put it back together solely led on my intuition. Needless to say, I failed miserably."

For the other five participants, engaging with technology as children were experiences with connotations of power divides in relation to an adult, frequently a male parent or an older male sibling. There were frequently themes of gender related to the difficulties described. In describing earlier memories, Niomi wrote, "As a young girl in the 1970s and 1980s, the biggest technologically-related difficulty I encountered was being held back from – or outright banned from – engaging with technology. I got Barbies (which I hated) while my brother was given DIY electronics sets to play with (ie, Mechanix sets). I'd ask for the sets, and show more interest in the sets, but I wasn't allowed to use the sets and I was never given any for my birthday or at Christmas, etc. no matter how many times I asked. Those were for boys, Barbies were for girls. It's one of those things I still feel some resentment over."

Zinta shared an experience of having had to defer to her father or a male sibling: “All I can think of now is fiddling with the VCR or the computer and having to adjust settings or hook things up. If I couldn't figure it out, I would defer to someone else, usually my dad or my older brother.” Niomi named sexism, misogyny and “nuclear-family mentality” as contributing factors to such difficulties.

For Alissa and Phil, the negative gendered interactions occurred in the context of named educational environment. Alissa writes, “When I was 6 or so, I did a 'computer class' where I typed in rows of code for what seemed like an eternity on Wednesdays. I don't think anyone actually explained to me what I was doing it for, not my parents who enrolled me nor the man who 'taught me.' . . . If someone had explained it to me, I probably would have been more interested in it. Instead, it was that old idea of just telling a girl to do something, without trying to engage her. I also think this was the start of my frustration with and intimidation by computers, and that sense that computers and electronics in general are realms that are not intended for me because of my gender.”

Phil's response to this question was particularly evocative and I have chosen to include it here in full, for the extent to which it allowed me to consider how gender divides could still be reflected in male experiences. It is also a valuable look at how technological literacy is acquired in technologically-cautious religious communities:

> One of the most challenging experiences with engaging with technology when I was young was when I decided to learn how to code in Visual Basic. I had been using QBasic for some time, writing very simple programs and small games. When my family bought a computer that ran Windows, however, I was excited at the prospect of learning how to use a language that was based on a graphical user interface rather than being simply text-based. While I progressed quickly at first, I soon began to run into many problems with compiling. While I spent a significant amount of time trying to figure out what the source of the errors were, I never managed to locate them. This quickly became very discouraging, and led to a disenchantment

with the idea of programming in any language. It is only recently that I began studying any programming languages.

The main problem that I faced in learning about technology was the fact that I had to learn it all alone. Every aspect that I know about technology is self-taught. In my childhood, this was due to several factors, most importantly my homeschool education and my parents' religious affiliation.

From grades 1 through 12, I was homeschooled, primarily due to my parents' religious convictions. This meant that not only did I not have actual teachers, but interaction with my peers was also extremely limited. As can be imagined, it was a very insular learning environment. Most of my learning was done through textbooks, all of which came from right-wing fundamentalist Christian American publishers. Technology, in that context, has a very complicated history. Modern science is seen as a humanist endeavor to remove the need for a god. Technology, having its roots in science, thus comes from a fundamentally sinful background, but it is still difficult for even the most right-wing of publishers to condemn technology in general, due to its extremely practical uses. Because of this contradiction, technology was, for the most part, ignored in my homeschool curriculum. History textbooks simply did not talk about the importance of technological revolutions, science textbooks were generally at odds with the majority of modern scientific thought, and technology courses simply were not an option.

Another significant factor was that my parents' church has a deep-rooted fear of technology. While I was growing up, elders in the church would regularly condemn things like computers and the Internet, claiming that they put a source of temptation and sin directly into the houses of believers. I vividly remember an announcement that the church was recommending that "monitor-based technologies" should not be used in homes, unless absolutely necessary for work-related purposes. While my father generally disagreed with this attitude, allowing me to explore technology as much as I liked, it was not a pastime that I could freely engage in with friends, or even openly discuss with many of the people that I knew growing up.

My mother, the person who planned my educational courses throughout my schooling, was put into a very uncomfortable position regarding technology in my education. While my father believed in the importance of technology, he was very busy and had little time to become involved. My mother was very suspicious of much technology due to the influence of the church, but was convinced by my father and by recognizing my obvious interest in the subject. Beginning in grade 9, I was allowed to create one of my own courses per year, all of which focused on technology. While at the time I viewed this as a personal triumph, it was only after starting to attend university that I came to see that all of these experiences were severely lacking in guidance. Not having a teacher or classmates with whom to discuss projects stunted my learning and led to innumerable frustrations in trying to make things work.

> Many of my current challenges in regards to working with technology stem from my childhood experiences, and the methods that I developed to work around those issues. Due to the fact that I was forced to study on my own, I became a very independent learner. While this certainly has its positive sides, it also has some negative consequences. It is difficult for me to simply ask teachers questions about things that I don't understand, and even harder to ask classmates or colleagues. My natural reluctance to ask questions to others is compounded by a certain tendency in certain technology-focused fields to discourage others from asking questions. In many online Linux forums, a stereotypical response to many questions is "RTFM," i.e. "read the f---ing manual." With the growing popularity of Ubuntu, a distribution focused on being easy-to-use and with a large, newbie-friendly community, this attitude is greatly mitigated in the general Linux community, but still persists in many more specialized groups. This attitude forms a needlessly difficult barrier to entry, and enforces a very steep learning curve. It also creates numerous other secondary barriers; for instance, if I find that the online community around a certain project is very unfriendly, I am much less likely to want to try the project, and my interest and motivation to learn will significantly decrease.
>
> This is one of the main reasons that I was quite excited about the Power Up! project. The idea of learning together in a group is one that I have realized is sorely lacking in many technological circles, which are largely dominated by online interactions, with communication between more or less unknown people. While useful, it does not often encourage real-life interactions or facilitate other methods of learning.

3. What are the specific aspects about engaging with technology that feel challenging to you as adult? Please provide examples. What, in your opinion, are contributing factors to those challenges? Much like Phil, the other participants also experience difficulties in engaging with technology as adults. In three cases, participants described instances of discomfort or judgment in adult situations – sometimes when engaging with peers or friends. To Alissa, a "recent example would be that friends offered the use of their projector for a movie night, and a few of them laughed at me when I didn't understand how to set up a projector." Zinta highlighted challenges she has encountered in the

bicycle cooperatives to which she belongs[51]: "A lot of difficulty has come with bikes and learning how to fix [bicycles]." She further cites as an example "bike mechanics who act like their way is the best way to do something and they know everything."

For Alissa, a lack of knowledge is in and of itself a hurdle to acquiring it and a lack of familiarity with technology acts as a barrier to acquiring further technological literacy: "I feel like I don't have the appropriate resources to learn – I can look some stuff up on the Internet, but because of my limited knowledge, I often get frustrated because there is a lot of information out there, but I have no way to evaluate what is useful and what isn't." Anna further stressed this and saw her own personal vision of herself or acknowledged limitations, as technologically limited, as an inherent barrier. "On your own, it can feel quite overwhelming. There is the struggle with working with your own temperament too. For me I can sometimes be patient, but also I can be impatient and get so frustrated that I return to a more familiar technology."

Zinta instills the notion of choice into her lack of technological knowledge and sees it in relation to core values, how she sees the world: "I haven't made space in my head or in my apartment for collected tools related to technology. . . . I supposed I just don't have an established narrative for it in my life, except relating to bikes."

As a summary of these personal narratives, it is evident that all of the Power Up! participants have experienced a complex array of barriers to engaging with technology. Many of these barriers

[51] Both Zinta and Alissa were at the time involved with the student-run McGill University-based bicycle maintenance collective The Flat.

connect to the power that a wide array of social institutions, including gender expectations, educational systems, religion and the predominant social discourse, have had over the participants. It is therefore understandable that when participants were belittled as a result of their lack of knowledge, that complex and contentious dynamics emerged and further reinforced low confidence or lack of interest in engaging with technology.

In fact, all of the participants highlighted to various degrees in their own narratives, their own perceived shortcomings. Over the course of the reflections, it became clear that participants were partly interested in this project because they were frustrated with their lack of familiarity with technology or with the dynamics that had surrounded it. The expressions of frustration expressed in these narratives were sometimes very powerful. To Alissa, "There is certainly a sense of shame for me, and a desire to hide the fact that I don't understand the tech that is being used." In other narratives, shame was substituted for self-consciousness or embarrassment. In fact, this allowed the theme of vulnerability to enter discussions amongst participants at a relatively early stage in the project.

4. What do you see as appealing in knowing how to engage with technology? In their narratives, all the participants perceived technological literacy as both appealing and personally and socially important. There was a recognition of both its personal applications – what participants could do with this technology – as well as of its social importance - what technology represents in a greater sense and how understanding it allows insight into how the world works. The two were not seen by the participants as mutually exclusive. Phil stressed the importance of fun – the personal pleasure derived

from the capacity to personally engage with technology: “My attraction to technology is primary based on... how to take an object that isn't very interesting to me or that I can't use, and change it in order to make something that is useful or fun.” This recognition of the personal rewards were also named by the other participants as significant alongside the social significance of this sort of literacy. To Niomi, “As a posthuman enthusiast, and someone who believes we are currently in the process of evolving from homo sapiens to who-knows-what-we'll-be once biology merges with machine ... knowing how to engage with technology is the difference between extinction-obsolescence and perseverance as a species.” To Anna,

> In understanding technology I feel it is demystified and I feel more in control of my life and my surroundings. There is such a focus on technology these days! I feel it is only going to become more and more important. It is good to be part of the discussion and understand the logic of the technology in my life. It is never a good idea to give away all the power and knowledge, so I feel a need to stay involved as a form of micro-activism. Also I am always interested in making more kinetic sculptural work and it seems technology is the way to go for this. As well, so many people are enamored of technology so it seems that if I am to be a part of the community I live in and be able to relate to others I should educate myself.

It was often in relation to these named barriers that the Power Up! participants, in their reflections, stressed the importance of having access to supportive learning environments – places and groups of people where they could collectively make sense of unfamiliar territory, where it is allowed to fail, to “not know.” To Anna,

> On your own, that can be quite overwhelming. . . . Looking ignorant and stupid is another challenge to overcome when you are learning something new as an adult. It is great if you can be in what feels to be an emotionally safe environment where it is ok to make mistakes and ask silly questions repeatedly. Great teachers are a rarity! I've had good teachers but I've also had people that were challenging to learn with as they got frustrated easily and couldn't understand

> how to explain things in a variety of ways. It was harder and less fun to learn with those sorts of teachers and I was more likely to become an independent student when paired with learning with a good teacher.

The importance of having access to a supportive learning community is echoed by Alissa:

> When I can work on something without having to rely on someone, or being able to ask someone questions and feel confident that I know what I am asking and that I will understand the answer is both empowering and encouraging. It means I am more likely to learn more. That I will be able to, in my turn, explain how to engage with technology is also appealing. I volunteer as a bike mechanic and teach people how to fix their bikes, and the process of watching someone learn and helping them understand and become empowered in fixing and understanding and talking about their bikes is a really rewarding process to be a part of, and so the more things I understand how to do, the more opportunities I have to show someone else what I know.

All of the participants had readily identified misgivings in engaging with technology and were very generous with the depth of their reflections. In that respect, the perpetration of negative experiences through traditional top-down authoritarian structures was a recurring theme that got me excited to see how the group would react to a peer-driven educational model.

However, the reoccurring gendered nature of some of these negative prior experiences – perpetrated by brothers, fathers, friends and educators – was also in hindsight a first clue as to what would inform our group's interaction with the predominantly male Foulab membership.

First facilitated group discussion

On Monday September 24, 2012, we reconvened at Foulab to engage in a facilitated group discussion. I arrived at the lab early to set up the lab projector on my laptop but I wasn't able to make it work. Raptor, a lab member and PhD student who had agreed to attend this discussion, observe it and take notes, suggested that the VGA cables might be in the wrong outlet. I dismissed this even though this eventually turned out to be the problem. I eventually became frustrated and gave up and when participants arrived, I assigned the task to Phil. Phil and Raptor eventually figured out the problem and afterwards, this got me reflecting on my evident perpetuation, at this very first Power Up! session, of a clearly gendered interaction where Raptor's suggestion was not investigated and Phil was assigned the task of resolving it when he arrived.

The other participants eventually all made their way to the lab – first Alissa who was having a "bad" week[52] and then the others soon after. We settled in and participants and Raptor got further acquainted before we eventually launched into a discussion during which the participants gradually opened up about their respective life-history reflections and explored the similarities in their expressed prior reluctances in engaging with technology. In hindsight, it is evident that during those first exchanges, we were exploring the necessary common grounds that would become a base to Power Up!

---

[52] Having a bad week or a bad day was a reoccurring theme. Participants either made this explicit and stated it when coming in or disclosed it when asked how they are. According to my field notes, Alissa and Niomi were the participants who most frequently were having "bad" weeks or days.

as a community of practice. Our shared challenges were an important component of the core culture of our undertaking and the purpose of our community.

The first month - the kind of bike-powered generator we wanted to build

The first month of the project comprised the information session and the first three official meetings at the lab that primarily saw us reflecting on the project, how we envisioned it in relation to our group dynamics and in terms of the kind of bike powered generator we wanted to build. Much of these first meetings had us getting to know one another, and slowly developing a method that we would use to work as a group.

A typical get-together would have me arriving fifteen-twenty minutes early in order to go get beer and snacks, open the space and arrange a computer and projector in case we wanted to refer to our wiki or other on-line resources. Project participants would then start to arrive with all of them typically present by between ten to twenty minutes after the get-together was due to start. There would then be a period of fifteen minutes to a half hour of socializing and eating snacks with participants catching up with one-another, before we actually began to even discuss Power Up! We would then progress cautiously towards whatever task we needed to address and eventually work on the project for two to three hours.

As a participant observer, this part of the project at its onset was perhaps the most challenging – since I very much felt the project's lack of parameters – since aside from having named that we wanted to collectively build a bike powered generator, none of us held the totality of the skills required,

know-how or confidence to accurately name the steps that were needed to undertake in order to complete this task. This initial abstractness in the project – the fact that it was at its onset essentially made up of a vague proposition that lacked experience, concrete steps or actual components - was at times very intimidating to me, especially given the evident labor which the project would require and the slow pace we were moving at.

I also believed that the human element was important to foster at the onset and, in line with concerns expressed by Wenger, was anxious for the relational inter-dependency to set in:

> Ensuring the cohesion of a team through friendship is different from outlining a set of goals, a schedule, and a work plan; calling upon the moral commitment of participants is different from presenting a statistical demonstration of consistent injustice. Through recourse to each can create a very different atmosphere, both avenues can be effective in influencing the development of a practice. (1998, 92)

I intuitively felt that one of the most crucial aspect of the project were the relationships between the participants and how and whether shared leadership would successfully emerge, which I believed would ultimately result in whether or not we would manage to build the generator. As such, it was difficult, over the course of the first month at the onset of Power Up! to witness myself struggling between applying too much or too little direction to the process – in relation to what I sometimes felt was a carefree disposition on the participants' part – and questioning whether or not my forcefulness, when it came up, was a result of 1) my work experience as a facilitator, 2) a gender-driven sense of ownership over the space, 3) my established comfort in the Foulab environment or 4) an acute awareness of the demands of the research project and feeling the need to move forward. In all likelihood, the tension I felt was a result of all four.

One example of the way in which this anxiety in myself – in relation to the speed at which the project was evolving - manifested itself, was a negative reaction I had during the information session we held on Monday, September 24 when the participants came to visit the lab and discuss the project. During this first get-together as a group, Anna suggested that we could create a wiki to share resources with one another and document our emerging vision of the generator. When she brought it up, I felt myself becoming annoyed at this unexpected development – which I immediately associated with my own challenges at setting up web-based platforms. I right away feared that this potential new component of the project which I hadn't initially anticipated would require significant investment on the group's (or my) part and rather than view that moment as an expressed interest in a potential learning tool, felt that it would likely detract from what I felt the primary objective: building a bike-powered generator.

I expressed my concerns cautiously, asking Anna for clarifications about the work that would be required to set up this wiki. Anna assured us that it would be easy to set it up and that she would take care of it. She did – in fact, over the course of that very first evening, working on her computer while we chatted – and subsequently, the Power Up! wiki became a useful and important component of the project, especially during those first few weeks when we attempted to make sense of the sizable amount of information widely available on the topics of electricity and bike powered generator creation.

There were a number of learning approaches which we took part in over the course of our work together in order to come to a collective agreement as to what would make up this project. This included the following approaches summarized below in Table 3:

Table 3: Learning approaches

Learning Approaches	Notes
We all undertook research individually into bike powered generators and electricity and shared the resources on the Power Up! wiki and during meetings.	Drawing on existing resources available on-line. Different kinds of bike-powered generators developed by others were brought forward for consideration as well as other resources that would allow us to better understand how electricity is generated. Amongst the various resources which were especially useful were the following: • Musician and sewing artist P-Nosa's website[xi] which includes plans and notes on his own bike-powered generator. • The Science Share website.[xii] • The Instructables website which included various models of bike powered generator including a 440 watt generator[xiii] which we referred to regularly. • The Steward Community Woodland permaculture site and an article about different approaches to consider when building a BPG.[xiv] • The Renewable Energy Index site.[xv] • YouTube videos[xvi] of various BPGs.
The group took part in a facilitated group discussion at the onset of the project in order to discuss the kind of generator we wanted to build.	During this discussion, we debated the pros-and cons of the different strategies we could use such as whether we wanted the bike powered generator to be a bicycle on a stand, an exercise bike, whether we wanted to store the energy produced in a battery which would incur us some amount of loss in power or use the bike powered generator to directly power up whatever tool we were interested in using.
I researched and shared with the group youtube videos on electrical conductivity.	We watched these as a group at Foulab as part of a get-together and subsequently discussed these. The videos we screened were: • A 1940s General Motor instructional videos on conductivity.[xvii] • A Sullivan Training Systems video defining Volts, Ohms and Amps.[xviii] • An Afrotech Mods video on conductivity.[xix]

Niomi researched and carried out projects attempting to create rudimentary motors using magnets and fruit.	She uploaded plans for these to the wiki and brought the components to replicate the experiment to a thanksgiving party held at my place and then to a group session at the lab.
Over the course of two get-togethers, participants shared their own concept maps of what made up a bike-powered generator.	This allowed us to visually represent our own understanding of the components that made up a BPG and to begin to understand the merits of the various approaches we could use.
Participants gathered and shared text documents explaining how electricity and power are generated and on the different components of a generator.	These documents were uploaded on an ongoing basis to the wiki and were referred to during our weekly meetings. Sometimes print-outs of a particularly inspirational article were brought by a participant to share with others.
We discussed with lab members – asking questions on the Foulab listserv and to lab members in person when we were at the lab.	As described below, our interactions with lab members did not always result in satisfactory experiences. Although there were times when useful information was provided, likely as not, asking a question to the Foulab listserv or to participants during open-house night, might result in cursory information.
Information was shared and discussed between Power Up! members in a variety of ways.	Informal one-on-one and group exchanges would occur during our weekly get-togethers as well as by email and on the Power Up! wiki.
Hands-on interaction with the tools of the lab and the components of the project.	Much of the learning occurred through hands-on trial and error and by directly experiencing what it was like to make direct use of the technology required to build the BPG.

Thanksgiving weekend and weekend visits

Thanksgiving was notable for two reasons. First, it marked our first acquisition of a number of the actual components, which the project would require. This took place when Zinta and I drove to Addison, an electrical components store in the east-end of Montreal. Second, it led to a deepening of interpersonal relationships amongst members and led me to experience a bridging between the research project and my personal life when some of the Power Up! members (Zinta, Alissa and Niomi) came over to my house for a party.

During the previous week's Power Up! meeting, Zinta, Niomi, Phil and I had all expressed interest in going to Addison to get some of the components that we would need to build the generator. Many of these components were fairly specific and couldn't be found at Foulab and rather than spend additional time looking for these outside of the lab and for the sake of moving ahead with the project, I opted to purchase them. We agreed that I would reserve a car and would pick people up at Zinta's in the early afternoon. However, when my roommate and I decided to host a Thanksgiving party, we decided to go to Addison in the morning instead and I extended an invitation to Power Up! participants to come over to the party afterwards.

I drove over to Zinta's in a rented car at around 9:30 am to pick her up. We had heard from Phil via email that he had made plans and wouldn't be coming and Niomi had previously told us that since she wasn't a morning person, she couldn't join us that early. When I got to Zinta's, we had juice and looked at the bike-powered generator plans on the Instructables website, which we had all opted to draw inspiration from, and the list of things we would need to get. This planning part felt fun and

exciting – despite not having been too thrilled at getting up early that morning, I found myself enjoying the planning of it once Zinta and I were working on it together. After discussing it, we printed the list of components and went over to Addison.

At Addison, Zinta and I wandered around fairly aimlessly for a few minutes. It's a huge, highly specialized environment filled with all sorts of electrical components and construction tools. It felt intimidating and I became conscious of deferring to Zinta's lead in making our way around the store. Eventually and after briefly discussing our general confusion on where the things we were looking for could be, we asked a clerk for help. The clerk, an older man, was friendly and accommodating even though it was clear that we didn't really know what we were talking about. Zinta spoke with him in French and he didn't switch to English, despite her accent and occasional hesitation. Despite the store's relative busyness, the clerk took the time to show us some of the components that we needed (fuses and a fuse coupler) and pointed us to other sections of the stores where we could obtain the rest – cables and voltage meters. We went looking for these and engaged with other clerks – all of whom had friendly or neutral dispositions. I was not expecting us to be favourably received in this foreign environment and eventually we became comfortable enough in the space to venture around the store on our own to gather the rest of what was needed.

Notably, though this somewhat aimless searching was a slightly frustrating experience to me, Zinta seemed to be enjoying herself and expressed delight at the wide array of electrical switches available and how colourful and fun to use they appeared. Her enjoyment was infectious and I eventually felt myself relaxing into the space and our shared experience. Over the course of about an hour, we ended up purchasing many of the components we needed and left in relatively high spirits.

During the drive back, we talked about how positive we had felt this experience at Addison had been and eventually moved on to talking about our personal lives. I dropped her off, returned the car and went back to my house to help my roommate prepare for our Thanksgiving party.

We had invited people to come over around one o'clock in the afternoon to celebrate Thanksgiving. Niomi, Zinta and Alissa all came over and joined ten or so other people for games, food and singing. Anna had also planned on coming over but had to cancel.

The previous week at Power Up!, we had discussed the possibility of going to the lab after the party to work on the generator and at around five o'clock, we discussed this but Alissa said that she had made other plans and wouldn't be able to go. I also got text messages from Phil and Anna saying that they too wouldn't be able to join us for a work session. Nevertheless, as people left the party, Zinta, Niomi and I sat in my living room and talked about the project as the party began to wrap up. Niomi had brought the components necessary to try out a simple battery motor experiment and we talked openly as she slowly built it with the parts that she had brought: coils of copper wire, a magnet, a battery. Niomi shared personal details about her childhood and some of the difficulties she has had in engaging with men. Her and Zinta discussed intimacy, gender roles and men's domineering attitudes towards women. I didn't feel too comfortable with this discussion, given that Niomi was asking me personal questions, but nevertheless went along with it. Eventually, after Niomi completed the battery project, they both left.

Though the exchange initially left me feeling cautious and aware that we were now solidly in territories wholly unrelated to technological literacy, I eventually came to realize that it was a useful exchange – during which Niomi, Zinta and I developed closer links. After this exchange, discussions of

sexuality became an increasing part of the exchanges amongst our cohort members. Subsequent to this, my relationship with Niomi continued to grow and I was able to react with increasing ease to discussions when references to my sexuality were later brought up in discussions. I also perceived the trip to Addison to get parts as a strong step towards concretizing the project – which was no longer strictly abstract but was now made up of tangible physical components.

Aside from Thanksgiving, there were two other Saturdays when work took place at the lab on Power Up! On Saturday, October 27, since neither Alissa nor Zinta had yet brought a bicycle over to the lab for us to use – despite having mentioned on a few occasions that they would - I brought over an old bicycle left in my basement.

Another Saturday work session took place on November 10. Reviewing my notes, I remember it as a frustrating experience – as a result of getting last minute cancellations from Zinta and Alissa, and showing up at the agreed-upon time to no-one being there. Eventually, Anna did arrive and we had a fruitful evening of work, finishing up the bike stand and painting it with blackboard paint. During this work session, I had an earnest exchange with Anna about the frustrations I was experiencing with the group members' sometimes lack of reliability. This is described in my field notes:

> Anna and I pick up snacks and coffee and head back to her loft. We work on the stand from 4:30-5 pm til about 9 pm. We completely finish it, paint it several coats of paint and start to paint it with yellow lightning bolts at Anna's suggestion. Anna and I develop a friendship during this session. We talk about our respective families and the challenges we have with them. We also talk about art - her practice and my projects. She introduces me to her loft mate. We talk about the project, how it's been permissible for Zinta and Alissa to not come out on this Saturday whereas Anna and Niomi were very apologetic about this. Anna points out that this is because I'm not friends with her, Phil and Niomi and it wouldn't be ok to do this. I share with her some of the fears I have about the project not finishing up and how I feel myself driving it too strongly sometimes. She says that she is very dedicated to the project and won't drop it at

> all. She says that she got a nice email from Alissa earlier today, expressing worries of disappointing us - after Alissa had emailed a much briefer apology to the group, and that Anna had replied, telling Alissa not to worry about it. (November 10, 2012)

Aside from the fact that this work sessions allowed me to develop a closer relationship with Anna and to complete some of the work, it made me realize that even if Zinta and Alissa did not necessarily feel that they were always accountable to me directly since our friendship made this permissible, that they were nevertheless committed to the project, to the extent that their behaviour might impact their (more precarious) relationships with the other members of the group.

The Cleanup

When we came in to work on Power Up! on October 15, the lab was in a state of intense disarray – the central space and the lounge, where we would normally meet were both filled with various items that had been taken off the shelves – random electrical and computer components – towers, monitors, motherboards, lengths of cable as well as other general refuse which all made it difficult to use many areas of the lab.

The Cleanup also introduced a first conflict between the lab and Power Up! On October 16, Etienne, a lab member sent a message to the general Foulab list:

> Please be advised that the area where your project is currently being stored is under reorganisation and construction. The guarantee that it will stay there cannot be assured due to the current undertaking of a major lab cleanup. Furthermore, I have taken the liberty to throw everything into a box for further maintenance, and strongly advise that it stay this way. If the goal of the project is to observe how a group-think like Foulab can help a number of people, it stands to reason that proper project organization and upkeep within such a space is something

> that could probably be of primary benefit. Thank you for your understanding in this matter, - Etienne. (Personal communication, October 16, 2012)

Etienne's formal tone and his sending the message to the general Foulab email list rather than to my personal email both led me to interpret it as a somewhat hostile display. I also found it to be unwarranted since I was also a dues-paying lab member and thus had equal rights to use of the space. Considering my options, I decided to reply once again to the general list: "Sorry Etienne - I thought it was ok to leave our stuff in a corner on that shelf. What would be a good spot for me to leave it? Thanks for putting it in a box. - Alex" (Personal communication, October 17, 2012), to which he replied, "It's currently organized in a plastic box at the foot of the shelf it was at. Some larger pieces are still up there. It can go back on the shelf, but please just keep it arranged in such a way that it's not a sprawled out pile that takes up the whole shelf, preferably kept within the confines of the container. Thanks!" (Personal communication, October 17, 2012).

I wasn't quite sure what to make of this exchange since the equipment we'd left behind had been stacked in a neat pile (though admittedly not in a storage bin) and we had taken care to label the items as connected to Power Up! In the end, I chose to interpret the exchange as the kind of inevitable conflict that frequently occurs in any shared work environment, echoing Wenger's proposition that communities of practice are environments susceptible to the unpredictability of human nature (1998, 97). The Cleanup caused multiple conflicts amongst the Foulab membership – this was evident from the frustrations expressed on the email list during its course. What was notable about the exchange Etienne and I had was the extent to which this notion of boundaries was immediately invoked. To Etienne, the way we had chosen to store our equipment was clearly a violation on our part of an

important code we had not known existed - presumably because we were inexperienced outsiders. The Cleanup moved Foulab and Power Up! closer towards a place of tension and made the lab's cultural boundaries further evident.

The increased state of disarray that the lab was thrown into was a source of frustration as the project continued. It became a challenge to find adequate places to work when we would come in for the project. At this point, a group of us were invested in building the bicycle stand that would hold up the bike powered generator while others were primarily working on understanding the electrical configuration we would need to use to generate electrical power. While we were not at a stage yet where our electrical know-how was high enough to warrant work, building the bike stand required a fair amount of floor space and tool use. Typically, we were working with several different boards of wood that we were cutting to different lengths before bolting, gluing and painting them. As such, the lack of space resulting from the Cleanup significantly impacted us and forced us to work in the hallway, just outside Foulab.

The messiness caused by the Cleanup was compounded in late November by a severe water leak in the Foulab ceiling directly above the power tools section of the lab, resulting from damaged or ruptured pipes in other loft spaces in the building. We first noticed the damage caused by the leak when we came in for Power Up! on November 20. The leak persisted for a few weeks during which buckets were placed around the lab to gather falling water. At one point, a tarp was set up by members to contain the leak but it eventually fell as well, increasing the mess.

During this period, frustration was frequently voiced by lab members on the listserv and various solutions were voiced – some more practical than others – as well as frustration directed at the landlord for the general lack of upkeep of the building; and at various members for not doing necessary tasks to complete this project. The frustration was also felt by Power Up! members and in my notes of November 27, I mention that as a result of the disarray, “I no longer go to Foulab as a first place to check in during work evenings.”

It isn't until our December 5 work session that we witnessed a noticeable improvement in cleanliness at Foulab. By then however, our project was largely completed and we had gotten into the habit of working out of Anna's loft which had become our alternative space to work out of during the Cleanup.

Switching to Tuesday nights

After five sessions held at the Foulab on Monday night when there were few, if any, lab members present, and where there was, despite the Cleanup, space for us to work, we switched to meeting on Tuesday evenings, open house night, as a result of a scheduling conflict for Anna. Our first meeting held during open house was on Tuesday, October 30 and the atmosphere was markedly different than when we met on Monday nights. As we then shared the space with a number of people including lab members and visitors, we typically had to contend with the different work areas and the tools being used by others.

In terms of space itself, this presented a difficulty because there just wasn't room enough in Foulab's now extensively cluttered space during open house night to accommodate the lab's membership and open house night visitors as well as the six of us and the space we needed for the bicycle and bike stand and the various tools and parts we had gathered. For a few weeks, we set up our work areas in the hallway just outside the Foulab front door and ran an extension cord from inside whenever we used tools that required current. This actually worked well enough as a setup since it allowed us a comparatively roomy space to work in: we were just outside the lab and could go in to get more tools as needed and it also allowed us to interact more frequently with lab members and visitors as they came in and out.

In some cases, the interactions we had with lab members during this period were positive. This was often as a result of interactions with specific members. Raptor's presence was particularly helpful at the onset of the project. During the initial meetings when she and Justine were present, their engagement and interest contributed to positive initial experiences at Foulab for the project participants. Griffon, likewise, was notable for his friendliness and sustained interest in the project. On October 30, while we were working on the bike stand in the hallway outside of Foulab, Griffon arrived at the lab with two friends including one whom he introduces as a participant of the McGill Robotics lab. He described Power Up! accurately and positively to them and mentioned that he was looking forward to reading the final report. Elfman, another lab member frequently present during Tuesday nights, was also encouraging and would on occasion ask me how the project was going. In front of other Power Up! members, he once told me about a BBC documentary he had seen about power use required to meet average house needs and the amount of BPGs required to meet that need. These were

fairly brief interactions that, though they did not lead to any particular breakthroughs on the project, nevertheless conveyed positive acceptance and encouragement.

In addition to the times when Power Up! participants ended up socializing with Foulab members, being able to witness all of the interesting projects taking part at Foulab during open house night was in and of itself a source of inspiration. My December 5 field notes relate the excitement I felt at seeing a lab visitor with a large, glowing replica of a magical staff. Nevertheless however, there were also many frustrating aspects related to engaging with the Foulab members and visitors on Tuesday nights and remarks or behaviours perceived as sexist or unwarranted were sometimes directed at Power Up! participants. This is detailed below.

Switching to Anna's loft

On November 13, when we came in for our seventh work session, it was clear that the Cleanup was not likely to be completed soon. The lab was busy and very messy and with the increasingly cold temperature setting in the unheated hallway outside of Foulab, we asked Anna if we could work out of her loft. She agreed and from the point on, this is where we met to work on the bike-powered generator, only going over to Foulab when we needed to use or borrow tools.

At first, I had fairly significant misgivings about us shifting to Anna's loft since I felt that this was a departure from the objectives of the project as situated in a hackerspace environment. Nevertheless, I reconciled myself with the fact that logistically, it made more sense to work from Anna's loft then us staying in the lab's now messy and cramped environment and that ultimately, our

departure from Foulab was a reflection on the nature of the boundaries of this community of practice and the difficulties we had in integrating it. Ultimately though, Anna's loft was close by and allowed us to stay in proximity to Foulab.

Anna's artist loft is one of a series of sub-sectioned rooms in another space in the same building which houses Foulab. She holds the lease to the space and rents out the different sub sections to other artists, while holding her artistic practice in one of the sub-sections.

When entering Anna's section, there is a small, cluttered kitchen area filled with foodstuff and cutlery as well as various art supplies and tools. Immediately to the left of the kitchen is a small, private bathroom and past this is an empty room that Anna rents out to another artist. Past this empty room is Anna's work space – filled with her artwork, various tools, project that are being worked on, shelves filled with books and miscellaneous supplies, a couch and many different plants bordering a window. The whole space has a feel of cluttered and chaotic creativity – not altogether unlike Foulab. When we first visited Anna's loft, on October 1, it was to have a look at a series of wooden doll sculptures that Anna was working for an upcoming exhibit that she had told us about. At the time, the Power Up! participants were excited to visit Anna's loft and marvelled at her sculpture and the space itself.

After this first visit, we gradually become more comfortable in Anna's space and came to develop rituals that had not previously been present or possible at Foulab. Although we kept on occasionally bringing beer, drinking tea became a more frequent occurrence. We also began to play music more frequently – sometimes taking turns at choosing songs on an online music database. Foulab

felt less and less like a host of the project and more as an associated structure – someplace where we could go to use tools that Anna did not have – which did happen on a fairly regular basis.

It's also worth noting that Anna's loft had its own bathroom and that as such, we no longer needed to use the filthy and smelly bathrooms in the building that we were limited to while we were at Foulab.

Completion of the project

On Tuesday, October 30, we were working on linking the motor to the bicycle and we had come up with a way to connect a discarded skateboard wheel and two metal plates to the motor in a way that would allow a rubber motor belt purchased at Rona,[53] to loop around the rim of the bicycle's back wheel and connect to the motor. This proved to be a significant development since it allowed the motor to be powered directly by the bicycle.

Once we had figured out how to connect the motor to the bicycle – which took place over the course of two weeks – the rest of the project fell into place relatively quickly since at around the same time we figured out how to interact with the motor, the wooden bicycle stand had become serviceable. It was good that we were nearing an end because some group members – particularly Alissa – began to

[53] We bought the belt at Rona only after trying some solutions using found objects at Foulab: using a computer printer belt, a rubber belt and a bicycle tube. None of them worked – lacking both the strength and flexibility of an engine belt.

mention that they were looking forward to the project being completed and that in all likelihood, they might stop coming if it continued past the December 2012 holidays.

Nevertheless, by then, it seemed to me as if we worked relatively well as a group. At the onset of a work session, we would debrief our weeks and chitchat before splitting up into work teams which would then handle various tasks. As needed, we would switch from group to group over the course of an evening which would last a few hours. Over the course of two sessions, we attached the motor to a piece of two-by-four placed underneath the bicycle stand and we connected the wiring and components we had picked up at Addison to the motor and to the battery. On November 20, we brought an electrical reader from Foulab and measured the electrical output we could generate with the BPG. This was a festive get-together which saw us in turn get on the BPG to see how much current we could generate by pedalling as quickly as possible. The most we were able to generate was twenty volts.

During this period, we also agreed to make the BPG look as beautiful as possible and Niomi brought in glitter, plastic feathers and stickers that we used to decorate the BPG. This attention to aesthetics was also important to Anna who had previously taken steps to paint the wooden bike stand with blackboard paint, on which we drew lightning bolts in yellow chalk. See Appendix 1 for pictures of the bike-powered generator.

While there was probably more that could have done with the project at this point - particularly in terms of solidifying the structure of the BPG, maximizing the electrical output of the generator and ensuring that all the project participants had sufficiently appropriated the knowledge we had attempted to generate – since we had ultimately accomplished what we had set out to do and built a

working generator, we decided to close the project. One last session was held before the holidays to discuss the project and debrief our interactions. Tellingly – in terms of the decreasing interest in the project - two members (Phil, Niomi) were absent at the last conversation and Zinta arrived late.[54]

Chapter 4: Summary of Themes

In this chapter I present the various themes which emerged over the course of Power Up! These represented significant reoccurring components of the educational experience that we shared. I will refer to these over the course of the project and in my conclusion.

Table 4 below summarizes the research themes.

Table 4: Research themes

Theme	**Explanation**
Interacting with Foulab • Lack of support • echnological literacy • Conflicts with Foulab	Interactions with Foulab were sometimes difficult in terms of our shared use of the space and in relation to varying levels of technological literacy between research participants and lab members. Lack of support, identified gaps in technological literacy and conflicts with Foulab are three sub-themes to this grouping.
Gender & Race	This was a recurrent theme and dealt with barriers in engaging with technology, tools or Foulab that were directly related to gender as well as interactions between Power Up! Participants that dealt primarily

[54] Nevertheless, I believe that their absence did allow for a more intimate debrief of the project and contributed to Alissa and Zinta contributing comments that they would not necessarily have otherwise shared.

	with gender – whether as a vehicle for relationship building or as an identified contributor to conflict. Race came up less frequently than gender as a theme. This theme is named here separately in relation to its coming up independently of gender during initial project get-togethers as well as in relation to the lab's predominant racial makeup.
Beer	Beer is named as a theme for the extent to which it consistently came up as a contributor to bridging relationships between participants or between participants and lab members. Tea can also be named as a secondary theme since it took on increased social significance within our group once we began to work out of Anna's loft.
Friendship	This theme is related to relationships built amongst participants. It was evident that above and beyond the completion of a shared project that Power Up! allowed its participants to develop ties with one another.
Co-learning	Beyond the deepening interpersonal relationships developed amongst the participants, working on Power Up! allowed us to develop a culture of working and learning together on a shared goal that was wholly separate from our relationships. While the instances I coded as related to co-learning were social in nature, they nevertheless stand apart from those I listed as Friendship interactions.

Interactions with Foulab members and users

Our interactions with Foulab and its members and users were varied and not entirely positive. This resulted from a lack of support from the lab members who had expressed interest in project initially and tensions with lab members resulting from different level in technological literacy, conflicts over use of the space and conflicts related to gender and identity.

Lack of support: Few of the lab members who had expressed in supporting the project actually responded to requests for assistance and as a result, Power Up! participants relied on Foulab primarily for its physical space and its tools.

For example, over the course of the first few weeks, as we struggled to make sense of the project and attempted to acquire some of the notions of basic electricity we felt we needed and wanted perspective on the kind of generator we should build, we turned to the different lab members who had expressed interest in Power Up! and solicited their input and advice. For the most part, the lab members I contacted for help did not write back – either when I initially wrote them as a group, or subsequently, when I tried to direct my questions to individual members. Two exceptions were Clever D who felt that his input at this early stage would compromise our ownership of the project: "I hear you on that, but in this situation, in early stages, I often feel like 'design authority,' as folks will interpret what I say as what must be done. It's tricky to do 'hands off" design brainstorming" (Personal communication, October 1, 2012). Electrus did volunteer to hold distance workshops on the fundamentals of electricity and electronics from overseas via Skype, but the time difference made it difficult to schedule a time that would work for him as well as the group.

This lack of investment by lab members is to some extent understandable. Over the course of the project, there were repeated conversations dealing with the lab's declining membership. As a result of this reduction in members, the lab's culture was altogether different from what it was a few years prior and I am tempted to keep in mind that communities of practice are first and foremost accountable to their members. As such it is not altogether surprising that as a result of a decrease in membership,

the individuals who had initially expressed interest in Power Up! may have had to shift their priorities towards other more pressing matters.

Different levels in technological literacy: There were also challenges related to differences in interpersonal communication styles, hostility or shyness. As captured in my notes, "We're also talking about the regulators and wondering if Foulab would have some. Zinta shares 'One time I asked at Foulab, do you have any regulators, motors, invertors and they were like "no, go away"' Niomi responds to this that she feels InTel (lab member involved in the exchange) can be a little bit dry but that it's 'just shyness'" (Field notes, December 4, 2012).

While we were at the lab and Foulab members were in attendance, there were times when we were able to benefit from the lab members as a resource, by asking people spontaneous questions. Sometimes, the input was helpful but also sometimes, when engaging with Foulab members at the lab, we experienced what I describe as a general sense of "overwhelmedness" at the amount of information we would sometimes get from a lab member. This occurred most often when a clear difference in technological literacy was evident – such as when lab members volunteered much more information about a topic than what was asked. What I would see as a relatively simple question put forth by a project member would sometimes result in a lengthy explanation which seemed to contain elements of expertise excitement and even showing off which did more to heighten the awareness of the lack of knowledge held than provide enlightenment on whatever was at hand. One example of this took place on December 4:

> We go over to Foulab to look for a large enough wooden base to connect the two stands. The lab is cleaner than it's been in at least a month. Tools are ordered nicely and there's no obvious

> mess. Ambherst and 2 other people I don't know are there. I say hi to Ambherst. We find a piece of wood and on the way out Niomi asks a lab person about a regulator and if there'd be one around. The person (Linus) inquires what it's for and when Niomi tells him, he provides a very, very elaborate and complex explanation of what he feels we need – without really listening to what we are saying or realizing that it is too much info to share. It's not really helpful and is a bit aggressive in the amount of info delivered and so a bit overwhelming and soon after he begins, Zinta and Alissa quickly leave to go back to Anna's loft. (Field notes, December 4, 2012)

This sort of exchange occurred on occasion and was usually interpreted by Power Up! participants as boasting. During and after these exchanges, Power Up! participants would typically exchange knowing looks or debrief informally and would acknowledge the frustration felt at having experienced a significant amount of largely unwarranted information.

In hindsight, I have come to believe that these sorts of interactions present a strong selection purpose to the community of practice that is Foulab. Lave and Wenger propose that "control and selection, as well as the need for access, are inherent in communities of practice" (1991, 103). I would argue that in engaging us in highly technical conversations, the members of Foulab were, on some level, testing us and evaluating whether or not we could be perceived as peers, which clearly, we weren't.

Conflicts over shared use of the space: A significant difficulty in carrying out the project at Foulab resulted from tensions resulting from a shared use of the space with the membership. Sometimes, this was as a result of poor communication around use of the space such as the tense emails I exchanged with a lab member over the storage of our equipment and which resulted in my feeling apprehensive when engaging with this lab member following the incident and project. Another example is when I came to Foulab on November 10 and was surprised to see several people working at the lab

building 3D printers. I had not been aware that a workshop was being held that Saturday and the presence of that workshop and many participants made it impossible to work on Power Up! in the lab on that day. Nevertheless though, I felt some comfort in Wenger's proposition that conflicts are part of the experience of shared-learning: “Peace, happiness, and harmony are therefore not necessary properties of a community of practice” (1998, 77).

One the most memorable elements of the project, the Cleanup, was an example of a conflict over the shared use of the space. Initiated by a member, this initiative lasted several weeks during which sorting through the lab's belongings that now occupied the main space became the lab's overwhelmingly primary priority - over and above its educational purpose. It was the Cleanup that initiated conflicts with a lab member over the storage of Power Up! Supplies, which had us working on Power Up! in the hallway and which eventually resulted in us shifting our primary location to Anna's loft, rather than Foulab.

Gender and race

Gendered interactions: Gender was a strong recurrent theme during Power Up! and was often acknowledged as a prior barrier during crucial upbringing years by participants, in relation to how they currently relate with the world and in terms of tensions experienced during the project between participants and Foulab members.

The space itself – from its messy, tool-oriented setup, to some of the cultural artifacts (sexist stickers) on display, conversations amongst members (use of the word bitch, overheard by Zinta) and filthy bathroom smelling strongly of urine, all had a strong male connotation.

Furthermore, participants acknowledged throughout the project that there would be gendered barriers to their engaging with some of the technological spaces we would need to turn to for supplies. According to my September 24 field notes, "When discussing possible leads for used equipment, a scrapyard in Verdun was mentioned by Niomi and in response to the kind of male environment it would most likely be, participants were very specific about this needing to be a group outing." This was discussed some more later during that work session and again participants expressed they'd most likely feel unsafe going by themselves to the scrapyard, presumably due to the possibility of sexual harassment and assault,[55] and also believed that they would perhaps get charged more than the parts they would be looking for would be worth. In the case of the scrapyard, it's worth noting that Niomi did end up going by herself. From my notes: "Niomi has gone to the junk shop in Lachine and has gotten a 12 v motor. She talks about the experience and says that it was reasonably positive – the people were nice and she doesn't feel that she was taken advantage of though she acknowledges that $10 might have still been too much to charge" (October 22, 2012).

In addition, participants felt at times patronized or hit on by male individuals at the lab. For example, on November 6, we were working on the bicycle stand in the hallway. Alissa and Anna were

[55] Although this was never named as such during any of these exchanges. Instead, participants would simply agree to the legitimacy of discomfort.

attempting to cut pieces of wood with a handsaw. A lab visitor that I had not previously seen before stopped to watch on a few occasions and then offered advice to Anna and Alissa on how they should be positioning themselves in order to prevent injury. Anna responded curtly, cutting him off - "It's ok, we got it." The lab visitor nevertheless continued – two or three more times - to express concern and each time, Anna would again responded with the same short, friendly reply though increasingly curt. Eventually the visitor left, after which Power Up! participants made fun of the exchange, comically exaggerating the dangerous nature of what was essentially a simple task. Alissa said, "I get a little sensitive sometimes" (Field notes, November 6, 2012).

On November 13, Sam, a lab member, and Chewie, an occasional visitor at Foulab, came by Anna's loft while we were working. Both had been present at Foulab the previous week and had interacted briefly with Power Up! members. This visit was unusual inasmuch as Anna's loft is not directly adjacent to Foulab. Sam had a bottle of home-brewed alcohol with him and though both Sam and Chewie seemed interested in the project, the exchange quickly shifted to a relatively one-sided conversation with the both of them speaking a lot and participants listening and the two of them providing many suggestions on how we should move forward with the project. While Alissa seemed interested in reciprocating their interest, Anna seemed less inclined to engage with them. Eventually, Sam offered us another round of alcohol and both of them left, after which looks were exchanged – even with Alissa whom I had assumed was interested in the visit - and brief comments were made as to the gendered nature of the visit.[56]

---

[56] Driven in this case, presumably, by sexual interest.

On October 30, Lazer, a lab member who was sitting at one of the work tables working on his computer, looked up as we were discussing the project and asked how the project was going. He asked what we were planning on powering with the generator and Zinta answered curtly, “vibrators.” Lazer seemed taken aback by this and looked unsure of how to respond. I had interpreted his question as relatively innocuous and Zinta's response as unreasonable and, feeling uncomfortable at the exchange, I quickly jumped in and elaborated on Zinta's response, explaining to Lazer that our goal was to power up a vast range of appliances in relation to a potential apocalypse where self-sufficiency would be necessary.

Even when not engaging with Foulab members, gender was a strongly recurring thematic. One example was the frequent discussions of intimate-sexual relationships between participants. This set in a few weeks into the project, as participants became more comfortable with one another, and at that point there were frequent discussions of crushes and flings. Niomi frequently initiated these.

Another gender theme worth elaborating on was the personality conflicts within the cohort, between Phil and I and the other Power Up! participants and particularly Alissa, Zinta and Niomi. At times, I was aware of these dynamics. One time Alissa got upset with me for being pushy during an assembly task. This is illustrated in my notes:

> Phil and I mount the bike on the stand. I ask Alissa if she can help tell us if it’s straight. She comes over but after a bit says curtly ‘you’ve got more than enough people to figure this out’ and walks away. I get the sense I was being a bit pushy. Later on, Alissa works on securing the bike seat post with rubber tubing. It’s very tight and hard to push in and I offer advice - maybe just use one layer of tubing? Alissa seems to not take this well ‘do you want to do this?’ she asks, sharply. (Field notes, December 4, 2012)

Other times, I was clearly unaware of gendered tensions within our group. During the project, I had perceived Phil to be accommodating and willing to take a step back to the leadership of the other participants. However, there was apparently also an underlying gender-based tension between Phil and Alissa and Zinta which I had not been aware of, but which they nevertheless opened up about during the project debrief, when they both described him as "forceful in a traditionally male way." This was not echoed by Anna – who was surprised when Alissa and Zinta expressed it. However, during the project, I made occasional notes about a gendered component to Phil's interactions with Niomi, who would more often than not solicit his opinion over that of other project participants when she was unsure how to proceed with one of the electrical aspects of the project. My November 20 field notes provide an example of how Phil was perceived by Niomi and Anna: "As we wrap up I ask people what they think of the project - if they're learning. They all say that they are. Niomi compliments Phil: 'You're a great addition to the group' She doesn't feel that Phil displays a lot of testosterone. 'You're normal, not like us, we're artistic.' Anna disagrees 'I don't think he's normal.'"

Race: Although it wasn't as obvious a theme as Gender, Race was in fact cited a few times at the onset of Power Up! in the context of some of our early discussions. My October 1, 2012 field notes illustrate this:

> When I come back from the bathroom, participants (mainly Anna and Niomi) are talking about women and competitiveness in the workplace and the idea of being authentically female. Anna likens this to the notion of being authentically black. Niomi feels she's personally outside of the definition of an authentic female. Anna says that with being black, it's more aggressive and allows for her being branded as "white-washed," a "traitor" Niomi says it's like the expression of being an "Oreo" and Anna says she hasn't heard this expression in a while.

Although race was not a strongly recurrent theme during Power Up!, the question of authenticity of character invoked by Niomi and Anna would come back consistently over the course of our exchanges. In that regard, I am citing race here as a sub-theme worth mentioning primarily in relation to Foulab's predominantly homogeneous racial makeup which I find interesting in relation to both its mandate as a space that wishes to some extent to promote social engagement, but also in relation to criticisms leveled at hackerspaces in general. To Wenger,

> Recognizing the scope of mutual engagement and its importance in the negotiation of meaning does not imply a glorification of localism. Claiming that communities of practice are a crucial locus of learning is not to imply that the process is intrinsically benevolent. In this regard, it is worth repeating that communities of practice should not be romanticized: they can reproduce counterproductive patterns, injustices, prejudices, racism, sexism and abuses of all kind. In fact, I would argue that they are the very locus of such reproduction. (1998, 132)

As a member of *monochrom*, who in turn were in part responsible for the introduction of the hackerspace model to North-American hackers at the 2008 HOPE Conference, Johannes Grenzfurthner has encouraged the radicalization of the hacker movement and has in the past challenged its homogeneous makeup – in relation to area of politics, gender and race. In "Hacking the Spaces," Grenzfurthner and Frank Apunkt Schneider (2010) consider the identity makeup of hacker culture and encourage its connection to broader notions of social change:

> We find today's hackerspaces excluding a lot of ethnical and social groups that don't seem to fit in or maybe feel so and are scared by the white male nerd dominance, their (maybe) sexist or exclusionist jokes or whatever might be contributed to them. Or perhaps they don't have the proper skills to communicate and/or cooperate with the packs of geeky guys (or at least they might think so). What is needed is the non-repressive inclusion of all the groups marginalized by a bourgeois society just as it had been the intention of the first hackerspaces in counter-

> cultural history. If we accept the Marxian idea that the very nature of politics is always in the interest of those acting, hackerspace politics are for now in the interest of white middle-class males. This needs to change. . . . Let's start to work on this and see what would happen if we change the somehow boring hackerspaces of the present into some glamorous factories of an unpredictable freedom for all of us even those who do not fit in the classical nerd scheme.

And though I am conscious that the scope of my project did not adequately explore issues of race and, more broadly identity politics, there were certainly enough identified challenges related to other identity markers (mainly gender) to warrant a direct parallel to Wenger's statement that "inevitably, our practices deal with the profound issue of how to be a human being. In this sense, the formation of a community of practice is also the negotiation of identities" (1998, 149).

While Apunkt Schneider and Grenzfurthner (2010) are right in pointing out the sometimes complacent, largely homogeneous white male makeup of hacker culture, I would argue that these are sites whose members nevertheless experience shifts to the extent that politicization, a coming to an awareness of dynamics of social power, rarely occurs immediately. According to Chonavec, Lange and Ellis, politicization is a gradual awakening, the eventual outcome of series of interconnected experiences: "It is a process through which people change not only their circumstances, but themselves" (2008, 193). Hackerspaces are significant for the extent to which they allow for this gradual investment. Members of hacker-maker communities typically get involved for personal reasons

and presumably it is through connecting with the spaces and their values that an awakening occurs to the significance of their participation.[57]

Beer

Beer came to my notice as a potential theme, at the onset of the project, as I was beginning to review my lab notes. It seemed to come up a lot – and in varied ways. As I review my notes now that the project is done, I can see the extent to which it subtly permeated both the lab culture and our own interactions as a group.

Beer was a recurrent and visible component of the lab culture – where members occasionally hold beer making workshops and where the first thing in evidence when stepping into Foulab was frequently a stack of empty beer bottles. Beer caps were frequently around – under foot, on tabletops. The refrigerator was most often full of Foubeer and lab members and visitors were hanging around drinking it.

Since Foubeer is sold for two dollars per bottle and since it is in frequently high demand and short supply, the first time we held a meeting at Foulab, I wound up picking up a twelve pack of Moosehead beer on my way to the lab – knowing that this would most likely be enough to carry the project participants through an evening's worth of work while allowing us to have a few extras for lab

---

[57] This has been seen during emerging social movements such as the Arab Springs and Occupy during which hacker groups, and perhaps most notably the hive-mind collective Anonymous, became increasingly political and developed series of tactics that supported on-the-ground efforts.

members with whom we would be interacting with. It was a successful contribution. On my end, I appreciated the post-work drink and it allowed me to feel a bit more at ease in a new environment-project during which our social interactions as a cohort tended to be a bit tenser.

Sharing beer with Foulab members contributed on a few occasions to the creation of (or attempts at creating) amicable links. During our first introductory evening at Foulab, a lab member offered Niomi a beer. We would sometimes offer lab members some during our project. There was also an instance which I describe more fully above when two lab members, Chewie and Sam, came to visit us to enquire about our project at Anna's loft and brought home-made cider with them to share.

And though this theme is codified in relation to the beer most frequently shared with the Foulab members, amongst our group we shared other beverages. It's worth pointing out that our shift to Anna's loft, gradually introduced tea-drinking to our work sessions – using Anna's delicate tea set, aesthetically quite different from the Foubeer bottles.

I have come to believe that, in the context of the many codified layers that subtly regulate engagement with the lab, Foubeer is an invitation, presenting the sort of unique beverage-induced opportunity for dialogue similarly found in places like bars and cafes where strangers might congregate for the purpose of getting to know others.

Relationship-building

One of the most rewarding aspects of observing the working dynamics of Power Up! was seeing the evolution of the interpersonal relationships of the members. At the onset, as we struggled to find a way to work together, I was aware that one of the important aspects in this project succeeding was the extent to which participants would develop a sense of responsibility towards one another. I felt that this would primarily occur if they developed affinities with one-another.

Affinities that I would qualify as friendships developed quickly amongst the participants over the course of the project. While Zinta, Alissa and I knew each other fairly well before Power Up!, Anna, Phil, Niomi were relatively new relationships – both in relation to each other and to the rest of the group. I had only interacted with the three of them (and they with themselves) a few times before – and strictly in the context of playing together in anarchist soccer games during which the interactions are limited to those proscribed by game play.

In my observations, Anna quickly became friends with everyone and seemed to maintain relationships with others after the project. Certainly, her friendships with Alissa and I endured and both of us spent time at her loft watering the plants during the winter 2012 holidays.

Though there were some preliminary tensions (perceived on my part) between Niomi and I, we soon became friends. She was also quick to develop friendships with the other participants and there were instances after the project when both Alissa and Zinta expressed that they missed Niomi and wished to reconnect with her. It's worth pointing out that I subsequently invited her, as well as Anna and Phil, to join other projects that I was involved in.

The relationships which gave me the most pause for reflection were my relationships with Zinta and Alissa. I knew both of them well before the project – over the course of which our relationships did not seem to shift significantly. There were actually times when I wondered if the project was being perceived by Zinta and Alissa more casually than it would have if we had not been close. For instance, there were instances during the project when I felt that Alissa was primarily socializing. Occasionally, Alissa would leave early during a work shift or would indicate other commitments as barriers to coming to a get-together. Whenever she indicated that she could not be present, Alissa would also make it very clear and would frequently warn us ahead of time.

As the December holidays approached and we were nearing our tenth session, I perceived in Alissa a gradual decrease in motivation and presence and I became anxious that she might drop the project altogether. At a discussion on November 20, she made it clear that she wanted the project to be completed and that she could see herself stopping if it required us reconvening after the holidays.

While I was sometimes unsure of Alissa's ongoing commitment, Zinta, on the other hand, tended to approach the project with what I felt was consistent reliability – letting me know if she was likely to be late, engaging directly with the task at hand in a way that seemed to convey an awareness of the importance of completing the project. There were a few occasions throughout the project when I attempted to rush us past the snacking and chitchatting that would always occur during the first half hour or so of each work get-together. In my November 6 notes, I wrote about the extent to which Zinta clearly read my intent and rebuked me slightly and made it clear that she was aware of the shared responsibility and that they would soon get to work.

> When we get to the lab, Phil and Anna are there. Phil looks exhausted and while we begin to talk about who will do what, he nods off a few times, closing his eyes. We talk about what we still need to purchase and do. Anna says she's feeling hopeful about the project and says she can relate to the other participants as "down to earth types." Niomi says that she will be bringing in the alternator for next time.
>
> We decide that Zinta and I will go to Reno Depot to buy a motor belt, blackboard paint and screws while the others will work on the stand. We head out on our bikes and our experience at the store is positive. The clerk who helps us is a woman and she is very helpful. While we're there, Alissa texts me to say that we need to bring back a mallet and chisel.
>
> When Zinta and I get back to the lab, we see Anna, Phil, Niomi and Alissa in the hallway hanging out and having tea. I'm feeling a bit annoyed at this. It doesn't look as if they're working very hard on the bike stand. We take out the belt and look at the motor. Niomi and Phil are having a conversation about the motor and the skateboard wheel. Niomi seems to be soliciting Phil's advice. Zinta and Alissa seem somewhat disinterested and I feel myself pushing a bit - asking them what they're up to and if they'll be fixing the bicycle. Zinta picks up on this and pushes back "we're having tea." Alissa responds though and begins to involve herself in the bicycle and later the bike stand along with Anna and Phil. Anna is cutting wood and Phil is cautioning her not to split the wood of the stand. (Field notes, November 6, 2012)

This sort of exchange occurred frequently throughout the project. The work took place in short spurts either driven by inspiration, improvisation – or in some cases, pressure. As the project evolved and relationships deepened, it became increasingly frequent that frustration and unreliability would sometimes occur. On December 3, I sent out a congratulatory email to the group about us having successfully built the generator and began to address the workshop we had planned on holding at the conclusion of the project. "There's some back and forth around that. At one point, I joke that we can now plan a two-act play. Zinta replies on the list with: 'Alissa, you can be the electron that sits around doing nothing'" (Field notes, December 4, 2012).

My interpretation of these dynamics was that generally participants were not necessarily uncomfortable with the discouragement and lack of motivation sometimes expressed. I saw it largely being interpreted as welcome transparency on Alissa's part, which in turn warranted equal openness

and feedback. This was a further indication that at the very least, we had successfully created a working hub where honest and direct feedback could be readily provided in direct parallel to the completion of our chosen project.

Co-learning

Ultimately, it became evident that Power Up!, rather than strictly being a study of a community of practice (Foulab) and its parameters and culture, became a project about what is involved in actually forming a community of practice. According to Wenger, this process of becoming a community of practice takes time and is informed by social connectedness: "Our experience and our membership inform each other, pull each other, and transform each other. We create ways of participating in a practice in the very process of contributing to making that practice what it is" (1998, 96). As the project unfolded, we developed our own set of parameters, our own culture and an interdependency that allowed us to complete the project.

There were clearly different working styles at play. Phil would not say much and would work very diligently even when at times he was obviously physically exhausted from a long day – on a few occasions I remember seeing nodding off before resuming whatever he was doing. Niomi would work quietly, often checking information on her computer, working side by side with others and eventually, as she grew in confidence, sharing information about her personal life and her passions for the project – and particularly aspects related to electrical conductivity, offering advice to others. Zinta would contribute consistently and positively, oftentimes obviously aware of the "interpersonal process

dynamics" that I was observing and noting down. Alissa seemed the least self-driven although she would make her limits clear and would show up consistently, occasionally bringing forward strong and unexpected contributions. Anna took a leadership role in the project from the onset, diving into the dynamics headfirst without hesitation and I suspect that her strong emerging relationships with Alissa and Zinta helped sustain their interest in the project.

This process was rife with tensions. Our lack of knowledge was compounded by the lack of pre-established parameters for us to work in. My notes of our November 20 check-in illustrate this:

> After a while, I ask if people want to check in about the project - how it's going and how to move forward. People agree. Alissa jumps in and says that oftentimes she hangs back and feels she doesn't have a lot to do. Zinta agrees with this. Anna says that this is the nature of projects where people collaborate together and also that 3 hours is a short time to get settled in and then to accomplish. I express that I'm worried that what with the vacations coming up that people might begin to peter out.
>
> Anna asks what I need from them (the participants). Zinta suggests that having 2 shifts of overlapping groups of people would work better since she feels we're too many to work together efficiently. Alissa agrees and says that she also needs more direction. She says that sometimes she looks at people working and she's not sure what to do - how to jump in. She says she's likely to peter out after the holidays. In response to this, Anna normalises the experiences of expressed frustration - given that we're not used to working together and that people have different skills.
>
> Anna also makes fun of Alissa for petering out "We'll have to call you Peter" and points out that Alissa and Zinta's friendship with me permits them to peter out. This is much more direct feedback than I would feel comfortable giving. To Anna, "For me, it's not an option. I'm committed to this." Alissa says "If I don't come, I don't think it would make a difference." Anna says that in a large group, even people not working is a contribution - by watching and giving their take on a task or being friendly. . . . Alissa jokes in response to this and says she can give us a tape of her laughing.
>
> Anna says that when someone isn't there, "we miss them." Anna proposes that we come up with a schedule of the next few weeks and decide what we will have accomplished by when. (Field notes, November 20, 2012)

At the time, I remember feeling acutely grateful at Anna's directness in this exchange and the concrete proposals she brought forward to help resolve some of the tensions we were experiencing. Afterwards, we put together a work plan and for the rest of the project began to work more efficiently within work teams.

The pacing of the project had a life of its own and this was clearly a leisurely activity for some of the participants who would sometimes arrive late, eat snacks, joke, do some work, then break again before doing a bit of work and then stopping for a week during which online exploration might occur. This is acknowledged in my October 30 field notes: "We're looking at the project and I express that I'm starting to get it and that the project is coming along finally. Participants agree. Anna describes it as 'chunky learning' - and stresses the hands-on nature of it. Zinta says 'it's not fun if it's too fast' and mentions that 'it takes time.'" In considering Anna's chunky learning, I am reminded of Christopher Clark's Applesauce research in which a particularly notable learning exchange is named by the classroom teacher as an "Applesauce moment ... elements of fun, teamwork, practical activity, and many social and academic learning opportunities" (1990, 333) This slow-paced, "chunky" learning rife with social interactions and slow-paced but strong relationship building was ultimately the nature of the Power Up! learning experience.

Conclusion

As I saw Power Up! evolve, I became increasingly interested in the notion of autonomous learning as in relates to technology. At the conclusion of the project, there were many identifiable leads that I will be interested in pursuing.

As an obvious first step, and since I did not sufficiently explore its outcomes here, I will want to summarize the workshop which Power Up! participants led at Foulab on March 23, 2013. As part of this workshop, we provided a succinct and dynamic power-point presentation, an expanded version of which would provide me with an effective means of presenting this project to others.

In the same vein of wishing to share what we learned with others, I would want to compile and share the steps that can be taken in order to build a bike powered generator. In that sense, I would like to follow up on Niomi's interest in developing a concise and easily understood on-line and print resource. Given increasing social interest in environmental issues and sustainable power, I believe that letting others know how to build a simple bike powered generator has significant merit. Indeed, since I have begun to speak more broadly about my research and this project, I have encountered interest in other institutions interested in building physical sites for sharing technological literacy.

In terms of my own future contributions to educational research, I am now particularly interested in 1. Further exploring the characteristics and the politics of communities of practice and the sorts of sites which hold similar features as Foulab: member-led, free of institutional ties and 2. The social movement learning that takes place in the hacker-maker social movement to which hackerspaces belong to. I believe that both could allow me to encounter and explore rich educational environments.

The notion of success can be challenging to grapple with. As I reflect on Power Up!, I am first acutely aware of the project's limited potential for extrapolation. Initially, I had naively thought that this project might ultimately pave the way for learning applicable to other sites and that the project itself might be recreated. However, as I reviewed my notes, it became obvious that Foulab is a unique environment tailor made for and by its members with an outlook and culture (technologically oriented, messy, male) that reflects those who use it most. And while Power Up! was a rich educational experience for our small learning community, it is also obvious that our project was ultimately our own. There were just too many variables involved in the physical and social makeup of Foulab and in the particularities of what the Power Up! members brought to the project, for it to be replicated in its educational entirety.

Further, I am conscious that the project did not succeed in promoting the continued involvement of the Power Up! participants in Foulab. I had attempted to provide Power Up! "learners with opportunities to make the culture of practice theirs" (Lave and Wenger 1991, 95) by promoting their engagement in Foulab. Instead, Power Up! became a for-and-by space, altogether autonomous from Foulab. The clashes we experienced with Foulab made it clear that the culture of the lab was not our own. Foulab's was a male-centered, male-driven environment and our educational cohort was primarily made up of women who were acutely aware of the extent to which gender had previously played a role in their own perceived barriers to engaging with technology. Lab members were technologically savvy and we weren't. We spoke a different language than many of the lab members did. To us, engaging with technology was a cause for anxiety, to the lab members, it was familiar terrain – something to get excited about. As a result of this and other factors, we became insular. Power

Up! was about ourselves, our working relationship, the collective challenges we experienced when engaging with Foulab and about our investment in a shared project. In the context of the Foulab community of practice, we remained strictly on the peripheries, unable to move towards full and confident participation.

Lave and Wenger propose that "control and selection, as well as the need for access, are inherent in communities of practice" (1991, 103). I argue that in engaging us in highly technical dialogue, the members of Foulab were, on some level, testing us and evaluating whether or not we could be perceived as peers. In considering ways in which the boundaries of communities of practice are maneuvered, Wenger considers the role of a broker:

> Brokers are able to make new connections across communities of practice, enable coordination, and – if they are good brokers – open new possibilities for meaning. Although we all do some brokering, my experience is that certain individuals seem to thrive on being brokers: they love to create connections and engage in "import-export" and so would rather stay at the boundaries of many practices than move to the core of any one practice. (1998, 109)

I have come to understand that my motivation in carrying out this project was partly related to the extent to which I had hoped to act as a broker in order to introduce Foulab to others who would benefit from integrating the space and would in turn, expand the mandate of the lab. However, in that sense, I was not successful and ultimately, Power Up! did not integrate into Foulab. The notion of membership in our case emerged in relation to Power Up! exclusively – not in relation to Foulab. We developed a sense of identity, purpose and responsibility in relation to our shared project and its parameters.

In hindsight, I've come to understand our conflicts with Foulab as an extension of its culture as a community of practice. The space, after all, belongs to the current members of the lab. The sort of support that I had hoped for from Foulab hinged on personal experiences that were dated and with individuals who were no longer around. This experience has informed the extent to which I now perceive communities of practice as vulnerable spaces - vulnerable to downward shifts in membership engagement. The lab as it currently stands is more insular than it once was and I worry that unless newcomers arrive to instill life into Foulab, that the community will continue to experience a decline towards a possible demise.[58]

And though Power Up!'s integration into Foulab did not come to pass, what occurred was an equally fascinating exploration of what is involved in creating a community of practice. In that sense, I am tempted to say that Power Up! was also a success. Our isolation from the lab allowed us to draw closer to one-another than we presumably would have otherwise. Our own, autonomous community of practice emerged partly as a result of the gap between Foulab and ourselves. Finding ourselves largely on our own, we were able to experience deep ties between ourselves, with strong relationships and with conflicts that were unique to our group. From cautious conversations on our respective vulnerabilities, we moved towards a sense of joint purpose and common investment in a project. Through repeat engagement, relationships evolved and so the joint investment strengthened as we found ways to work together and to learn from one another and to grow as a result.

---

[58] Over the course of the weeks leading to the end of Power Up!, there were continued discussions on the drop in membership as well as several messages expressing frustration at the lab's state of messiness.

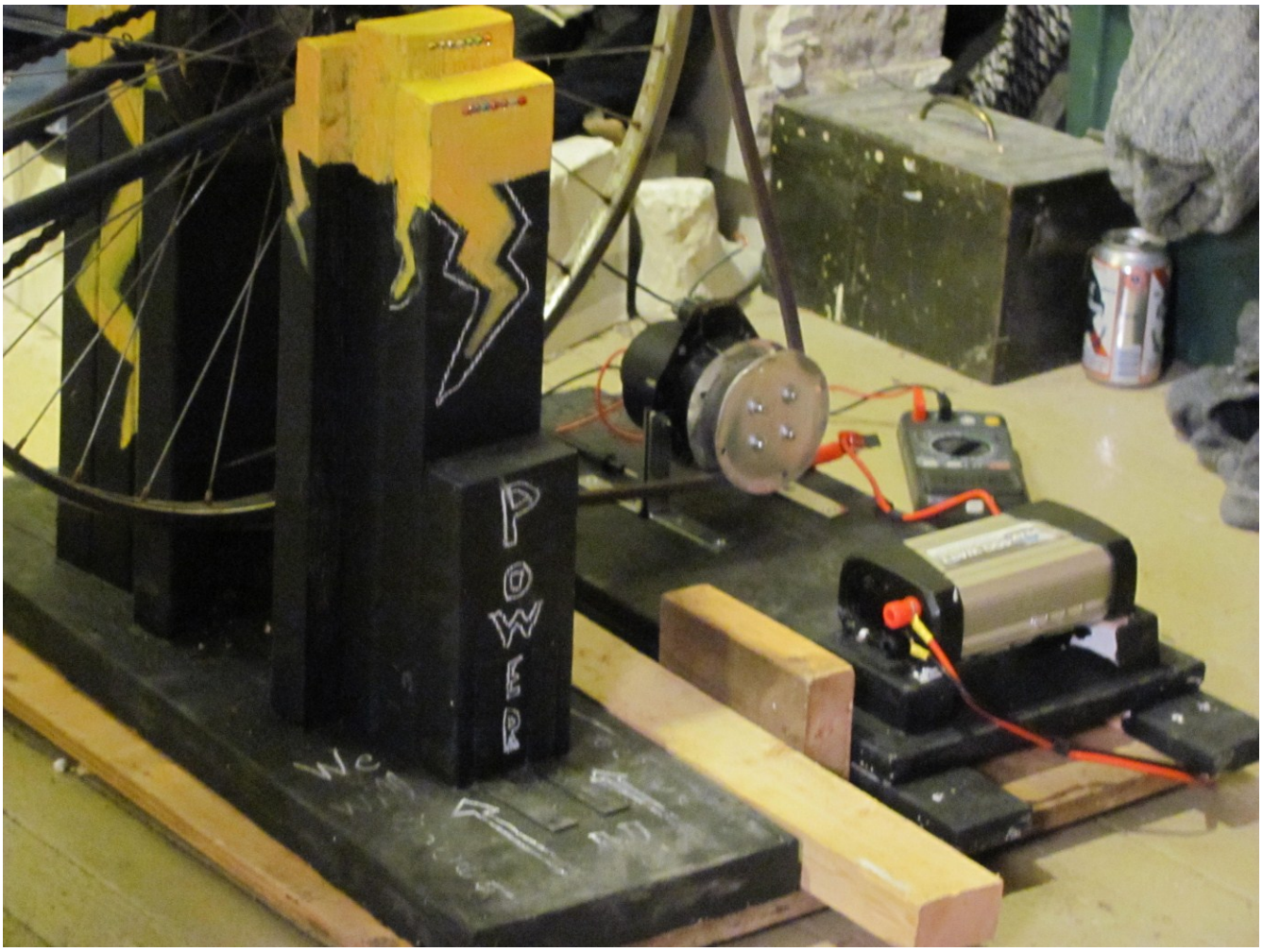
In relation to its stated research objectives, the project allowed participants to learn about Foulab and hackerspaces through a direct and sustained engagement. It allowed participants to develop an awareness of other practitioners and spaces in Montreal. It gave participants the opportunity to learn about the fundamentals of technology – both in relation to the more abstract notions related to understanding things such as conductivity as well as through a chance to experiment with tool use. Through Power Up!, we acquired tangible knowledge which we did not previously possess. This was the result of our collective participation in a shared named space that we all contributed to creating.

And beyond our respective individual growth, as a result of this shared investment in our community of practice, the project undertaken was successfully completed: a bicycle-powered generator was built and it works.[59]

[59] It now sits in my basement, waiting for the zombie apocalypse.

APPENDICES

Appendix 1: The Bike Powered Generator during the glittering session



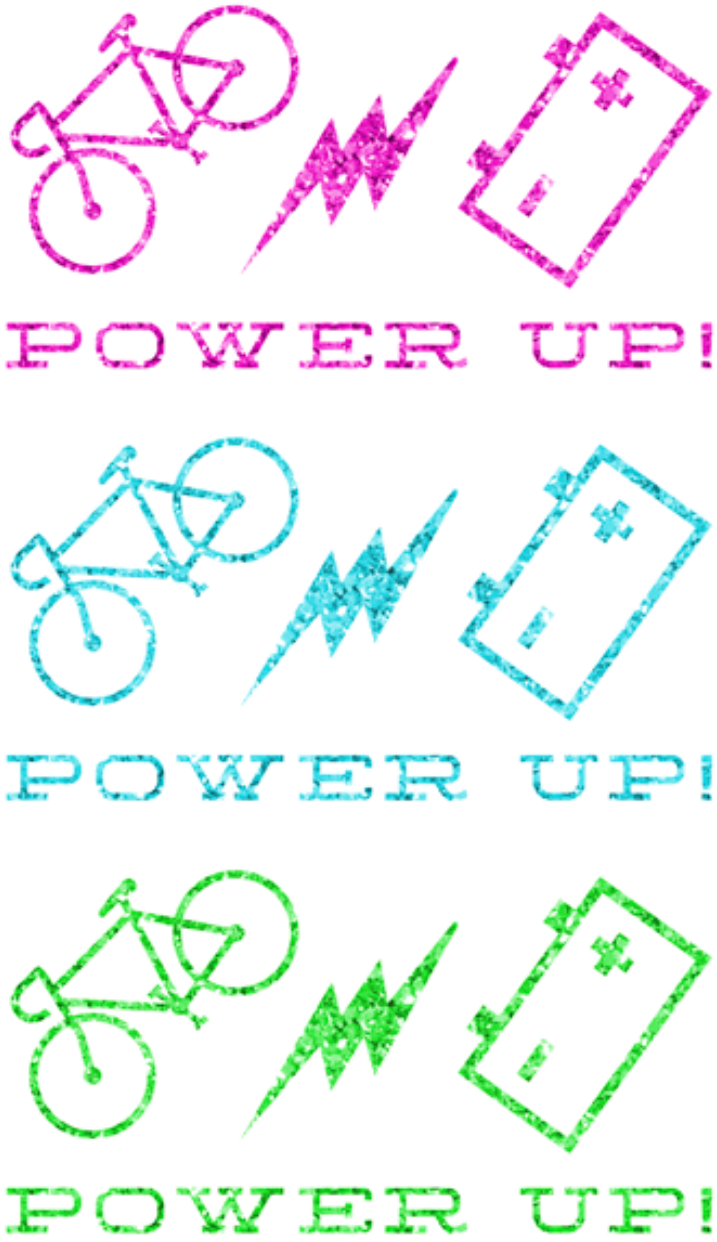
Glittering supplies brought in by Niomi. Pabst Blue Ribbon in full effect.

Niomi and Alissa working on the BPG. Zinta in the foreground.

Feathery handle-bars.

Alissa and Phil working on the bike.

Appendix 2: The workshop



Flyer design by Zinta to go along with the invitations to attend our Power Up! closing workshop

References

Applebaum, Jacob. 2010. "Keynote lecture." Lecture, HOPE 2010, The Hotel Pennsylvania, New York, July 16.

Apunkt Schneider, Frank, and Grenzfurthner, Johannes. 2010. "Hacking the Spaces." *Monochrom*. Accessed November 21. http://www.monochrom.at/hacking-the-spaces/.

Birden, Susan. 2002. "Collective Transformations, Collective Theories: What Adult Educators Can Learn from the Boston Women's Health Book Collective." Lecture, Adult Education Research Conference, Raleigh, NC.

Berkana Institute. 2010. Accessed December 11. http://www.berkana.org/.

Blankwater, Elgin. 2010. "Hacking as a Way of Life: Ethnographic Research on Hacker Communities" (Msc, Sociology, Univeriteit van Amsterdam).

Cavalcanti Gui. 2013. "Is it a Hackerspace, Makerspace, TechShop, or FabLab?" *Make Magazine*, May 1. http://makezine.com/2013/05/22/the-difference-between-hackerspaces-makerspaces-techshops-and-fablabs/.

Chonavec, Donna, Elizabeth Lange, and Lee Ellis. 2008."Social movement learning: A catalyst for action." In *Mobilizations, Protests and Engagements: Social Movements in Canada*, edited by Marie Hammond Calaghan and Matthew Hayday, 188. Halifax: Fernwood Publishing.

Chubb, Aaron, and Elizabeth Lange. 2009. "Critical Environmental Adult Education in Canada: Student Environmental Activism." *New Directions for Adult and Continuing Education* 124: 61–71.

Clark, Christopher. 1990. "What You Can Learn from Applesauce: A Case of Qualitative Inquiry in Use." In *Qualitative Inquiry in Education: The Continuing Debate*, edited by E. Eisner & A. Peshkin, 327–38.. New York: Teacher's College Press.

Culton, Kenneth R., and Ben Holtzman. 2010. "The Growth and Disruption of a 'Free Space': Examining a Suburban Do It Yourself (DIY) Punk Scene." *Space and Culture* 13(3): 270–84.

Deseriis, Marco (2011). "Improper names: The minor politics of collective pseudonyms and multiple-use names." New York University. Dissertation.

Freire, Paulo. 1970. *Pedagogy of the oppressed*. 30th anniversary ed. New York: Continuum.

Freedom Downtime. 2001. Directed by Emmanuel Goldstein. DVD.

Garfinkel, Harold. 1967. *Studies in Ethnomethodology*. Englewood Cliffs, NJ: Prentice-Hall.

Gershenfeld, Neil A. 2005. *Fab: the Coming Revolution on Your Desktop--from Personal Computers to Personal Fabrication*. New York: Basic, 2005.

Goldstein, Emmanuel. 2008. *The Best of 2600: A Hacker Odyssey*. Indianapolis, IN: Wiley, 2008.

Groenendyk, Michael, and Riel Gallant. 2013. "3D Printing and Scanning at the Dalhousie University Libraries." *Library Hi Tech* 31: 34–41.

Heirs Project. 2010. "Grounding Principles." *Heirs to a Fighting Tradition: Sharing Our Stories, Working for Justice*. Heirs Project. Accessed December 11. http://www.heirsproject.org/grounding_principles.shtml.

Hackerspaces. 2014. "HackerspaceWiki." Accessed July 2. http://hackerspaces.org/

Kera, Denisa. 2012. "Hackerspaces and DIYbio in Asia: Connecting Science and Community with Open Data, Kits and Protocols." *Journal of Peer Production* 1(2): 1–8.

Kera, Denisa. 2013. "Innovation Regimes Based on Collaborative and Global Tinkering: Synthetic Biology and Nanotechnology in the Hackerspaces." *Technology in Society* 37 (May): 28–37.

Lave, Jean, and Etienne Wenger. 1991. *Situated Learning: Legitimate Peripheral Participation.* Cambridge, UK: Cambridge University Press.

Lessig, Lawrence. 2005. *Free Culture: The Nature and Future of Creativity*. New York: Penguin.

Lindtner, S. 2012. Remaking Innovation. Accessed July 2, 2014. http://www.ics.uci.edu/~lindtner/documents/Lindtner_Remakinginnovation.pdf

Ludlow, Peter. 2010. "Wikileaks and Hacktivist Culture." *The Nation*: 25–26.

Mentor, the. 1986. "The Hacker Manifesto."

Moilanen, Jarkko. 2012. "Emerging Hackerspaces – Peer-Production Generation." *IFIP Advances in Information and Communication Technology*. 378: 94-111

Raison, David. 2010. "Hackerspaces, Postmodern Learning Spheres beyond the Virtual?" (Diploma thesis proposal, University of Innsbruck, Austria). Accessed July 2, 2014. http://david.raison.lu/hackerspaces_online.pdf

Robertson, Evan D. 2010. *Hacker Spaces: User-Led Innovation and Economic Development*. Atlanta: Georgia Institute of Technology.

Silver, Jay. 2009. "Awakening to Maker Methodology: The Metamorphosis of a Curious Caterpillar." Cambridge, MA: MIT Media Lab.

Taylor, Edward W. 2010. "Cultural Institutions and Adult Education." *New Directions for Adult and Continuing Education* 127: 5–13.

Tweney, Dylan. 2009. "DIY Freaks Flock to 'Hacker Spaces' Worldwide" *Wired.com*. Conde Nast Digital. Accessed July 2, 2014. http://www.wired.com/2009/03/hackerspaces/.

Wenger, Etienne. 1998. *Communities of Practice: Learning, Meaning, and Identity*. Cambridge, UK: Cambridge University Press.

Wenger, Etienne. 2012. "Communities of practice: A Brief Introduction." Accessed January 1, 2014. http://wenger-trayner.com/theory.

Winn, Joss. 2014."The University as Hackerspace." Accessed July 2. http://joss.blogs.lincol.ac.uk/2012/03/16/the-university-as-a-hackerspace/.

---

[i] http://thenexthope.org

[ii] Http://www.Foulab.org

[iii] http://makezine.com/2013/05/22/the-difference-between-hackerspaces-makerspaces-techshops-and-fablabs/

[iv] http://wikileaks.org

[v] http://www.mithral.com/~beberg/manifesto.html

[vi] http://hackerspaces.org/wiki/Hackerspaces

[vii] http://makerspace.com/

[viii] http://fab.cba.mit.edu/

ix http://foulab.org/en/news/Foulab_News/2009/05/24/A_Documentary_Featuring_Foulab

[x] http://powerupproject.wikispaces.com/

xi http://www.pnosa.com/

xii http://www.sciencesshareware.com/bike_gen.htm

[xiii] http://www.instructables.com/id/ETW4MPKF5ETOBS6/?ALLSTEPS

[xiv] http://www.stewardwood.org/resources/DIYcyclepower.htm

[xv] http://renewableenergyindex.com/diy-alternative-energy/bicycle-generator

[xvi] http://www.youtube.com/watch?v=HwAtOmOU5wc

[xvii] http://www.youtube.com/watch?v=IpaEGhjpZgc&feature=related

[xviii] http://www.youtube.com/watch?v=zYS9kdS56l8&feature=related

[xix] http://www.youtube.com/watch?v=8gvJzrjwjds&feature=fvwrel