Molding Makers: An Ethnography of an Academic Makerspace

by

Jessica Marie Whyte

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Abstract

As an exploratory ethnography of Semaphore Studio307, an academic makerspace situated in the Faculty of Information at the University of Toronto, this work provides a rich description and analysis of students' experiences in an academic makerspace. Its findings are intended to inform the design and administration of this space and others like it with the voices and perspectives of the people who use them. Topics covered are how students first discovered the space, their motivations, needs and wants once there, views of the space, and how they worked together within it.

Acknowledgments

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Table of Contents

List of Figures

Chapter 1
Introduction

For this thesis, I will explore a single university makerspace over an academic year with a focus on the experiences of students who use the space. I will do so through an exploratory ethnography (Stebbins, 2001; Spradley, 1980) of Semaphore Studio307, a new makerspace in the Faculty of Information at the University of Toronto.

This chapter introduces the research project by first providing a brief background on myself, my position, my objectives, the research site, and the people who enlivened Semaphore Studio307 (hereafter referred to as Studio307). It then provides an overview of the chapters that follow. Chapter 2, the literature review, provides background on making and makerspaces for readers unfamiliar with these concepts.

1.1 Researcher Background

I came to this graduate program (Library and Information Science) from a background in community radio. I worked at a station in Halifax, NS and because we always piped the live broadcast throughout the offices, each day was spent listening to radio produced by community members. I would hear shows about the Eritrean diaspora in Nova Scotia or the minutiae of the Uniacke Square neighborhood and wonder what drove people to do this – to show up every week, participate in this piece of public life, and make radio? I also enjoyed the creativity and active participation and I wanted to retain aspects of this in my work in Library and Information Science. To that end, I wanted to apply my curiosity about why people participated in the public or commons to libraries. I was not interested in

artifacts or books, I was interested in the people inside. Because of this interest, I chose a research project that included the library, but also the people that enliven it and, specifically, their motivations and impacts. I also chose a site, a makerspace, which shared community radio's creativity, productivity, and even rhetoric.

1.2 Researcher Position

This is a subjective work written by someone intimately involved with the Studio307 project. I helped design and build the space and I worked in it. This involved organizing a community consultation process for the space design, setting up curricula, scheduling, purchasing, budgeting, securing additional funding throughout the year, and staffing the space with my co-worker, Che (some names have been changed at participants' request). In this research, and in keeping with the idea of reflexivity, I will embrace and acknowledge my presence and experience. Liz Stanley and Sue Wise (1993) inspired the position from which I am writing this, and discussions of this position and the decisions behind it are available in Chapter 3 – Methods.

1.3 Objectives

Rather than trying to prove the value of Studio307, validate existing claims about academic makerspaces, or come up with my own universal theory for the impact of makerspaces, I instead want to ask a simple question, 'what is happening here?' (Hammersley & Atkinson, 2007, p. 164). To that end, my motivating research questions are:

Why did students come to Studio307? What were their expectations and views of the space? How did they characterize their experience of the space? Finally, how can these new understandings inform the development of this space and others like it?

These questions are broad, but also suitable for the descriptive stage of an exploratory ethnography. When trying to understand a new phenomenon, Marcia Bates recommends that "description comes first" (2005, p. 2) and Robert Stebbins argues that to understand a phenomenon well, you must start by looking at it in broad terms (2001, p. viii). Nancy Fried Foster & Susan Gibbons' ethnography of students' library use at the University of Rochester also serves as a model for me in their general and exploratory approach to their research (2007). They purposely set aside presuppositions and sought to answer their basic question - what do students do when they write a research paper (p. v)? I also want to point out that while asking "what happens here" may seem broad, the site and scope are not. If the driving question at the core of most ethnographies is "what is happening here?", my focus is on the "here" through a topic-oriented, micro-ethnography of a single social situation (Spradley, 1980, p. 30). To be clear, I am not seeking to explain maker culture as a whole or make assertions about the global potential of makerspaces. Instead, in keeping with a scope appropriate for a master's thesis and with an eye on future concatenation (Stebbins, 2001), I aim to describe this particular community and my understanding of their experience.

Because this research project will provide a description and analysis of students' experiences in an academic makerspace (including my own experience), it constitutes a relevant contribution to broader discussion about the pedagogical impacts of these spaces (Benjes-Small, McGlynn Bellamy, Resor-Whicker, & Vassady, 2017; Halverson & Sheridan, 2014). As a site-specific ethnography with an emphasis on the personal experiences of participants, it will also be of interest to the members of its community and administrators of the space and other spaces like it. Finally, this research is intended to be for its participants, rather than about them (Stanley & Wise, 1993). There is a goal for this research and that goal is to inform the design and administration of this space and others like it with the voices and

perspectives of the people who use them. To that end, I will also be including recommendations (see Chapter 10 – Conclusions and Recommendations).

1.4 Field Site

Studio307 is an approximately 300-square-foot, student-run studio workspace within the Faculty of Information at the University of Toronto. It is located in Room 307 of the Claude T. Bissell Building and acts as an extension of the Semaphore Research Cluster. Two students staff the space - myself and another student, Che. Staff members oversee open hours, organize and run programming, and manage the space on a day-to-day level. Funding and equipment are provided by: Semaphore Research Cluster; TechFund (a student fund); the Inforum (the library within the Faculty of Information); and the Faculty itself through space and institutional support.

This academic year, 2016-2017, was the pilot year for the space. The goals for Studio307's pilot year included ensuring sustainability for future years and to build an active, enlivened making and fabrication lab accessible to all students within the Faculty. The focus at Studio307 is small-scale fabrication, prototyping, critical making, exhibition-building, and skills development for current and future librarians and museum professionals.

1.5 People

Because Studio307 is situated within the Faculty of Information, it serves graduate students in the following concentrations: Library and Information Science, Museum Studies, User Experience Design (UX), Knowledge and Information Management, Information Systems and Design (ISD), Critical Information Policy Studies (CIPS), Culture and Technology, Book History and Print Culture, and Archives and Records Management. In this way, it differs from academic makerspaces in engineering or

applied design departments, or spaces intended to serve entire university communities. For example, the programming in Studio307 was designed to serve students in an Information Faculty. Therefore, rather than offering a general introduction to Internet of Things technology and programming, we offered workshops that also touched on culture and privacy issues, or how to integrate this technology into exhibits. Or, rather than just a basic introduction on how to operate 3D printers, we provided workshops on how to maintain and repair 3D printers targeted at future librarian and museum professionals who may require a stronger command of the technology. Unlike spaces targeted at engineering or applied design students, Studio307 did not offer any heavy machinery (e.g. CNC machines or large wood-working tools).

While my observations cover all the students and faculty who came through the space during my time there, I tend to, in this work, concentrate on a core group of eight students. These eight include regular participants, peripheral participants, and people who only visited the space once. Chapter 4 – An Overview of Studio307 includes an introduction to each.

1.6 Thesis Overview

After providing a summary of relevant literature, sensitizing concepts, and my methods, I will delve into my findings, which were reached through inductive, iterative, and thematic analyses and then compiled and written as a fieldnote-centered narrative (Emerson, Fretz, & Shaw, 2011). The first findings chapter (Chapter 4) is a description of Studio307 focused on the physical layout, staffing structure, and people within the space. Next, I will explore how students first discovered or became involved with the space (Chapter 5), why students came or their motivations (Chapter 6), their needs or wants once there (Chapter 7), how they viewed the space (Chapter 8), and, finally, how we worked together within it

(Chapter 9). I will end with recommendations for this space and others like it (Chapter 10).

Chapter 2
Literature Review

This chapter begins with definitions of makerspaces and makers, then narrows in on similar works on makerspaces in libraries and academic libraries. Finally, it concludes with an overview of the sensitizing concepts (Blumer, 1954) which will serve as theoretical lenses for the study.

2.1 Makerspaces

Researchers have provided histories of what is often called the "maker movement" (Dougherty, 2012) that are tied to DIY culture and political responses to industrialization (Maxigas, 2013), but also, subsequently, critiques of creeping commercial interests (Sivek, 2011; Grenzfurthner & Schneider, 2009). There are also theories that posit makerspaces as the site for the next industrial revolution (Anderson, 2012), transforming education (Martinez & Stager, 2013), or serving as a source of entrepreneurial innovation (Dougherty, 2012). A complete history of this world (variably known as hacklabs, hackerspaces, or FabLabs, among other neologisms) and the shift from independent to commercial makerspaces would require starting as early as the arts & crafts movement, beginning in the late 19th century, and working our way forward. For readers interested in this history from an LIS perspective, I recommend Rebekah Willett's work, *Making, Makers, and Makerspaces: A Discourse Analysis of Professional Journal Articles and Blog Posts about Makerspaces in Public Libraries* (2016), which provides a succinct retrospective of the maker movement that goes beyond the history of *Make*, a commercial magazine often credited with sparking the current popularity of what it refers to as the maker movement.

Because this ethnography is situated in LIS, I want to remain within that space and find what I hope will be a common understanding of the terms from within my own field.

A commonly used definition of makerspaces in LIS is Lauren Britton's "a place where people come together to create and collaborate, to share resources, knowledge, and stuff" (Britton, 2012). This is broad, but likely because no two makerspaces are the same (Moorefield-Lang, 2015) and pinning them down to one nicely bundled mission or activity is difficult and, I would argue, limiting and unnecessary.

The definition of a makerspace can also shift depending on whether the focus is on the core capabilities of the space (e.g. the technology inside) or on the people or communities who enliven that space. For example, in her discourse analysis of makerspace rhetoric, Shannon Crawford Barniskis asks which, if any, ideologies or uses are privileged over others when journalists or practitioners write about makerspaces in libraries. She argues that the most common metonym for makerspaces is "3D Printer," but that it was journalists who tended to focus on the technology or capabilities, while library practitioners concentrated on social connections and access (2015). And, in her earlier work on makerspaces in rural libraries, she asked both practitioners and patrons to describe their makerspaces and reported "all participants described the makerspace as a social space where makers could share the discovery process, support each other, and engage socially" (Barniskis, 2014). For Crawford Barniskis' subjects, it was the people and relationships that defined their makerspaces, despite their surface similarities like having a 3D printer or a milling machine.

Both the definitions provided by Britton and Crawford Barniskis' subjects focus on the social or culture, rather than the function. They leave the door open for a range

of activities and implementations, but they may not match how those outside of LIS understand and see these spaces. To ensure a firm definition for the purpose of this thesis, I will combine Britton's focus on sharing knowledge and things; Moorefield-Lang's insistence no two makerspaces are the same; and Crawford Barniskis' revelation that people outside of this field like to link these spaces to technology. For this study, a makerspace is defined as: a unique network of people, programming, and tools organized around a mandate associated with technical literacy or agency.

2.2 Makers

It is difficult to make generalizations about the types of people who use makerspaces. Dale Dougherty, founder of *Make*, divides makers into three groups: zero-to-maker; maker-to-maker; and maker-to-market (2013). By creating segments, he designates the maturity of a maker as one who is ready to develop market-destined innovation or invention. But, often, the mature maker is not maker-to-market, but rather maker-to-scholar or maker-to-citizen (Ratto, 2013) or simply maker-to-participant (Gauntlett, 2011). Dougherty's definitions of makers have also been criticized, along with his commercial counterparts Chris Anderson (2012) and Mark Hatch (2014), for fostering and maintaining a male maker identity focused on a too-narrow range of interests (Buechley, 2013). Austin Toombs, Shaowen Bardzell, and Jeffrey Bardzell at the Indiana University School of Informatics and Computing have published works based on their 19-month ethnographic research project at a community hackerspace (2014; 2015) that focuses on how maker identities are formed and how their subjects merge a neoliberal libertarian ethos with the practical community maintenance required to sustain their space. They define a maker identity then as one centered around a libertarian ethos. But Camille Bosqué, in her dissertation *Personal digital fabrication, discourses and practices of diffuse design:*

A survey into FabLabs, hackerspaces and makerspaces between 2012 and 2015 (titled translated from French), argues that the underlying ethos in her studied spaces is one of sharing and openness and that this attitude permeates the individual design and making identity (2016).

What is tricky here, though, is that these identities and ethoses (the libertarian and the sharer) come from studies of niche independent spaces, not institutional ones like in a public or academic library. Profiles that are broader also come from perspectives outside LIS; that is, Dougherty's profile comes from the commercial sector and David Gauntlett's from a broader look at making culture. Matt Ratto's definitions of a mature maker as citizen or scholar (2013) get closer to the field and the academic context, but are more concerned with potential outcomes rather than inputs. There is a lack of descriptions of maker identities in the LIS sphere and I am assuming this is to prevent exclusion. Librarians shy away from pinning down their readers and community members, and there is a tendency, at least in the field of public librarianship, to say everybody is a maker with the Right Maker Mindset (Egbert, 2016; Burke J. J., 2014).

And so, I return again to Crawford Barniskis' work on rural makerspaces (2014). In it, she provides a summary of how library patrons who use the makerspaces see themselves – collaborative, needing an outlet, enjoying creating and sharing, enjoying working with their hands, learning new things, and having agency. It is a diverse list, but so are people. Given the diversity of motivations and identities, perhaps it is simplest to leave the definition of a maker as someone who learns and creates, typically in a shared space.

2.3 Making in Public Libraries

When you zoom in on the literature of LIS on makerspaces in public libraries, you find many practice-oriented papers. The work on makerspaces in libraries focuses predominantly on models for implementation (Britton, 2012; Slatter & Howard, 2013; Good, 2013; Burke J. , 2014), space or tool-focused analysis (Curran, 2012; Balas, 2012; Gonzalez & Bennet, 2016; Massis, 2013), or practitioner-focused research (OLA, 2017; Plemmons, 2014). The resulting work tends to define these spaces, and the people who use them, from the perspective of the administrator. This may, however, simply be a consequence of how new these spaces are in public libraries. There simply has not been time to graduate from implementation to deeper questions about the nature of the experience and impact. Ina Fourie and Anika Myer identified the need for further research into people's experiences in library makerspaces and the impact of makerspaces on information behavior (2015). Already on that front, Crawford Barniskis (2014; 2015) is currently conducting a multi-year study of public library makerspaces from participants' perspectives.

In short, the majority of literature on makerspaces in public libraries tends to come from the practitioner perspective and focus on concerns of practice. This, however, with time, is changing.

2.4 Making in Academic Libraries

Most universities have always provided at least elements of what are now branded as makerspaces. There have always been labs, machine shops, fabrication spaces, artist studios, and meeting spots sprinkled across most campuses. What differentiates these elements from what are now often described as makerspaces is putting these services in one location, investing in them, and naming (Wilczynski, 2015). According to Vincent Wilczynski (2015) and Craig Forest (Forest, et al., 2014), who are both from engineering disciplines, there has been a cultural shift on campuses, a

pivot towards active, design education and hands-on learning. I would also argue that another shift is the move from faculties or departments providing these services and spaces to libraries. In 2015, the Association of Research Libraries (ARL) surveyed its 124 members to ask about library involvement with fabrication, 3D printing, and makerspaces. The results were overwhelmingly positive (Wang, Wang, Wilson, & Ahmed, 2016) with most respondents (64% of 64 respondents) saying they were either implementing or planning the implementation of makerspace services. In response to this survey, the ARL developed what is called a SPEC kit (Altman, Bernhardt, Horowitz, Lu, & Shapiro, 2015). An ARL SPEC kit brings together survey results and documentation from multiple institutions to help other libraries learn about new or changing practices. The ARL's kit on rapid fabrication and makerspace services is extensive and includes user data, policies, and documents from 64 member institutions. This is helpful for understanding this shift in academic library services from the perspective of librarians, but does not include the unfiltered perspective of participants or students.

According to education scholars Kim Sheridan and Erica Halverson, little of the existing literature on makerspaces is focused on participant motivation, experience, or impact (2014). There is also the criticism, already mentioned above, that because many of these spaces are still new and developing, much of the existing work is concerned with how to build a makerspace or the experience of building one (Benjes-Small, McGlynn Bellamy, Resor-Whicker, & Vassady, 2017). For example, when Anne Wong and Helen Partridge ask "what are the experiences of Australian universities with makerspaces?" (2016), the work focuses on the experience of the institution and its staff, not its participants. This is similar to the outcome found in the public library sector of LIS work, where literature focuses on the functions of implementing and administering a makerspace, or as case studies of other academic makerspaces (Wang, Wang, Wilson, & Ahmed, 2016; Wilczynski, 2015). However,

the LIS field is changing. The first International Symposium on Academic Makerspaces was held in 2016 at MIT, indicating burgeoning interest. There were, of course, many sessions focused on implementation issues like staffing, safety, and management (ISAM, 2016), but there were also reports of a recently initiated five-year longitudinal, survey-based, and ethnographic study across three institutions on student experiences and how makerspaces influence student retention and self-efficacy (Linsey, et al., 2016); an observation and interview-based study of the Envision Maker Studio at UC San Diego (Delson & Dewald, 2016); and a call for academic makerspaces to serve as sites for educational and qualitative observational research that focuses on student experience (Hartmann, 2016). The 2016 American Society for Engineering Education also offered a 5-paper session called Makerspaces within the University, which included a paper on assessment based on student experiences and impact (Penney, et al., 2016), another alluding to future, student-focused assessment work (Blacklock & Claussen, 2016), and another concerned with measuring student motivations and the impact of makerspaces on their perceived abilities based on surveys (Morocz, et al., 2016). While this new scholarship is exciting, it should be noted that it is still developing, and the majority is coming from engineering education and engineering faculties. With the exception of Adam S. Rogers' work on the librarian's role in academic makerspaces (2016), the librarian and library perspective were not mentioned at the first International Symposium on Academic Makerspaces.

Another criticism is that much of this work centers on proving an academic makerspace's value (Radniecki & Klenke, 2017). There are claims that academic makerspaces provide alternative learning environments that strengthen curriculum objectives (Burke J. , 2015), that they support innovation and entrepreneurialism (Delaney, 2015), that they engage and empower students (Watters, 2013), or promote multi-disciplinary and collaborative learning (Wilczynski, 2015). For a

more critical look at how these spaces can improve, there is work coming out of the Invention Studio at Georgia Tech in Atlanta, GA, including a student paper on sustaining diversity and inclusion in their makerspace by removing barriers to entry (Noel, Murphy, & Jariwala, 2016). In this work, the authors identify instances of inadvertent exclusion from the perspective of students, and the various techniques they used to promote inclusion at their makerspace (providing training and tours, offering targeted group events or closed nights for certain communities, promoting diverse interests outside of engineering through arts-based workshops, and increasing student leadership roles).

Institutional makerspaces in universities also tend to serve entire university communities or applied programs like engineering or architecture (typically as rebranded former machine shops), not library schools. Western University's Faculty of Information and Media Studies is currently building a makerspace inside its new Graduate Resource Centre (FIMS, Western University, 2015), the University of Texas' School of Information recently created an in-house makerspace (Ferguson, 2017), and, of course, Studio307 at the University of Toronto's Faculty of Information, but these spaces are still young and scholarship within this niche is sparse. With the exception of Heather Moorefield-Lang's upcoming work on how maker skills are taught in library schools (Moorefield-Lang, forthcoming) and Kyungwon Koh and June Abbas's work on needed competencies for working in makerspaces (2015; 2016), in-depth analysis of how current and future library and museum professionals acquire these skills has yet to be done.

In short, two gaps in the literature and research pique my curiosity and motivate this thesis. The first is an in-depth focus on participants (the people who come to these spaces) and asking why they come or what they get out of it. Put simply, I want to contribute to the stories of the people who use these spaces. The second gap, which

is ultimately a consequence of site selection and not intent, pertains to the experiences of future library and information professionals learning about fabrication spaces and the associated technology.

2.5 Sensitizing Concepts

There are three sensitizing concepts from the literature I want to introduce. I relied on these as "directions along which to look" (Blumer, 1954, p. 7) and to help me understand and interpret my findings. They are:

1. Doreen Massey on the social nature and dimensionality of space (1994; 1999; 2013). According to Massey, we can think about space not just in terms of land mass or geo-coordinates, but as a dimension – a product of our relationships. We also get to think about how far those relationships extend, from tiny local scales like across the house to global ones, and how they overlap. For Massey, space is dynamic and multiple, and she describes it as a "pincushion of a million stories" (2013). This work will use Massey in two ways – first, to remind that space is simultaneous and multiple (different people can have different claims or interpretations of the same space, it does not have to be one way). Second, to help make a connection between students' apprehensions about a larger global issue (a changing career landscape) and a tiny room on the third floor of a graduate faculty.

2. Erving Goffman's concepts of face and front-stage and back-stage behavior. In his book, *The Presentation of Self in Everyday Life*, Goffman develops the idea that when we meet someone we engage in a form of theatre. We seek to present a particular version of ourselves, or face, and essentially control how we are perceived. At the same time, the other participant in the interaction is attempting to obtain information and possibly support or circumvent this theatre (1959). In this thesis, Goffman helps explain a student's embarrassment and anxiety about their lack of experience. Goffman also helps us understand Willet's finding that librarians engage in frontstage and

backstage behavior whether they are talking about a makerspace publicly or in private (Willlett, 2016).

3. Jean Lave and Etienne Wenger's use of legitimate peripheral participation, and Wenger's use of participation and reification to understand what they both call "communities of practice" and how they develop (Lave & Wenger, 1991; Wenger, 1999). Communities of practice is a term coined by Lave and Wenger to describe how people engage in collective learning. Their work encompasses workshops, multiple books and articles, management certificates, blogs, and training seminars. To summarize it all here would be outside the scope of this thesis. Instead, I want to introduce the two concepts I will be using: *participation and reification* and *legitimate peripheral participation*.

   For Wenger, *participation* refers to how members act and interact in a community and how that contributes to the norms or expectations within it. *Reification* though, is the development of norms using artifacts (e.g. a written list of rules) instead of behavior (Wenger, 1999). Both are needed and both must be in balance, they complement each other. Too much participation and things are up in the air or divergent. Too much reification and you stifle the community. These concepts of participation and reification will help explain certain barriers for students, like a lack of formal documentation in the space. While discussions of participation and reification will be found throughout this thesis, they are of particular importance in Chapter 7 when I explore the documentation and communication of skills expectations.

   Legitimate peripheral participation refers to how newcomers get involved in a community. According to Lave & Wenger, they often do so through small, low-risk actions (Lave & Wenger, 1991). Wenger uses this to create three levels or classes of participants: a core group, an active group, and the peripheral group (Wenger, McDermott, & Snyder, 2002). I am going to use peripheral and core participation in Chapter 5 to help me understand why students often needed an

> invitation before they came to the space, and how they made that transition from the periphery to the core.

In this chapter, I explored current work on makerspaces broadly and within the public library and academic library contexts. I also outlined the three sensitizing concepts that will be used in this thesis. Through this exploration, I identified the gaps within which I seek to position this work – that is, by offering up scholarship focused on the experiences of participants rather than practitioners, and, specifically, a focus on library and information studies students. In the next chapter, I will turn to methods, providing an overview of my chosen methods, justification for those choices, challenges, and position as a researcher.

Chapter 3
Methods

Because I wanted to focus on the students who use this space and their experiences, this thesis is an exploratory study using an ethnographic approach (Stebbins, 2001; Spradley, 1980). My primary data gathering method was participant observation (Spradley, 1980). For an academic year, I worked in Studio307 as both a work-study employee and a researcher. Raymond Gold, who identified potential issues within participant observation, would likely classify this arrangement as Participant-as-Observer, where the researcher is a part of the group being studied (Gold, 1958, pp. 220-221). There are challenges associated with opportunistic or insider research, but there is also value in that regular, day-to-day, face-to-face contact with research participants (Merriam, et al., 2001; Chavez, 2008; Taylor, 2011). Employment in the research site provided me that access and opportunity (Feldman, Bell, & Berger, 2003; Kondo, 1990).

I worked in the site for 8-10 hours per week split over two shifts. Throughout my workday, I took field notes. I used Robert Emerson, Rachel Fretz, and Linda Shaw's methods for writing, coding, and analyzing those jottings and field notes to generate theory from my observations (2011; Glaser & Strauss, 1967).

Towards the end of the observation period, I conducted semi-structured interviews with students. These interviews incorporated grand tour questions (Spradley, 1979) and object elicitation, a variation of photo elicitation (Collier & Collier, 1986; Harper, 2002) when an object or photo is used to elicit responses from interviewees and help the flow of the interview (De Leon & Cohen, 2005). Basically, I asked

students to bring an example of something they worked on in the space, and those objects gave us something to talk about, a reference point.

The flow of my methods is illustrated below (Fig. 1):

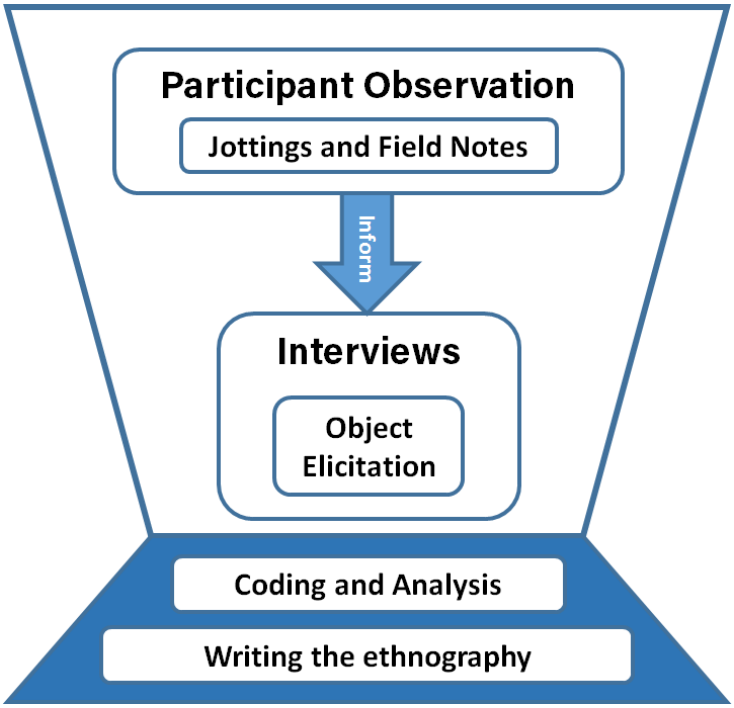

Fig. 1 Visualization of research methods

The ethnographic record, which is anything related to the documentation of the cultural scene under study (Spradley, 1980), consisted of audio recordings, transcriptions, collected ephemera, jottings, and field notes. After ethics approval was obtained from the University of Toronto's Research Ethics Board, data collection took place in the Fall 2016 and Winter 2017 semesters. The fieldwork stage ended in January, and all told I spent approximately 140 hours in the field and gathered 236 pages of miscellaneous documentation; everything was kept in both print and digital versions.

Coding and analysis of my data occurred in the latter half of Winter semester. My coding process was initially based on Emerson, Fretz, and Shaw's analysis methods (2011, pp. 143-160) which begin with open coding to identify themes followed by a more focused coding session looking for specific themes or topics that emerged during the open coding process. I found this very challenging. I was unable to hold the entire record in my head, remember where I was, or sort what was essentially a linear narrative in a binder into different and often overlapping themes. I also found this analysis method relied too much on repetition of an instance to identify a theme, so it was difficult for me to identify themes through comparisons or contrasts. It was here that I turned to Gery Ryan and Russell Bernard's *Techniques to Identify Themes* (2003).

In *Techniques to Identify Themes*, I found some analysis methods better suited to my needs and style, such as cutting and sorting. To start, I printed my flagged, interesting snippets on index cards and started sorting. At first, it was a physical sort, but I soon realized not everything could be easily binned into one category or theme. I also wanted to compare and contrast certain cards. To do this, I moved to color-coded dots and used those to look for common overlaps or pairings between themes, but also contradictions (Fig. 2). I was hesitant about this tactic at first, it felt laborious, but it ended up being the most fruitful and flexible analysis method. I also tried Ryan and Bernard's suggestion of comparing both similarities and differences. To do this, I broke out the answers to standard interview questions on a grid (e.g. "how would you describe this space to a new student?") and compared them (Fig. 3). Again, this was fruitful, and while exploring differences raised more questions, it also helped provide a more diverse and nuanced view of the students who used this space.

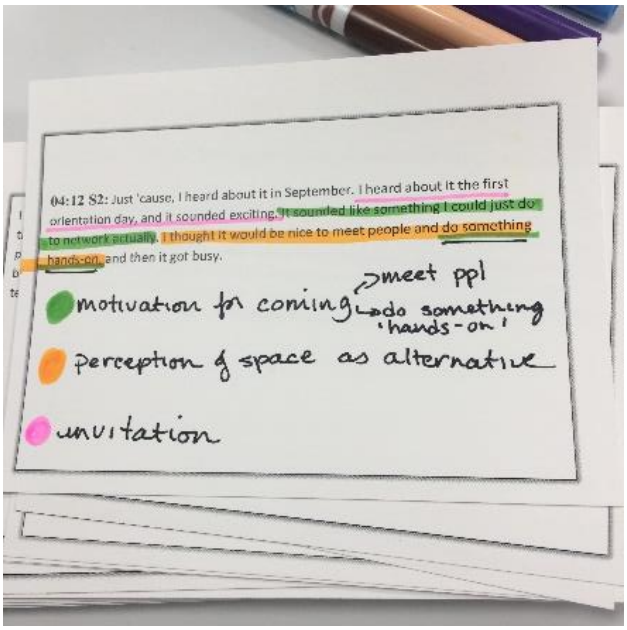

Fig. 2. Colour coding

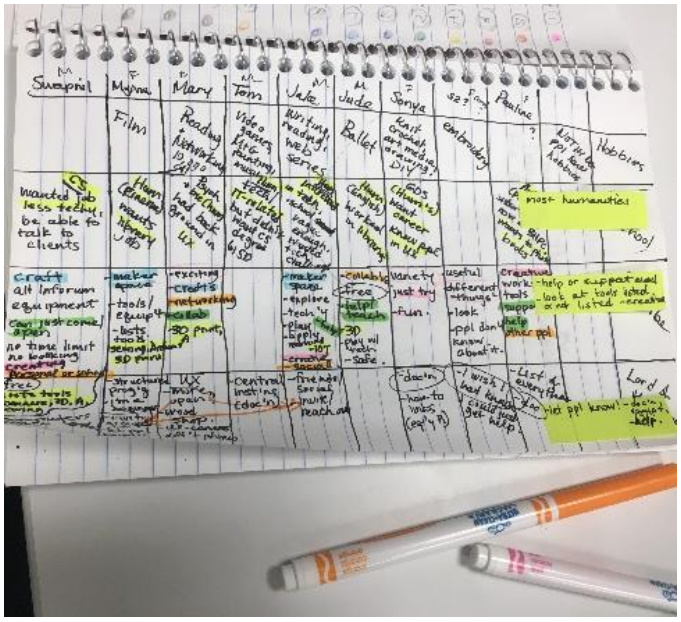

Fig. 3. Comparisons

I returned to Emerson, Fretz, and Shaw when it was time to write and applied their approach of thematic narratives and excerpt-commentary units to structure my findings. This method requires researchers to move back and forth between the world they are presenting, their analysis, and existing scholarship or research. The goal is to present a work that is well organized, presents the story of the scene through informants' words and the researchers' notes, and serves a scholarly purpose.

3.1 Discussion of Position

Insider research can present ethical issues and both internal and external criticism that the researcher is too close to their subjects (Taylor, 2011). But, according to Lyn and John Lofland, your personal and emotional interests keep you connected to your ethnographic research and enhance your ability to understand your subjects. They advocate for "starting where you are" (Lofland & Lofland, 2006, pp. 9-15) and their call to choose a familiar starting point is based not just on ease-of-access, or what

Jeffrey Reimer calls “opportunistic research” (1977), but what they describe as the “creative wellsprings of the naturalistic approach” (Lofland & Lofland, 2006, p. 15). Now, despite advocating for this level of familiarity, Lofland and Lofland follow it with a stern warning about polarities and the importance of keeping some level of ethnographic strangeness so you can still see novelties (pp. 16-17). In other words, get close, but not too close. Because of this warning, I worried, often, that I was too close. This fear was assuaged when I read Stanley and Wise’s *Breaking Out Again* (1993). While addressing concerns about methodological and ethical difficulties of familiarity with a subject, Stanley and Wise reject Lofland and Lofland’s attempt to retain a small amount of detachment. The authors feel this approach is dishonest and is still clinging to dated ideas of objectivity (p. 158). I was immersed in Studio307. I helped design it and build it. I worked in it. To deny that level of familiarity would be a lie.

In this work, I will also be referencing my own personal and emotional responses and motivations. Stanley and Wise encourage me not just to acknowledge my presence and personhood, but to capitalize on and make full use of it (2001, p. 161). First, I agree that the analytic use of feelings and experiences is “equally as capable of yielding ‘knowledge’ as conventionally ‘rational’ intellectual behavior” (p. 202). You will see an example of this when I explore the theme of needing or providing context and explore how my own social anxieties about intrusion are fodder for analysis. Second, I also agree that including myself in my research (not just admitting my presence, but embracing it) “does something to even up the imbalance of power between researchers and researched, though it obviously can’t remove it” (p. 177). For example, providing you with a small snippet of my background and subsequent motivation for tackling this topic may seem like little more than an attempt to endear myself, but it is also a first step towards opening myself up to the same level of scrutiny I expected of research participants. You will see more

examples of this in Chapter 8 when I discuss the theme of “Peripheral to the Institution” and examine participants’ statements about the position of Studio307 within its institution and my own failures to navigate that duality.

Finally, a note on my mode of presentation - my tone may, at times, be conversational rather than conventionally academic. Emerson, Fretz and Shaw (1995) encourage writing ethnographies as narratives that will interest an outside or external audience**.** Because I want my work to be accessible and of use to the practitioners designing and administering spaces like Studio307, and the participants making use of them, I try to use an accessible style.

In the following chapters, I turn to my findings.

Chapter 4
An Overview of Studio307

In this chapter, I will describe the space – how it was created, its physical layout, equipment, staffing, and the people met throughout this work.

4.1 Field site

Studio307 is a student-run studio workspace within the graduate-level Faculty of Information at the University of Toronto. It is funded by the Semaphore Research Cluster, TechFund (a student fund), the Faculty (in the form of space and administrative support), and the Inforum (the Faculty's library) with a budget of approximately $11,000 (this includes staff, equipment purchases, and consumables, but not loaned equipment, space allocation, or administrative support from Semaphore and the Faculty). As I wrote on the Studio307 website, "Studio307 was initially proposed as an extension of the Semaphore Research Cluster in the Faculty of Information and intended to be a more accessible, open, and hands-on version of Semaphore. Given: the number of courses in the Faculty of Information requiring or allowing material deliverables; the emphasis on participatory learning and creation as a crucial part of library programming and important skillset for future librarians; and the research interests of our students and faculty across concentrations, the absence of an accessible creative space was a problem" (Whyte, About 307, 2016). Studio307 was intended to fill that gap.

The first step in designing the space was a community consultation process, inspired by Foster and Susan Gibbons' methods used to inform a renovation project at the University of Rochester library (2007). While their work spanned two years and a

range of tactics, I borrowed two methods that were pertinent and feasible within my timeframe and ability: draw-and-write responses and design sessions.

To start the process, students were asked to complete community consultation worksheets that involved both drawing and writing about their ideal space (see Fig. 4. Community consultation worksheet, below). Recruitment methods included posters in the Faculty building, inclusion in Faculty email newsletters sent to all students and faculty, distribution of worksheets in classes, targeted recruitment of underrepresented groups such as Museum Studies students, and personal, face-to-face recruitment. Fifteen students completed the worksheets over the Summer semester of 2016. The following (Fig. 4) is an example of a worksheet filled out by a student as part of this initial community consultation planning.

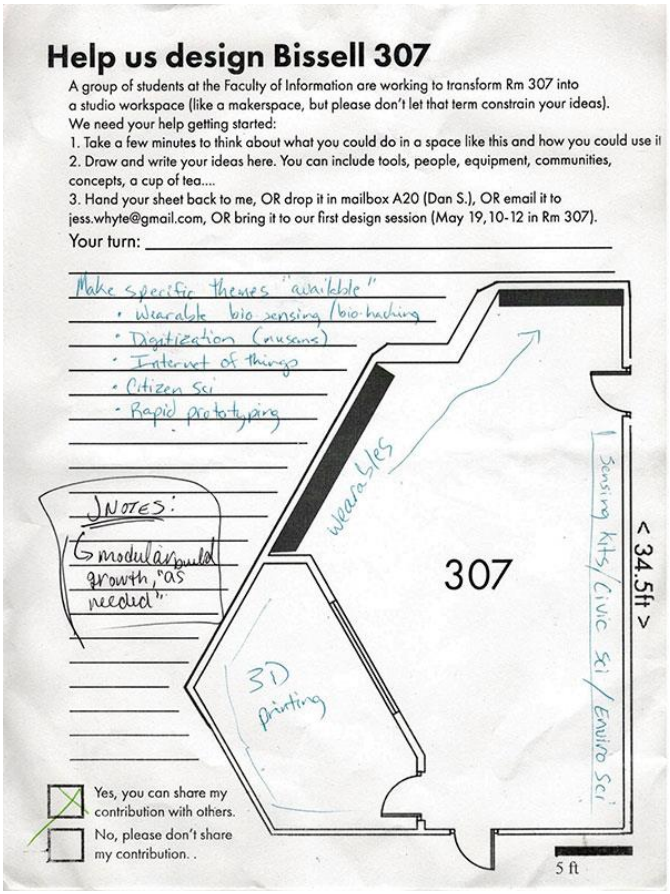

Fig. 4. Community consultation worksheet

The second stage of this process involved a design workshop (Foster & Gibbons, 2007) in which eleven people participated. The workshop began with individual analysis of the submitted consultation worksheets to seek out common elements or themes. This was followed by small group analysis where participants were encouraged to discuss their individual interpretations. Finally, a large group discussion explored how to create a composite based on our findings from the worksheets.

Based on our individual and group analysis of the worksheets, we came away with four major principles or goals for the space:

(1) This is a noisy space. Many students asked for collaborative space where they could meet and design together in an environment where they were free to spread out, make a mess and discuss. Key to this was space arrangement. For example, a central work table or "commons" was present in many of the submitted worksheets and the group agreed this was indicative of a need for a collaborative and collegial environment as opposed to a space for quiet, self-directed study. Other key indicators were calls for programming or curriculum and an active or populated space.

(2) This is a welcoming space. Eight of the submitted worksheets included aspects or elements designed to either extend the space out into the wider Faculty or welcome members of that community into the space. For example, there were requests for staff presence, open house hours, exhibit space, communication boards, workshops, and a booking system.

(3) This is a creating space. This third goal speaks to specific requests for equipment and tools geared towards building, designing, and creating across disciplines. These requests ranged from three students drawing or including sewing machines for cloth fabrication and wearable technology work to eight students

calling for a large whiteboard to work on collaborative design projects. Specific technology or equipment requests included Arduino boards and sensors for civilian tech initiatives, Raspberry Pi computers for exploration, a large monitor or HD television for demo presentations, and 3D printing/scanning equipment.

(4) This is a dynamic space. This goal speaks to the diversity of the faculty and their corresponding needs. It was reflected in the repeated call for a variety of designated "stations" (e.g. a soldering station, a printing station, a workbench area, a sewing station), but also the divide between students seeking a space for collaborative design in traditionally screen-based environments (e.g. students interested in UX and Systems Design) and those wanting to work on more material or physical designs (e.g. Museum Studies students) (Whyte, About 307, 2016).

In creating the space, Che and I attempted to implement these goals and specific programming and equipment requests. A central commons table comprised of six movable tables anchors the space in the middle of the room. Fixed "stations" (e.g. the Raspberry Pi station or the sewing station) ring the perimeter of the room. Equipment in the space includes: projectors and screens; a serger; Makerbot 3D scanner; two Makerbot 5th Gen 3D printers; a sewing machine; eight Arduino kits with components; an iron and board; ten Raspberry Pi computers with components; soldering stations; crafts supplies; fabric; wearables and wearable computing supplies; and an all-purpose computer workstation.

Students participate in the space through regular drop-in hours or structured curriculum in the form of workshops, lectures, and working groups or clubs organized around common interests. For example, the space hosts regular programming, such as the weekly 2-hr 'Arduino Club' (**Error! Reference source ot found.**), and one-off events, like an evening discussion on game design (**Error! Reference source not found.**).

Fig. 5. Typical day at Arduino Club

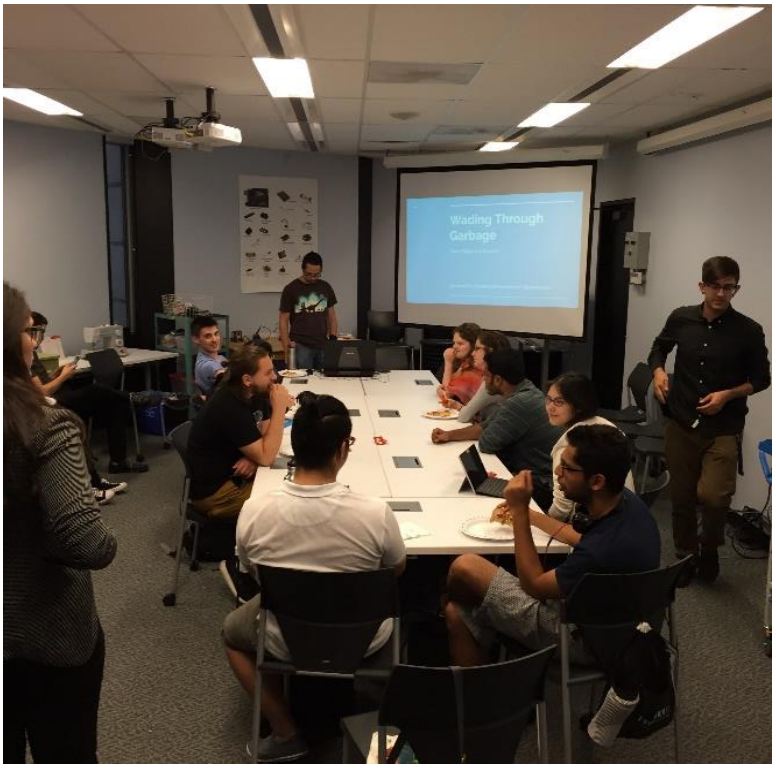

Fig. 6. Game design talk

Open hours were typically quieter than scheduled events or workshops, but most days would see at least a few people popping by to say hello, maybe borrow a pair of scissors, or work on a project. A typical week is shown here in Fig. 7:

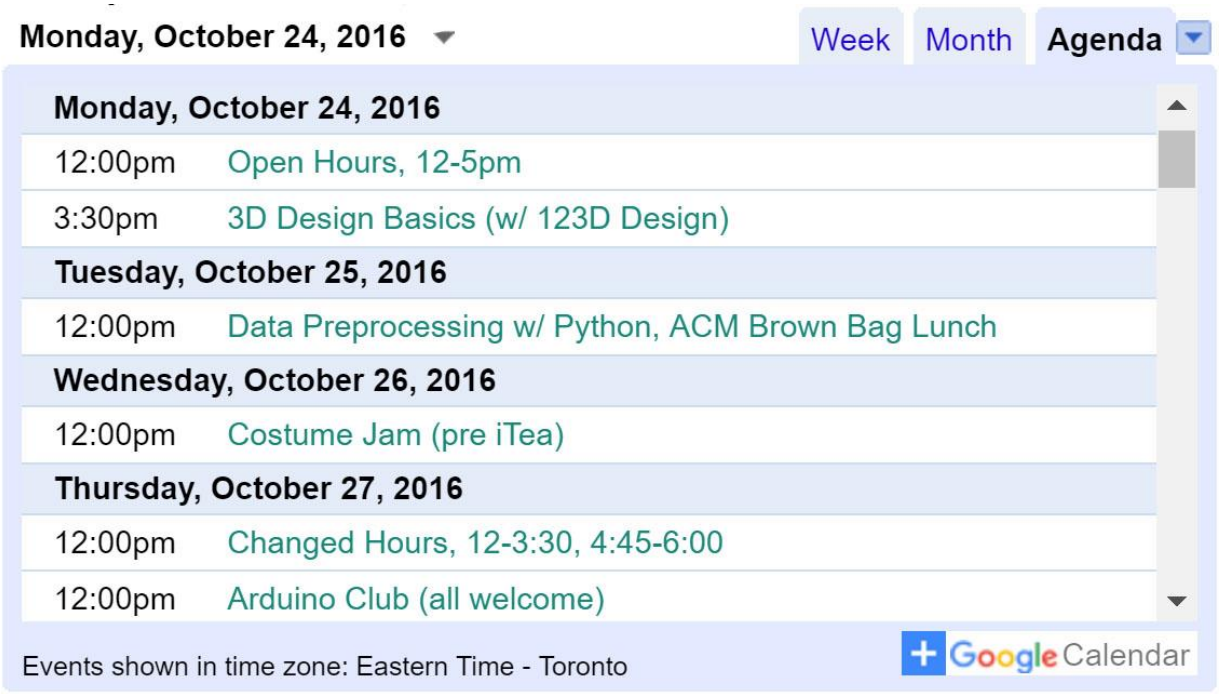

Fig. 7. Studio307 calendar (from http://studio307.github.io)

4.2 Staff

As a paid work-study employee, I served as the on-site support for 8-10 drop-in or open hours per week. I shared this role with Che, my co-worker. Together, we were also responsible for scheduling, programming, inventory, maintaining the space, administration, and applying for additional funding for things like consumable equipment.

4.3 People

In a graduate faculty of approximately 600 Masters students, there were over 300 unique visits to Studio307 last year, spread across an estimated 200 students.[1] While all of these students play a role in this work, I tend to focus on just eight in this work. They are:

Mel: Mel is a second-year Library and Archives student and is a regular at Studio307. She often uses the space to do school work, but also stops by for a creative break. In an afternoon, Mel might spend an hour on her thesis (a critical and analytical bibliography of a Japanese text) and then stop and sew up a pencil case or print a phone stand on the 3D printer. Mel is also a regular member of Arduino Club, coming most weeks to put together circuits and code, and often a helper for students new to the space. She described her time in the space as a departure from her school work. While we never officially collaborated, Mel and I spent many afternoons working quietly alongside one another.

Jake: Jake is a second-year Information Systems and Design student. He came to the Faculty because he wanted to improve his technical skills. While not a regular, Jake uses the space for class-assigned group work and attends occasional workshops or talks in the space. Jake was also involved with Studio307 from its earliest days, when it was just an idea.

Jude: Jude is a first-year Information Systems and Design student with a background working in libraries and as a former professional ballet dancer. Jude is considering continuing working in libraries, but is still open to other career paths.

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[1] Estimate based on staff usage logs, compiled by myself, Che, and volunteer students hosting events within the space.

Jude first came to Studio307 as a way to meet people and often dropped in for Arduino Club, to chat, or to borrow supplies.

Swapnil: Swapnil, a second-year Information Systems and Design student from a Computer Science background, is another regular. He often drops in to say hello, sometimes stays to do course work, and usually ends up getting roped into various projects or activities happening in the space. Whether I was moving chairs or rewiring the tables, Swapnil was often there to help. This relationship eventually formalized when what started as people dropping by the space to ask Swapnil for help with programming questions blossomed into a regular, weekly drop-in Python session.

Che: Che is my co-worker, a fellow director of the space. She is a second-year Library and Information Science student with a sciences background. Che is vibrant, and she brings people to the space. She often fires off tweets saying, 'come on down,' texts friends, or even calls out to people in the hall. She has one of those magnetic personalities, an element that was crucial to the space's success.

Pauline: Pauline is a first-year Book History and Print Culture major. She formerly worked as a photographer taking product pictures for book dealers and antiquarians and wanted to merge those skills with her studies at the Faculty of Information. She came to Studio307 to try her hand at 3D scanning a uniquely bound book in order to explore digitization of material artifacts.

Sonya: Sonya is a first-year student in User Experience Design. She first came to the space with Tom for Arduino Club as a way to meet people, but also to practice some of the skills they were learning in classes, like programming and physical computing. Sonya regularly called herself a technical newbie, and yet she corrected my code a few times.

Tom: Tom is a former Music major and first-year student in Culture & Technology who first came to the Faculty because he wanted a program that was both practical and abstract. Tom is a dabbler who seems to try his hand at everything. Tom also has key-fob access to the space and spends a lot of time exploring and trying new things outside of regular hours.

There are others, and I will introduce new students as they appear, but these eight represent the bulk of this work. In the next chapter, I will delve further into my findings with an exploration of how students discovered Studio307.

Chapter 5
By Invitation Only

In this chapter, I explore how students first discovered Studio307 and the role personal relationships played in encouraging them to enter and continue participating.

Most students discovered Studio307 through a face-to-face invitation. For example, they were given a tour during their Faculty orientation, we spoke to their class, they knew Che or I, or a professor encouraged them to visit. Here, we see how a professor's encouragement and a reason for being there are what inspire Pauline to enter the space to use the 3D scanner:

> **Pauline:** I had talked to Professor Galey, and he initially was going to send me up there [to Semaphore's main lab], but then they sent me down here [to 307]…He mentioned, 'Have you contacted the Semaphore?' and I said I wasn't sure who exactly to contact there. So, he was gonna introduce me to them. But then he came back to me and told me to come here.

I want to draw attention to how, despite our well-meaning website indicating we had a 3D scanner or our email blasts to students and faculty saying all were welcome, Pauline went first to someone she knew – her professor. It was rare to get students just dropping in without a purpose, like attending a workshop, or a personal introduction. Almost everyone I interviewed first came because they were invited. The only two who did not, Sonya and Tom, came together and even their decision to participate was dependent on existing programming and still supported by another person.

The personal relationship and invitation not only helped students discover and feel comfortable entering Studio307, but also, depending on the level of that relationship, led to increased and deeper participation. Here, Jake and I discuss his early involvement in the space as a member of TechFund (the student fund that partially supported the space) and as an early participant in the community consultation process that helped define and design Studio307:

> **Jess**: Did you tell me why you first came to Studio307? You just wanted to get more involved?
>
> **Jake**: Well, you told me about it. I guess I'm not the best person to ask because I knew about 307 before it was 307 and stuff.
>
> **Jess**: Yeah. It was just floating around then.
>
> **Jake**: And I drew like what I thought the space should look like and did those forms and stuff. So, I've always been pretty keen on it. And, so actually, when I did a tour for incoming students, I brought them in here and raved about it, I was trying to build excitement.

What I am interested in here is Jake's affinity for the space because of that early invitation and the level of his subsequent involvement. This affinity might be rooted in subject interest, but it is also cultivated by Jake's early participation in decisions concerning Studio307's funding and drawing out what he thought the space should look like as part of the community consultation. This enthusiasm even results in more invitations when Jake brings in students new to the space. If Pauline, as someone who only came once to do a specific and low-risk task, is what Lave and Wenger would call a peripheral participant, then Jake is a full member, a consequence of that early introduction and "being included in what matters" (Wenger, 1998, p. 74). Because access is not always a choice and is often determined by the existing community, these invitations and inclusions matter. According to Bethan Davies, "Individuals do not have open access to communities based solely

on their desire to be part of that community and to take part in its practices" (2005). In other words, an open door or a website is not enough, and an invitation, or what Lave and Wenger refer to as an offer of legitimacy, must be obtained or granted. In Jake's case, I was the existing community and I invited him in early. He was included in what matters. For Pauline though, the invitation came indirectly, and while I hope we were welcoming and helpful, I wonder if a more personal action, like a follow-up email, might have encouraged her to stay involved.

There was also confusion about how students could achieve deeper involvement in Studio307 and this is because membership was not particularly organized and the organizational structure of the space was not always transparent. We had clear requirements for entry (you must be a part of the Faculty of Information at the University of Toronto), a variety of entry points (e.g. workshops, open hours, clubs), and outreach (e.g. a website, class visits, tours), but the process for how a person might move from the periphery to the core was not always clear. These levels of membership, core and peripheral, developed organically and were not considered or included in the original plans for the space. For example, 24-hr key fob access was available to students outside of open hours, but it was not automatic, it was granted. In this example, I talk to Sonya, a regular participant in the space, about what fob access meant to her:

> **Sonya**: Knowing that I could come in to, like, use the space I felt very comfortable and I brought my critical making group in here to work on stuff 'cause we had access to the Arduino pieces, right, and that made me feel like I knew what I was, I don't know, that I could bring other people here I guess, [chuckle] to use it.
>
> **Jess**: If you were master of the iSchool [Faculty of Information], would you make fob access available to everyone or on a requested basis?

> **Sonya**: Yeah, if I were master of the iSchool I think I'd make a fob access granted on request. And it's, like, known that you can make a request for that, because I actually wasn't sure.

What is notable here is Sonya's remark that it should be known fob access was available (implying it was not widely known) and her apprehensiveness about whether she should ask about it. Sonya was not the only student who remarked on the vagueness of fob access. In this excerpt, Jude and I talk about his experience using the room after-hours for a group project when one of his group members, Tom, had fob access:

> **Jude:** Tom comes here a lot, and I guess he knew the room would be free. And, I guess we were trying to find a free space 'cause it was in the project week and I think we stayed here pretty late.
>
> **Jess:** Did you know fob access was possible?
>
> **Jude**: No, I didn't. But that makes sense, 'cause we were struggling to find a space.

The point I want to emphasize here is that the boundaries were not always clear. Sonya was not sure if she was allowed to ask for fob access to work on her projects and Jude did not even know it was possible. Access had to be asked for and, because it was not advertised, it was more likely to be offered by staff than requested by students. If I consider core or regular members as those with fob access, then it was not clear to someone on the periphery or outside how they might obtain that level of membership. You had to be "in the know" to know it was possible or feel comfortable asking.

Because this stratification of involvement and its dependence on personal relationships happened as we went, we (Che and I) were not aware of it as a barrier. It is only upon reflection that I see these relationships as both an asset (as an invitation) and a barrier (as an unclear process). Harkening back to Lave and

Wenger's concepts of reification and participation, a balance or harmony must be struck between the two. If space is structured by a variety of social relations and the product of interrelations (Massey, 2005: 9), then a student staff member provides peer support that extends beyond technical support or safety training (Forest et al., 2014). A staff member can literally welcome someone to the space and, as I found, this is a crucial catalyst for bringing new students into the space. As one student said during the community consultation process, "just having someone to say 'hello' is so important." But, perhaps only relying on these relationships did us a disservice as well. In this instance, Studio307 and I relied too heavily on participation to determine how students discovered the space and subsequently deepened their level of involvement. The consequence of this was that we ended up with tiers of membership that were undefined, mysterious, and subsequently served as a barrier for some students. Some reification or formalization in this case may have changed how students approached or used the space.

In short, students discovered Studio307 through personal relationships and their level of involvement depended on the depth of that relationship. When an invitation was not extended, the first introduction was often via a workshop or event and unsolicited visits were rare. Because the depth of student involvement was so dependent on personal relationships and we failed to proactively organize tiers of membership, we ended up with an opaque structure that may have deterred some students.

In the next chapter, I will explore one of the main motivations for why students came to Studio307.

Chapter 6
Technical Anxiety

In the last chapter, we explored how students discovered and became involved with Studio307. In this chapter, we will examine a reason students first came to the space, a single motivation. There are, of course, many individual reasons for coming, but here I want to focus on a common one – technical anxiety. I considered titling this chapter technical excitement because I worried about the negative connotations of the word anxiety. I want to clarify that the definition of anxiety that I am using is an adaptation of a "strong desire or concern for something to happen or to do something" ("anxiety, n." OED Online, 2017) that includes an accompanying sense of nervousness and anticipation. The "something to happen or do" here is the development of an increased understanding of technology. To clarify, I am using *technical anxiety* to mean *an eager, but tense desire to increase one's technical capacity*. This chapter starts with an exploration of students' uncertainty about their technical capacity in general and how that relates to why they initially enrolled in the Faculty of Information. I then move to the similarities between their reasons for enrollment and their motivations for coming to Studio307. Then, we look at how that same apprehension either encouraged students to, or kept them from, exploring certain technologies in the space. Finally, I end with a discussion on possible sources of that initial anxiety.

Most of the students I interviewed (9 out of 10) came from humanities undergraduate programs, and many enrolled in the Faculty of Information because they were seeking a graduate degree with a technical or practical component. This was often linked to concerns about finding a career or how to apply an arts degree in the job

market. In this excerpt, Jake explains his expectations when he enrolled in his initial program (Information Systems and Design), his apprehensions, and his experience:

> **Jake**: I felt that I'd come into this program really thinking it would be technically focused, especially because I went into ISD [Information Systems and Design] and I was ready to be unprepared and really overwhelmed by the technical requirements, but I was excited for it, too. But when I came in, I was completely underwhelmed by the technical requirements and how much I could possibly learn. And I felt like a big reason I'd come to the iSchool was…well, I felt I'd be dealing with data and information and learning these skills. So, there's a real gesture here to say, like, "Don't worry about the technology," like, "Don't worry about this technical stuff, you don't need to know it." And my feeling is you do need to know it to some degree, or else you're gonna have to learn it on the job in your careers now. It's inevitable that you're gonna have to know some technology.

I heard a similar story from Tom, a music major in his undergrad, when he explained why he chose his first concentration in Information Systems and Design:

> **Tom**: I knew I didn't want to do something with music, but I had spent a lot of time in undergrad messing around with computers and so I thought that I might want to do something IT-related, but I obviously didn't have a computer science degree. So, when I was looking at doing grad school, I found this program and I heard that it was general, and it was more about the abstract, administration style of that, I was interested in coming here. And then I felt like that was the one [Information Systems and Design] that was more geared towards doing that kind of practical, hands-on stuff. Yeah, that's how I ended up here.

Tom, who was drawn to the "abstract, administration style" of his program does not express the same disappointment in the technical depth of his education as Jake, but

both tell a story about wanting to do “something IT-related” or “technically focused.” It was a vague but common undercurrent for most students outside of the more traditional Library and Information Science, Museum Studies, or Archives and Records Management streams. There was Sonya who did her undergraduate studies in global development and art history and was “really concerned about getting a career instead of being in an academic institution,” or Mary, a psychology and business undergrad, who wanted “a good way to facilitate my background into UX and something more technical.” The only people I interviewed who did not explicitly express interest in increasing their technical capacity were Swapnil, a student with a computer science undergraduate degree who came to the Faculty to develop his project management and client communication skills; Jude, who came from a library background; and Naomi, a library student interested in working in the public library sector.

Similarly to why they enrolled in the Faculty, students often came to Studio307 because they wanted to increase their technical capacity. Here, Sonya tells me one of the reasons she first got involved in the space:

> **Sonya**: I was also just curious, I knew that you could make things in here and I love dabbling in different things, so I wanted to see what I could try. I also had... well, for a long time I was really scared of anything that was technology. [chuckle] And about a year ago maybe I took an intro to HTML, just something super-basic, but it brought down the barrier a little bit so I wanted to try and dabble in a whole bunch of different things, and it made it feel like it was possible. You can try something without it being really intense and it doesn't have to be scary. So, I wanted to keep trying different things that before I would have just pushed away as, "Oh I can't do that."

There is an eagerness in what Sonya is saying - an excitement fueled by curiosity, but also a touch of fear. In the next chapter, we will hear Sonya tell us that she still thinks of "anything that's thought of as technical or techy" as "a new world," and yet, we see her here as embracing that new world - curious, dabbling, and wanting to try different things. Tom, who first came to the space with Sonya, also told me they "thought that this would be a good place to try and become more familiar with the coding and actually putting things together." Tom and Sonya, two of the most active members of Studio307 and regular participants in Arduino Club, are an example of technical anxiety encouraging action and exploration, but the theme was common. Students usually came because they wanted to learn something new, try a tool they had never used or, like Myrna, find "an environment where [they] could comfortably start." In hindsight, I wish I had interviewed students who never came to Studio307. I, unfortunately, do not know why they did not come. Perhaps it was a lack of interest or time, but it would be interesting to find out if fear contributed. Here, Jude speculates on why he thinks some of his friends did not come to the space:

> **Jude**: I have friends in other concentrations as well, and I think they'll be a bit more hesitant to come, 'cause I think it has to do with this idea that it's technological, and therefore it's intimidating. So, in my concentration I can see any number of people that I know willing to come here. But, let's say Archives or something, I think they would say, "Oh, I don't wanna...," I think they would say, "I don't know any of that stuff."

I think it is important to recognize that I am unable to generalize about why students did not come to the space, but Jude's remarks provide us with a clue that it was perhaps due to hesitation or the idea that students felt they needed previous experience or knowledge before entering the space. In their work at the Invention Studio at Georgia Tech, Alexis Noel, Lauren Murphy and Amit Jariwala identified four main barriers to entry for students: "anxiety due to lack of experience, a lack of

information regarding equipment and usage, a fear of alienation, and a pre-existing notion that makerspaces are only for engineering" (2016). As evidenced by this chapter, I, too, found that anxiety due to a lack of experience was a barrier, but am only able to discuss it as a barrier once students had already entered the space.

Once students were in the space, the nervousness that accompanies technical anxiety also discouraged some from trying new things. In this excerpt, Jude is explaining why he never tried using the 3D printers:

> **Jude**: I personally find the 3D printers a little intimidating, like, I don't wanna use it and break it, cause 3D printers, I know they're expensive. So, I personally wouldn't go make something on it, unless I had someone there like yourself. I'm actually scared to break it.

Pauline, a Book History and Print Culture student and photographer, gives a similar-sounding answer when I ask her why she has not tried exploring any of the physical computing tools like the Arduinos or Raspberry Pi computers:

> **Pauline:** It just seems overwhelming. It gets way beyond my comfort level. I can't even get past HTML coding. Scanning is one thing, I know photography and that world, but that stuff, coding, it just seems outside of anything I've ever done.

The words intimidating and overwhelming came up frequently in my interviews. Students, like Jude, were afraid they might break something or, like Pauline, just felt unsure of where to begin or start. Students were both motivated to come to this faculty and Studio307 by the same technical anxiety that kept some from trying certain tools or equipment. Fear served as both a motivator and a hindrance. I observed, at the tool level, students avoiding trying something because they do not want to break it or find it overwhelming. Or, like Pauline, trying it anyway because of a perceived need. At the space level, I observed students coming or not coming

because of concerns about their technical capacity. At the faculty level, I observed another connection between technical anxiety and why they enrolled in their programs. Given these scales, how can this be reframed in order to understand what causes that anxiety on a global level?

While this ethnography focuses on a local space, external factors still influenced the local happenings at Studio307, specifically students' motivations for engaging with and in the space. These external factors reached in and out of the space. According to Massey, because we can think about space as a product of our relations and connections, we can consider how far those connections and relations extend (Massey, 1994). I am reminded of those external factors and their impact when I look at our Faculty's website, see the recruitment banner shouting "Our highly interconnected information-based society requires innovative, collaborative and knowledgeable information professionals," and then warning us that "today's technologies have transformed the way we connect with, shape and use information" (Future Students, 2017). Here, we have this little space, a small room tucked away on a university campus, and it may seem insulated and like its reach is insignificant. But, if we consider space the way Massey does, as a product of our connections and power relations, it helps us understand how Studio307 fits in with students' reinforced concerns about the job market and changing economies. Fears, fueled by our own Faculty, about a job market where, as Jake says, "it's inevitable that you're gonna have to know some technology," often drove technical anxiety. That same technical anxiety fed into why they enrolled in their program, fed into why they came or did not come to Studio307, and even fed into how they used the space.

Technical anxiety influences motivations and decisions, but it is not the only catalyst. There were other reasons for coming to Studio307 - like Jude wanting to meet new people or Naomi wanting to learn how to use the sewing machine. There

were also overlaps, like Sonya wanting to both increase her technical capacity and simply enjoy the process of making and dabbling. But here, in this chapter, I focused on one common motivation that appeared frequently and at multiple levels or scales – technical anxiety.

In the next chapter, I explore how students preferred to use and participate in the space once there.

Chapter 7
Needing Context to Imagine

In this chapter, I explore the role inspiration plays in how students use the space, and the balance between structuring that inspiration and allowing for autonomy. I also discuss the tension between students wanting guidance or structured support, but also valuing freedom or privacy and how room can be made for both.

Before students discovered a new tool or capability, they needed inspiration. Some tools in Studio307 went untouched (for the entirety of my research period) and when I probed students about why they did not try a particular piece of equipment, the answer was, as we saw earlier, related to technical anxiety (not knowing how a tool might be used), but also often tied to a lack of inspiration or context (not knowing what it might be used *for).* The following excerpt is from a discussion with Sonya about how she might improve the space:

> **Sonya**: Something that I had difficulty with, was I wasn't sure how to make use of certain things, or what everything was, necessarily. …Like that Makey Makey, I never would've discovered that myself. Or the soldering wands…? Iron? [chuckle] Whatever it is. I have no idea what I would use that for. It's cool that it's here, but I just don't know what to do with something like that, [chuckle] and I think that's true for maybe like the Raspberry Pi as well. I just don't know...I don't have enough context to imagine what I could do with it, I guess. At least with the 3D printers, I'd heard of Thingiverse before. And to just be able to browse through things that people have done before, I found gave me enough [inspiration] to be, like, "Oh yeah, that would actually be a really cool thing to have. I never would've imagined that's something that you would do." And

> then once I had that I was like, "Okay, well I can build off of this," and it helps you imagine other things, other ways of approaching the same thing.

What I want to draw attention to in this excerpt is the significant role inspiration plays in Sonya's discovery. Sonya says she "wasn't sure what kinds of things you might do with stuff I wasn't already familiar with" and refers to the Makey Makey (a kit that allows people to connect everyday items, like a banana, to a computer and use them as controllers), which we demonstrated one day at Arduino Club. She also cites Thingiverse, a website where people share their designs for 3D prints or laser cuts, and says she can build off that existing work because it helps her imagine other things she can do. In previous work, I recommended making items visible as a way of supporting discovery (Whyte, 2016), but simply leaving an item out on a table or listing it on a website might not be enough. Even once a student has overcome technical anxiety, visibility is not enough – often, inspiration and context are also needed.

To further contextualize the use of tools, the addition of inspiration alone was also not enough - often that inspiration needed to be structured or guided, as in a workshop or organized event. In the following excerpt, Jake and I discuss how he used Studio307 over the year and delve into why he regretted not coming to a Halloween costume-making party:

> **Jake:** I really wanted to do the Halloween costume thing here, because I would love to learn how to use a sewing machine. …I guess, for me, it's also, well, there was something about the making, like, a costume *thing*, a sewing machine *thing*, where I was like, I don't have to invent my own project so much. Which is something that...Well, going back to my Raspberry Pi idea, that is, to have the context already helps me, I think, in terms of thinking about what I wanna do.

The point I want to emphasize here is that Jake is also stressing the importance of inspiration, but using it to explain the appeal of workshops. By attending a workshop or event, like the Halloween costume-making party, Jake does not "have to invent" his own project. He is instead free to simply learn or discover the equipment without the additional pressure of first having to come up with an original project or idea. Looking through the staff logs, attendance would naturally spike on days with programming, and future, independent usage of specific materials was also tied to programming. For example, the Raspberry Pi computers went untouched until a Pi workshop was held in February and then they were subsequently pulled out, borrowed, and experimented with on multiple occasions. On a less uplifting note, the Dremel, a multi-purpose rotary tool, was not featured in any workshops and still sits fresh in its box.

Structuring a workshop around a prescriptive task may seem rigid or repressive. There is an underlying libertarian ethos in sectors of maker culture that focuses heavily on tinkering and independent discovery (Toombs, Bardzell, & Bardzell, 2014; 2015; Kostakis, Niaros, & Giotitsas, 2014; Van Holm, 2014) and enforcing too much structure or dictating use might be seen as running counter to those ideas of open discovery and free exploration. However, Studio307 is not a hackerspace, a madlab, or a DIY makerspace. It is a studio in an academic institution backed by curricular intentions. Students are not necessarily there to sign on to DIY culture and they are not always walking in as experienced makers.

Providing too much structure (e.g. "in this workshop, we will be making this object") may also seem counter to makerspace ideals like peer-to-peer or informal learning (Britton, 2012; Colegrove, 2013). That is, instead of learning through shared interest or creating with peers, structured workshops are seen as too unidirectional or reified. In her discourse analysis of makerspaces and libraries, Willet (2016) points out how

simplifying these polarizations between informal and formal learning can be. She remarks that there is space for multiple forms or styles of learning and opportunities to blend them together. I found that structured programming, despite being prescriptive, was not only welcome, but it also supported discovery and future, independent work. Like Willet, I agree that there is space for both formal and informal learning and both forms not only support student objectives, but are needed.

In Studio307, students wanted both that structured support but also freedom to explore. On one hand, students welcomed the staff presence and structure discussed above, but they also wanted the freedom to make mistakes without being supervised. In the remainder of this chapter, I will discuss that tension and some reflections on my own anxieties around discerning whether that help was welcome.

When I asked interviewees to describe Studio307 to an imaginary incoming student, they often mentioned how there was staff available. In these excerpts, I ask Jude and Pauline to do just that - to explain the space to me as if I am a new student:

> **Jude**: I would tell them it's like a collaborative hub space where it's free for you to use as a student here. You can come by and just make something. There's usually a really nice person there teaching you how to do stuff. But I also know that it's a free space, so whenever you wanna create something, do something with whatever, you can…it's free space, safe space. Yeah, I would tell them that.

> **Pauline:** It's like a creative workshop where depending on your project, there's available tools and support to work on your project. It's just a really good space to work in and do your thing. Just because, I can imagine like, if I'm over here working, say on the 3D printer and I need help with it or I even just want info like, "Hey, what do you think? How do you think this looks?" Or say,

> try and problem-solve. It's good to have other people to talk to versus working alone.

There are two aspects of these excerpts which are important. One is how both Jude and Pauline include the availability of support in their description of Studio307. They highlight it as a feature. Perhaps this is because they are talking to me, someone who worked in the space, and are being polite by acknowledging my work. But I think the support is sincerely valued because both also explain *why* they like having someone there. For Jude, the value of another person is to teach or support, and for Pauline, it is to collaborate or bounce ideas around. However, the second aspect in these excerpts is the description of the space as "free" and "creative." It is not as explicit, but there is a subtext there, that this is a free space to experiment and explore and students are not beholden to a particular curriculum or the expectations of others. This hints at Goffman's theories about face and embarrassment, which I will turn to soon, and why people may want to learn or have new experiences free from the watchful eyes of others.

Freedom from observation was a catalyst for some students, encouraging them to try new things, make a mess, or take ownership of Studio307. Here, Swapnil is explaining why he wanted to use Studio307 for a group project and compares the space to the Inforum (our Faculty library), using oversight as the benchmark:

> **Swapnil:** I was with my team for our critical making course and we're building so many things, we're doing crafting, we don't want to make a mess in the Inforum space. Because again, the clearing that mess and it's like there are always people just watching what you're doing, and you're walking in and out all the whole time and everyone is looking. Over here, you have all the equipment that you want, your scissors, you have glue. Whatever you want, it's right here, so it would have been so much easier.

It is noteworthy how Swapnil twice mentions watchful eyes as a deterrent. He wants to make a mess away from "people just watching what you're doing" and be free to move around without everyone "looking." He was not the only one. When talking about ownership of the space, Tom told me he felt better looking for tucked away tools when he was alone because "it feels different if the door is open and people are watching or whatever." Tom then told me about his time alone in the space, trying to repair a set of headphones with the soldering iron while he waited for a print job to finish or learning how to fix a filament break on the 3D printer on his own, and I wonder if those things would have happened had I or Che been there. For Tom and Swapnil, a lack of supervision translated to ownership and a willingness to do more. In other words, a lack of supervision also translated to inspiration. I understand this contrasts with my earlier finding that context and support lead to inspiration, but there is room for both.

Returning to Willet's discourse analysis (2016), she warns about oversimplification in the makerspace literature. Willet is discussing how authors like Britton (2012) or Colegrove (2013) seem to vaunt informal learning without questioning who that might benefit or exclude, or appear to assume social and collaborative learning always trumps individual effort. As it applies to freedom and structure, this is not always simple. Many of Studio307's participants have never met and their motivations, expectations, and outcomes are not universal. This is an example of there being moments where support or inspiration are needed and others where a supervisory eye is too prescriptive or restrictive. There is a need for structure and guidance, but also for free space and time to explore and try out new things. These things do not have to conflict with each other. They can complement and overlap and do.

For some students though, valuing freedom or privacy while working in Studio307 was less about enabling action and more about reducing risk or embarrassment. Earlier, we saw how Pauline highlighted the availability of other people as collegial and supportive ("it's good to have other people to talk to versus working alone"). But, as we kept talking and I asked Pauline if she thought she might use Studio307 more if she had 24-hour access, she touched on what she saw as the downside of having other people around:

> **Pauline:** Yeah, well, 'cause it can be intimidating as well. If you don't know necessarily what you're doing and you don't want everyone being like, "Oh, she doesn't know what she's doing."

The point I want to extract here is how Pauline wants to avoid perceived embarrassment or judgement. Considering that the students who use Studio307 are all peers and adults, I would like to think it is unlikely anyone would ever remark or think "oh, she does not know what she's doing," but the threat is real to Pauline. According to Goffman, embarrassment is all about unfulfilled expectations and if a person does not possess the attributes, information, or capacities they are expected to possess, that is what causes embarrassment (1967, p. 105). Where Goffman does not go is clarifying *whose* expectations. In this case, my expectation that no experience is required does not match Pauline`s expectation where she believes she should know what she is doing. When Pauline told me she thought Studio307 could be intimidating, I realized we did not make it clear what our expectations of new users were. We, the staff at Studio307, did not work hard enough to make people feel comfortable about their skills. There are no signs on the wall that say things like "Everyone is a Beginner" or "Step 1: Fail." There is no automatic precursor to every workshop like "there are no silly questions," and other than the line "no experience required" on our Arduino Club ads, there is little documentation available on what, if any, expertise is needed.

To understand this shortcoming, we can also return to Wenger's concepts of participation and reification. According to Wenger (1998), participation is how members interact and through those interactions develop norms and expectations, and reification is the use of artefacts like policies, curriculums, or posters on the wall to affect how members behave. In other words, reification is taking something abstract (e.g. a concept like all are welcome) and turning it into a thing (e.g. a sign on the door that says, "all are welcome"). While participation and reification do exist in a tension-relationship, they are not in opposition. Instead, they are meant to complement one another. If there is too much reliance on participation, the community and space are unanchored. People do not know what the expectations are and develop their own diverging versions. If reification prevails, you stifle your community and that freedom to explore or take ownership is smothered. In this instance, with Pauline and possibly others, the scales were tipped towards participation. We left too much not reified or formalized, like our intent that this was a welcoming space and that no experience was required.

These worries about structure leading to stifling or observation leading to embarrassment did not only exist for students, I also found myself wrestling with this as a staff member and provider of that support. On one of my first days, a student came in and asked if Studio307 was available to use outside of open hours. I replied, "no, not yet" and she remarked how she preferred to work "without someone looking over my shoulder." That stuck with me and I became sensitive to it. In my field notes, I often worried about whether I was imposing on people or forcing unsolicited help on them. This excerpt, from three months in, captures that anxiety well:

> **Field Notes (Dec, 2016):** I spent most of my time fluttering between Kelly and Jude, trying to strike a balance between helping and hovering. This, I think, is the hardest part of this job - you worry that people aren't asking for help because maybe

> they're nervous, shy or worried they're bothering you, so you go over to have a look and maybe offer a suggestion, but then you start worrying that you're a helicopter or drone annoyingly buzzing overhead and forcing them to tackle their project your way. I found myself repeating phrases like, "if you already know this, please stop me" when explaining something or "let me know if I'm in your way," and also doing awkward things like never touching their work and trying to offer explanations verbally, not physically. It's awkward.

This excerpt illustrates how, early on, I had my own concerns about how to gauge what level of support to offer and whether my presence might make others nervous or smother their creativity, initiative, or agency. If I am to trust Stanley and Wise (1993), these kinds of emotional responses are sensitizing guide dogs. This anxiety serves an interpretive function as an important source of insight. If I am worrying about being in other people's way, maybe they are, too, and it is worth exploring. For that reason, I opted to seek out this theme in my notes and transcripts.

In this chapter, I explored how inspiration and support can serve as a catalyst for discovery once students were in the space, but also the balance that must be struck between helping and hovering in order to allow for individual exploration. Specific tools or equipment often went untouched in Studio307 when students did not know how an item might be used, or what it might be used for. Students also appreciated when that inspiration was structured. Guidance, whether in the form of inspirational examples, workshops, or individual staff assistance, often led to increased use. However, this was not universal, even amongst individuals, and despite appreciating help, students also wanted privacy or freedom to explore on their own. This freedom provided room for students to try new things and freedom to fail away from watchful eyes or without risk of judgement. In Chapter 10 – Conclusions and

Recommendations, I will discuss how this balance between support and freedom might be achieved.

In the next chapter, I will return to participation and reification again. This time, to explore how diverging versions or interpretations of Studio307 effected how, or if, students used the space.

Chapter 8
Peripheral to the Institution

For some students, their activities in Studio307 were co-curricular, that is, meant to complement or support in-class learning experiences. For others, it was also extra-curricular, that is, outside of the realm of normal curriculum and motivated by personal experience and interest. This sometimes led to confusion over what was allowed or what was considered a valuable pursuit and whether that mattered. In this chapter, I explore how students saw the space as peripheral and the subsequent confusion over whether it was co- or extra-curricular or both. Then I delve into how, despite wanting to encourage both uses, I, as a staff member at Studio307, inadvertently privileged one over the other and the consequences of that privileging.

Despite being physically situated within the Faculty of Information at the University of Toronto and operating under the banner and management of the Semaphore Research Cluster, students often thought of Studio307 as peripheral to the institution. One example is how they compared it to another student space, one more internal and institutionally managed: the Inforum (the Faculty library). Here, I am asking Mary about how she would explain Studio307 to new students:

> **Jess:** What if they asked, like, "So, why is this space here?"
>
> **Mary:** Why I think this space exists?
>
> **Jess**: Yeah.
>
> **Mary**: Well, I think this space exists so that students can come together to work, kind of like the Inforum, but a little bit more personal-like and casual, and people come and go, and they meet new people, and they can also do cool things like work on Arduinos, get involved in more technology-based products just

> like software engineering as a whole, and get exposed to that tech field.

Mary is describing the space as like the Inforum in that it is a work space for students, but she differentiates it. She describes it as more personal and ad-hoc with people coming and going. People come and go at the Inforum, too, of course, but the sense here is that 307 is less structured. I asked Swapnil a similar question and he took the comparison between the Inforum and Studio307 further:

> **Swapnil**: I would just say to them that, 'If you're doing any craft work, anything craft related, rather than using Inforum, come down here. You have all the equipment that you would need…But yeah, you could use this rather than the Inforum and there's no time limit over here. You could just come. If this is open, you don't have to book anything compared to...'
>
> **Jess**: …like, a meeting room?
>
> **Swapnil**: Yeah, I mean, as of now, as it stands now, I would say like, 'You don't have to book anything. Policies could change, I understand, but you have equipment. So, if you're creating things, if you're looking to be...[trails off]. If you're trying to do a personal project, also, it doesn't have to be a school project. … Feel free to use it for whatever purpose that you want.

There are two things I want to focus on here. The first is that Swapnil, like Mary, juxtaposes Studio307 with the Inforum. He distinguishes it from the Inforum in three ways: you can make a mess here, you do not need to book the space, and you can work on personal projects. Again, these things can happen in the Inforum - it is a fairly laid back place designated for students - but there is a perception that the Inforum is for coursework or traditional desk work and perhaps a little more rigid, whereas Studio307 is for other types of work, less formally dictated by institutional regulations, and away from institutional oversight. Returning to the language of Wenger's community of practice, the Inforum is described by students as

institutional and reified, while Studio307 is described as unstructured and defined by participation (2008). The second thing I want to recognize from Swapnil's description is the emphasis he places on personal endeavors and how students should "feel free to use it [Studio307] for whatever purpose" they want. This indicated to me that there may be differing views on the purpose of the space.

Students were confused as to Studio307's status, they saw it as both co-curricular and extra-curricular, sometimes simultaneously. They might link their work in Studio307 to coursework, but then also describe what they did there as distinct or different from traditional coursework. In this next excerpt, Jake explains why he had not visited Studio307 as much in the Winter semester:

> **Jake:** I almost feel that, like the classes get in the way of all of the self-directed learning I'd like to do and all the things I'd like to explore. So, I feel if there was just an open day to just play around here, I'd have a blast.
>
> **Jess:** What about your classes this semester? Is there anything that this space might play into there?
>
> **Jake:** So, last semester, I had all the kinda group projects, I had Critical Making which fed really nicely into this. This next semester is gonna be a lot of readings and papers, and that level of classic academic engagements. I think this space might be a sanity, or a kind of like, "I'm tired of writing, I'm tired of reading. I wanna use my hands. I wanna have a tactile experience now." And I think this will be a wonderful space for me for that.

Jake links Studio307 to his past coursework for Critical Making (a class that explores critical themes in Information Studies through hands-on work and physical computing), but plans to use the space this semester as "a sanity." For him, Studio307 will now be a counter, rather than a compliment, to what he calls "classic

academic engagements." Pauline, a student who came to do 3D scanning for a class project, does something similar:

> **Jess**: If a student asked you about this space, how would you answer if they asked, "Why does this Faculty have this space?"
>
> **Pauline**: Well, thinking for LIS, libraries are kinda moving away from just the traditional, like, "Here's a book." They're becoming more involved in the community and they're having different kind of programs and technologies available. And so, I feel it's important for future librarians to kinda train, and know the technology here, and to kinda be able to get really familiar with it, and learn those skills. And so, I think that aspect helps, but also, it just, especially for people like me, creative people, it's a good outlet to do something different.

Pauline's approach differs slightly from Jake's. For her, Studio307 is a place to learn career skills and do coursework (her 3D scanning project), but also a source of creative release or expression and she combines the two. With Jake though, there is a bit of a tension between what is personal and what is professional or academic, and these aspects are divergent. I would hear things from students like their interest in the space was "purely personal," but then still see them at Arduino Club or weekly Python tutorials applying in-class programming skills to personal projects or vice versa. Or, like Raj, they might tell me they came to an Internet of Things workshop "just because I thought it seemed fun, something to do," but they would still incorporate concepts from their Information Security courses in the in-workshop discussions. There is a discordance there - people are saying one thing and doing another - but this might be because people do not need to separate these things out so markedly. There is an institutional desire to be able to point to an activity or endeavor and clearly say how it links back to coursework or career skills, but it is not always that clean. Being able to quantify or specifically identify examples of co-curricular learning examples is great for grant applications, but the students

themselves do not always define their work in such a demarcated way and trying to force it can backfire. In the remainder of this chapter, I will explore how I, as a staff member, attempted to do just that by privileging the co-curricular and the subsequent consequences.

In failing to formally define Studio307 as co-curricular or otherwise, the space suffered some consequences in terms of use. For example, Studio307 may be peripheral to the institution but its proximity often led to confusion or hesitations around how it could be used. In this field notes excerpt, I recount a conversation with a student who was running a series of 3D printing workshops in the space:

> **Field Notes (Jan, 2017):** Cal stopped by to check on supplies for his upcoming workshop, make sure everything was ready to go and all that. Something interesting went down, I just happened to mention a couple of students were printing out custom game pieces for a Settlers of Catan game and he balked. He said that could eat up a lot of filament and I said, 'okay,' and then he replied, 'well, as long as you don't mind if people are just printing trinkets.' And then, then we got into it, but in a friendly way. I asked him what he thought they should be printing? Perhaps, pre-approved, blank 'Cal Circles' or utili-cubes? I joked that perhaps he'd like to start up a screening service to approve every print job, make sure it's up to his standards and all that. He took it in stride and conceded, but it was still funny to realize that people do have concerns about what's valid or good enough or, I don't know, I guess, academic enough? We're not all on the same footing here.

My argument with Cal was that regardless of motivation (co- or extra-curricular), students were still learning the limits and capabilities of the technology. Many of the projects tackled in Studio307 were driven by personal interests, but the outcomes were the same. Sonya and Tom may have first used the 3D printer to make a dry pasta measuring tool and Swapnil may have tried his hand at a custom Settlers of

Catan game piece, but what they made does not really matter. They still learned to level the build plate, load the filament, alter a design, test various fills, and operate and troubleshoot the printer. They still learned the capabilities and limitations of that technology.

Because this attitude that Studio307 did not differentiate between co- and extra-curricular was not documented and because the space was still affiliated with the institution, there was confusion amongst students. Some students, like Cal, saw the space as strictly co-curricular. My field notes and the staff log are peppered with entries like "a student came in to ask if it was okay if they worked on a personal project" or, "she asked me if it was okay if she just tried the 3D printer for fun, or if it had to be for a class." When asked, Che and I always clarified that students were free to work on whatever they wanted, but this was not documented in any signage or publicized policies. We were competing with the attitude that the space was strictly co-curricular (e.g. Cal), and it may have negatively affected use.

This confusion over extra- or co-curricular was aggravated by my own behavior. When I spoke to classes to introduce them to the space, I would always try to provide examples of how people used it for course projects. Or, when discussing Studio307 with a new administration staff member, I remember running methodically through every concentration in our program and providing an example of how each might use the space for a supposedly valid, co-curricular purpose ("UX students might use it for rapid prototyping, Museum students for exhibit building…"). When Che and I applied for funding, we would always back up our requests with rationale about how this activity or that piece of equipment supported curricular goals. I even made a display about how Museum Studies students might use the space focused entirely on professional development. In doing so, I tacitly supported this idea that the space was intended to be co-curricular. In her discourse analysis of the rhetoric around

public library makerspaces, Crawford Barniskis (2015) found a discordance between the front-stage speak in the literature about makerspaces supporting economic goals (e.g. developing technology skills for the job market or supporting entrepreneurialism) and the backstage conversations between librarians which tended to focus on things like open and equitable access to equipment or supporting social and creative needs. She describes it as librarians simultaneously serving their institutions, who are seeking funding and grants, and their users, who have different goals, and warns that the consequence might be the foreclosure of activities deemed "economically or educationally irrelevant." I am guilty of this frontstage/backstage behavior (Goffman, 1959). Regardless of whether I thought a project had to be specifically educationally relevant (I did not), how I was participating was contributing to that norm or expectation. Not only was I not clear that both co- and extra-curricular activities were welcome, but I actually privileged the co-curricular.

At the Invention Studio at Georgia Tech, a student-run makerspace, they specifically "welcome all types of projects, personal and professional" (Forest et al., 2014). Forest et al. point out how unique this is and that many other institutional making spaces do not allow the pursuit of non-academic projects. They also identify this as a draw, a way to encourage long-term engagement, and recommend studying whether it was "a personal project or required (class or research) project that caused the user to first enter" because "how the shift occurred from 'almost required' participation to voluntary participation, that is, from school project to personal exploration, is a compelling area for future studies." I, too, find this compelling, but based on what I saw at Studio307, I am not sure this demarcation is always possible. Working on a specific course deliverable is easy to define but, outside of that, the boundaries are not as clear. Students might say they are at a workshop because of personal interest, but they are still tying in class concepts or taking those concepts back to the classroom later.

Linking participation to curricular or career outcomes also has consequences. If administrators keep heralding educational or economic impacts as the ideal on the frontstage, a necessary tactic in an academic institution, you start to create an expectation or a norm. Unless administrators and staff are diligent about balancing this out by reifying the alternative (e.g. signage on the wall that says, "all projects, personal and school-related, are welcome," including it in orientation tours, or demonstrating it in exhibits or Twitter feeds), they risk alienating some students who may think their use or reason for being there does not fit with the ideal they have been trumpeting.

In this chapter, we saw how students viewed the space as peripheral to the institution, and the subsequent confusion about whether it was co- or extra-curricular or both. Despite wanting to encourage both uses, I privileged co-curricular uses in how I presented the space publicly and affected how some students used (or failed to use) the space. This is another case of participation prevailing. Students saw Studio307 as peripheral to the institution, but not outside of it. They ended up seeing the space as co-curricular or extra-curricular or both, I never clarified, and this resulted in students being unsure how or if they could use the space.

In the next chapter, I explore the day-to-day interactions in Studio307 and how students worked and learned together.

Chapter 9
The Collegiality of it All

In previous chapters, I covered how students discovered the space (by invitation), a reason for coming (technical anxiety), their needs once in the space (structure, but also freedom), and how they viewed the space (as both co- and extra-curricular). In this chapter, I want to explore what happened inside i.e. how we lived together. This chapter is about the day-to-day relationships in Studio307. In previous work, I defined collegiality as a term to describe the goodwill relationship between people who are united in a purpose, respectful of one another's work, and eager to help each other. In that work, I argued that collegiality feeds discovery (Whyte, 2016). Here, I want to focus less on collegiality's role and more on a rich description of the collegiality itself.

Parallel play (Parten, 1932), rather than organized collaboration, was common in Studio307 amongst regular members. In these field notes excerpts, I describe two quiet afternoons:

> **Field Notes (Oct, 2016):** Mel popped in around 3:30, she brought a friend, someone I've never met before. He worked away on his SSHRC application, while she worked on a quilt block she started yesterday. We mostly just worked quietly. I fiddle with something, Mel sews, her friend types, the radio plays. It was comfortable.
>
> **Field Notes (Nov, 2016):** I actually don't know what Jake was working on, an analytics project maybe? I kept busy with the whiteboard while he plugged away. The radio was playing, Che popped by for a little chat, but otherwise we were just there, working in tandem, doing our thing.

In these examples, we see a regular event in Studio307 – people working alongside, but not with one another. Parallel play, a concept from education and early child development originated by Mildred Parten Newhall, is when children play adjacent to one another, but not with each other. They are interested in each other's activities and interact occasionally, but they mostly play alone (Parten, 1932). In the early child development field, parallel play is described as a developmental milestone, something someone passes on their way to organized, collaborative, or co-operative play.

Organized co-operation or collaboration was surprisingly rare in Studio307. By this, I mean actual collaboration on a shared project. I would see it if students were working on a course-mandated group project (e.g. for the Critical Making course), but spontaneous or naturally-developing collaboration was not frequent. In the above, first field note excerpt, Mel was working on a quilt block that quiet afternoon. She ended up posting the block on the white board with the words "Add to me" and an arrow pointing to it. No one did. I started something, but never finished. Swapnil similarly intended his custom Settlers of Catan game pieces to be a shared project, but it never really took either. I do not know if we were on our way to collaborative projects, perhaps I did not stay in the field long enough to find out. But, here, in Studio307, and for the time I was there, the parallel state was often where we found ourselves. I do not mean we never co-operated or shared knowledge, just that it was rarely organized or focused on a shared project. The goal might be shared, but not the product. This concept of parallel play might not, at first, sound very collegial, everyone just chipping away at their own projects. But those moments of interest and interaction did occur, just on independent projects rather than shared ones.

Collegial moments were most common during structured events or workshops, and would often take the form of what I am calling chain-style learning where skills were

passed down the line from one student to the next. When we found ourselves working on similar projects or towards similar goals, the staff and participants had space and time to interact meaningfully. For example, I remember an overbooked Intro to the Sewing Machines workshop. We had one sewing machine and six people, four of whom had no experience. We also only had two hours. Within half an hour, Sonya and Mel (two students participants) were helping others learn how to use the machines while I helped someone prepare their next step. Within an hour, previously inexperienced students were helping others learn the steps they had just learned. It was a skills chain of necessity. People were united in a purpose (e.g. "let's learn how to use this thing") and eager to help each other by passing on what they had just learned.

Fig. 8. A typical week at Arduino Club

Arduino Club, a weekly drop-in session on physical computing targeted towards students with a range of experience levels, was also often a site for this chain-style learning. Arduino Club was project-based - meaning each week we each tackled a small project using an Arduino microcontroller. We, the participating students and

I, would typically choose a project together from either the Arduino Projects Book or the internet, and everyone would get an Arduino "kit" (a small box with an assortment of common components and bits needed to complete simple projects) and either a photocopy or link to instructions (Fig. 8), but the work itself was independent. On weeks with a mix of experienced and inexperienced participants at Arduino Club, things were less likely to follow the observed chain-like learning structure as discussed above. Instead of passing each step down the line, there were multiple mentors. Someone would present an open question to the group (e.g. "does it matter which connector is which on this motor?") and whomever had a moment would answer. In weeks where almost everyone was a newcomer, things were different and we would fall back into the chain-style learning pattern. I would start by explaining basic concepts, maybe provide an overview of the project, but then leave students to tackle it on their own. Heads would drop, students would plug away, and within a few minutes, I would often find myself helping the first person to reach the first hurdle or challenge. Then the next person to hit that hurdle or a similar one would often be helped by the first. Like the Sewing Machine workshops, this was also usually a product of necessity. I might be busy working on my own project, helping someone else, or digging out a needed supply, but other students who had just learned that skill or overcome that problem would step in. I would not describe this as co-operative learning, which implies group work (e.g. everyone working on a shared project). It was still parallel or adjacent, but with a chain-like series of collegial interactions.

The literature on makerspaces often describes this chain-style learning as collaboration or collaborative learning. In their work on the philosophy behind educational makerspaces, Steven Kurti, Debby Kurti, and Laura Fleming (2014, p. 8), describe a familiar scenario they label as collaborative:

> "For instance, consider a student experiencing a roadblock in designing a gear reducer. As the first student struggles in the design, another shares a solution he or she has used or is currently using. Then together the students work to overcome the obstacle; in this case one student is the classical "learner," while the other is the classical "teacher." Yet as the students collaborate to meet the challenge, they are both actively engaged in learning and teaching new concepts to each other. All the while the adult teacher observes from the outside, remaining out of the picture unless further rigor becomes necessary. The primary objective of the teacher in this case is to facilitate the acquisition of concepts by building a specific project. This is the ideal learning environment of an educational makerspace."

I agree with Kurti, Kurti, and Fleming that this is a good, and at times ideal, learning environment and that students teaching new concepts to each other is a common scenario, like what we saw at the Sewing Workshop or Arduino Club. But I disagree that this is collaboration. It is collegiality. It is knowledge sharing. It is chain-style learning. It is not, by definition, collaboration. Students are working alongside one another, towards a similar goal, and are eager to help one another, but the work is still independent. Each student has their own kit, their own variation on the project (there is almost always a personal tweak), their own motivations, and their own goals. They are respectful of one another's work but still personally invested in their own creation and learning.

David Gauntlett's approach to describing this social, yet still individual process, is applicable here. In his book, *Making is Connecting* (2011), he argues that making is connecting because acts of creativity usually involve, at some point, social interactions and by making and sharing, people are engaging with and connecting to their social and physical worlds. The benefits of this are, according to Gauntlett, increased social capital, personal development or enrichment, and happiness.

Despite stressing the importance of relationships and social connections in this process, Gauntlett then develops a definition of creativity that is still individual with joy as its only required outcome. Collaboration is not a requirement (p. 76). What I like about it is he still allows room for individual natures, motivations, and outcomes. There is community, participation, and sharing, but there is still individual work or purpose. Collaboration or co-operation often occur and there are subsequent benefits, but they are not the ideal or end goal.

There is a tendency to vaunt collaboration as an ideal and seek it out as an indicator of success, perhaps because interdisciplinary projects are lauded and funded. But, when I look back at my time in Studio307, that is not how students worked. At the start of this chapter, I asked what collegiality looked like in Studio307. Here, we saw that while students were eager to help and work with one another, most projects were still independent. Individuals had individual motivations and goals. Knowledge was still shared and students still supported and respected one another, but organized collaboration was rare and that is okay.

In the next and final chapter, I offer my conclusions in the form of recommendations based on these findings.

Chapter 10
Conclusions and Recommendations

In this conclusion, I will walk back through my findings not just to reiterate them, but also to respond to them. The objective of this work was to understand why students came to Studio307, their experiences once in the space, and, finally, ask how these understandings can inform the ongoing development of Studio307 and other spaces like it. This chapter is intended to address that last objective. However, because no two makerspaces are alike (Moorefield-Lang, 2015) and my aim was to describe Studio307's community and my understanding of students' experiences in that particular social situation, my subsequent recommendations may not be applicable in all cases. If you, the reader, are a practitioner designing or administering a space like this or a student participating in one, and do not see your own experiences reflected here, I encourage you to respond and to add your stories to this work and others like it in the field.

For structure, this chapter is divided into five sections based on the five major themes in this work – By Invitation Only (Chapter 5), Technical Anxiety (Chapter 6), Needing Context to Imagine (Chapter 7), Peripheral to the Institution (Chapter 8), and the Collegiality of it All (Chapter 9). Each section includes a summary of the findings and, if applicable, the positive and negative consequences of those. This is followed by succinct recommendations meant to embrace or address those findings.

10.1 By Invitation Only

In Chapter 5 – By Invitation Only, I explored the role personal relationships played in not only encouraging students to visit Studio307, but also the depth of their subsequent involvement. Despite a website, posters, or inclusion in the weekly

Faculty newsletter, it was often the personal invitation that first brought students into Studio307. If students were not invited, their first introduction to the space was typically a workshop or an event. Drop-ins were rare. I also found that the depth of students' involvement in the space was also dependent on personal relationships because we failed to organize membership or make that process transparent. The consequences of this were that we had unofficial tiers of members (for example, those with keyfob access and those without, or those who felt comfortable using the room as a personal workspace and those who only came for structured events) and no clear path between the two.

Recommendations:

1. **Personally invite students to the space.** Almost everyone I spoke to first came to Studio307 because they visited on an orientation tour, we spoke to their class, or they were told about it by a friend or professor. Passive invitations like a website, posters, or social media are, of course, crucial, but the personal invitation is a powerful catalyst for involvement. Often, administrators wonder how they can increase representation from various student groups, and the question back should be – have you invited them? In short, invitations and deliberate inclusions matter.
2. **If membership is structured, make that structure known.** The membership structure of Studio307, where some students had keyfob access and others did not, was not deliberate or widely understood. It developed on its own out of necessity and was ad-hoc and unorganized. The consequence of this was a club-like atmosphere. If invitations and inclusions matter, so do memberships structures. Make clear: the requirements for entry, how participants can get more involved once in the space, and the paths for doing so.

10.2 Technical Anxiety

In Chapter 6 – Technical Anxiety, I discussed one reason or motivation for why students visited Studio307. That is, an eager, but tense desire to increase their technical capacity. I argued this was also related to why they enrolled in their program and that the consequences felt in the space were both positive and negative. Anxiety served as both a motivator and a barrier. For example, students cited wanting to learn a particular technology as their reason for coming, while others explained how anxiety or fear was why they never tried a particular tool. I also concluded that technical anxiety may have served as a barrier for some students, keeping them from Studio307 all together.

Recommendations:

3. **Recognize technical anxiety as a motivator and provide a range of programming.** Technical anxiety drew students into the space. Our most popular types of events fell into two categories, the first were 101 or Intro sessions targeted at beginners and the second were very specific, targeted workshops covering a particular technology and one or two applications. For example, an ‘Intro to 3D Printing’ session or an ‘Accessing the Twitter API for IoT Projects’ workshop. This range allowed for multiple entry points.
4. **Recognize technical anxiety may also be a barrier and address it.** This can be done at both the tool and space levels. For example, providing introductory workshops to various tools, documentation on how to use equipment, and examples, or providing low-risk opportunities like our Halloween Costume Jam, where students can use the space and equipment in a way that allows for a diversity of interests. This can also be achieved through simple but explicit signage that all skill levels are welcome, and purposeful staff efforts to make that known at workshops and tours.

10.3 Needing Context to Imagine

In Chapter 7 – Needing Context to Imagine, I explored the role inspiration plays in how students used the space and how they appreciated structured inspiration, but also still wanted autonomy and freedom to explore. Often, tools that were not included in examples went untouched and it was typically structured workshops that served as the most powerful catalyst for use. However, autonomy was also valued because it allowed for space to try new things and avoid embarrassment.

Recommendations:

5. **Offer both open lab times and structured activities.** In Burke's work on making makerspaces work in academic libraries (2015), he identifies providing both "group training on specific creative activities" and "offering open lab times" as way to encourage students and support different types of learning. He also indicates this can sometimes be difficult in an academic setting where learning is often sequestered in semesters and tied to curricula. At Studio307, we tried to strike a balance by offering open hours and regular, structured events (workshops, clubs, and talks) tied to curricula and personal interests.
6. **Let students be alone in the space.** Time alone allows for exploration and risk-taking that often leads to ownership of the space and greater capacity. If security is a concern, this can be done by an organized lock and key access outside of regular hours. At Studio307, students working on projects were offered key-fob access in an ad-hoc manner and, as we saw, this caused confusion, but at the Invention Studio at Georgia Tech, students earn 24-hr access through an organized volunteer hours system. However, the volunteer model requires administration, oversight, and astutely navigating the unpaid labour landscape.

10.4 Peripheral to the Institution

In Chapter 8 – Peripheral to the Institution, I found students viewed the space as peripheral to the institution and explored the subsequent confusion over whether it was co- or extra-curricular, or both. In failing to formally define the space, we suffered consequences such as confusion or hesitation around how or if the space, or the equipment within it, could be used. Compounding this, we inadvertently privileged the co-curricular.

Recommendations:

7. **Define how the space can be used.** This exercise of defining how the space can be used is useful not just for participating students, but also administrators. Vocalizing that definition can help avoid privileging one use over the other. While I, and Studio307, did not excel in this area, some things that could be done are simple signs saying "personal projects are welcome" (assuming this is true), and including this information in orientation tours and documentation.
8. **Adhere to that definition.** If your space is open for both co- and extra-curricular projects, demonstrate that in your programming, outreach, and how you exhibit or celebrate student work in the space. For example, at Studio307, we offered events like the Costume Jam (extra-curricular) alongside Python workshops (co-curricular). Or, when celebrating student work, we showcased personal interest projects (e.g. posting Mel's 3D-printed black cat phone stand on our Twitter feed) alongside an exhibit of student projects from the Faculty's Critical Making class.

10.5 The Collegiality of it All

In Chapter 9 – The Collegiality of it All, I discussed how collegiality in Studio307 manifested as parallel play rather than the rarer organized collaboration. At its most

visible moments, collegiality took the form of chain-style learning where students would pass skills down the line as they each encountered and overcome similar challenges. This was especially true during workshops and club days where participants had a range of experience levels and staff were often unavailable to provide one-on-one support.

Recommendations:

9. **Allow time for discussion and down-time.** When planning a workshop, try to weave in time for discussion and down-time. It is in these moments that collegiality and discovery flourish. In previous work, I recommended makerspace administrators and staff reduce structure in workshops, when possible, and make room for playfulness and collegiality (Whyte, 2016). This recommendation was based on the finding that while catalytic moments were often born out of initially structured interactions, it was the downtime or collegial moments that often led to deeper discovery. For example, at Studio307, our most effective workshops were often those that provided time and space for those moments.
10. **Encourage collegiality by leading by example.** When staff members or peer supporters actively show interest in the work of others, ask for help themselves, or allow participants to support or teach others (e.g. answer questions or help a peer), it creates an atmosphere of collegiality. This behavior can often set off chain-style learning by putting students at ease, and letting them know it's okay to ask for or provide support and show interest in the work of others.

10.6 Conclusion

When I worked in community radio, I was fascinated by why and how people participated, what brought them to join, work, and stay. With this work, I wanted to apply that question to libraries, specifically makerspaces in libraries, and the people

who bring those spaces to life. I felt that makerspaces provided a site similar to community radio, one that included creativity, production, and participation.

However, in this work, I did not give universal answers for my research questions and this highlights the point I learned from my research, an overarching theme, that not only are makerspaces unique, but so are the people that enliven them. Their motivations, perceptions, and outcomes are diverse and that diversity should be fostered in how this space and others like it are operated. In other words, provide for different learning needs (e.g. open hours and structured workshops), provide for different expectations (e.g. co- and extra-curricular, or beginner and advanced), and provide for different personalities (e.g. personal invitations and more documented or formalized systems for inclusion). And while I declared I would not be explaining maker culture or makerspaces as a whole, perhaps this is my universal statement – these spaces are diverse, the people within them are diverse, the communities they serve are diverse, and that uniqueness should be considered when both operating and studying a makerspace. These are local spaces with local communities and while others may learn from my work and the work of others, the uniqueness of each space must always be considered.

As makerspaces shift further into the realm of library and museum services, I hope that stories and descriptions (like the ones provided here) and my encouragement to consider the uniqueness of each individual space and community, will prove valuable for future work in this field.

References

"anxiety, n." OED Online. (2017, March). Retrieved from Oxford University Press.

Altman, M., Bernhardt, M., Horowitz, L., Lu, W., & Shapiro, R. (2015). *SPEC Kit 348: Rapid Fabrication/Makerspace Services.* Association of Research Libraries.

Anderson, C. (2012). *Makers: The new industrial revolution.* New York: Crown.

Balas, J. (2012). Do makerspaces add value to libraries. *Computers in Libraries, 32*(9), 33.

Barniskis, S. C. (2014). STEAM: Science and art meet in rural library makerspaces (poster). *iConference Proceedings*. doi:10.9776/14158

Barniskis, S. C. (2015). Metaphors of privilege: Public library makerspace rhetoric. *iConference Proceedings, 19*, pp. 3-10. Retrieved from http://hdl.handle.net/2142/73726

Bates, M. (2005). An introduction to metatheories, theories, and models. In K. E. Fisher, *Theories of Information Behavior* (Vol. 11, pp. 1-24). Medford, NJ: Information Today.

Benjes-Small, C., McGlynn Bellamy, L., Resor-Whicker, J., & Vassady, L. (2017). Makerspace or waste of space: Charting a course for successful academic library makerspaces. *ACRL*, (pp. 428-436). Baltimore, MD.

Blacklock, J., & Claussen, S. (2016). Design, creation and assessment of innovation spaces. *American Society for Engineering Education*, (p. Paper ID: 16185). New Orleans, LA.

Blumer, H. (1954). What is wrong with social theory? *American sociological review, 19*(1), 3-10.

Bosqué, C. (2016, 01 27). La fabrication numérique personnelle, pratiques et discours d'un design diffus : enquête au coeur des FabLabs, hackerspaces et makerspaces de 2012 à 2015 [Thesis]. Rennes: École doctorale Arts, lettres, langues Université Rennes. Retrieved from http://www.theses.fr/2016REN20009

Britton, L. (2012). A fabulous laboratory: The makerspace at Fayetteville Free Library. *Public Libraries, 51*(4), 30-33.

Buechley, L. (2013). *Thinking About Making - Keynote at FabLearn.* Retrieved March 23, 2016, from http://edstream.stanford.edu/Video/Play/883b61dd951d4d3f90abeec65eead2911d

Burke, J. (2014). *Makerspaces: A Practical Guide for Librarians.* Plymouth, UK: Rowman & Littlefield.

Burke, J. (2015). Making sense: Can makerspaces work in academic libraries? *Association of College and Research Libraries (ACRL).* Retrieved from http://hdl.handle.net/2374.MIA/5212

Burke, J. J. (2014). *Makerspaces: A Practical Guide for Librarians.* Lanham: Rowman & Littlefield.

Chavez, C. (2008). Conceptualizing from the inside: Advantages, complications, and demands on insider positionality. *The Qualitative Report, 13*(3), 474-494.

Colegrove, P. (2013). Editorial board thoughts: Libraries as makerspace? *Information Technology and Libraries, 32*(1). doi:10.6017/ital.v32i1.3793

Collier, J. J., & Collier, M. (1986). The cultural inventory. In *Visual anthropology: Photography as a research method (Rev. ed.)* (pp. 45-64). Albuquerque: University of New Mexico Press.

Curran, K. (2012). Hacking in libraries...and 3D printers. *Multimedia Information & Technology, 38*(1), 35.

Davies, B. (2005). Communities of practice: Legitimacy not choice. *Journal of Sociolinguistics, 9*(4), 557-581. doi:10.1111/j.1360-6441.2005.00306.x

Davies, B. (2005). Communities of practice: Legitimacy not choice. *Journal of Sociolinguistics, 9*, 557-581. doi:10.1111/j.1360-6441.2005.00306.x

De Leon, J., & Cohen, J. (2005). Object and walking probes in ethnographic interviewing. *Field Methods, 17*(2), 200-204.

Delaney, M. (2015, Winter). Making makerspaces work on campus. *EdTech*. Retrieved 2017, from http://www.edtechmagazine.com/higher/article/2015/02/making-makerspaces-work-campus

Delson, N., & Dewald, J. (2016). EnVision interns: The power of volunteer student teams for a maker space on a large campus. *International Symposium on Academic Makerspaces proceedings*, (pp. 112-117). Cambridge, Mass.

Dougherty, D. (2012). The maker movement. *innovations, 7*(3), 11-14.

Dougherty, D. (2013). *Introductory letter in Deloitte Center for the Edge and Maker Media, Inc.'s Impact of the Maker Movement.* Retrieved March 12, 2016, from Maker Media: http://makermedia.com/wp-content/uploads/2014/10/impact-of-the-maker-movement.pdf

Egbert, M. (2016). *Creating makers: How to start a learning revolution at your library.* Santa Barbara, CA: Libraries Unlimited.

Emerson, R., Fretz, R., & Shaw, L. (2011). *Writing Ethnographic Fieldnotes (2nd ed.).* Chicago: University of Chicago Press.

Feldman, M., Bell, J., & Berger, M. (2003). *Gaining access: A practical and theoretical guide for qualitative researchers.* California: AltaMira Press.

Ferguson, J. (2017, Mar 08). *School of Information Creates Makerspace.* Retrieved from University of Texas at Austin School of Information: https://www.ischool.utexas.edu/news/school-information-creates-makerspace

FIMS, Western University. (2015). *New Academic Building Update*. Retrieved from http://www.fims.uwo.ca/news/2015/new_academic_building_update.html

Forest, C. R., Moore, R., Jariwala, A., Burks Fasse, B., Linsey, J., Newstetter, W., . . . Quintero, C. (2014). The Invention Studio: A university maker space. *Advances in Engineering*

Education, 4(2), 1-32. Retrieved March 30, 2016, from http://inventionstudio.gatech.edu/?media_dl=560

Foster, N., & Gibbons, S. (2007). *Studying Students: The Undergraduate Research Project at the University of Rochester*. Chicago: Association of College and Research Libraries. Retrieved from http://www.ala.org/acrl/sites/ala.org.acrl/files/content/publications/booksanddigitalresources/digital/Foster-Gibbons_cmpd.pdf

Fourie, I., & Meyer, A. (2015). What to make of makerspaces: Tools and DIY only or is there an interconnected information resources space? *Library Hi Tech, 33*(4), 519-525. doi:10.1108/LHT-09-2015-0092

Future Students. (2017). Retrieved from Faculty of Information, University of Toronto: https://ischool.utoronto.ca/future-students/

Gauntlett, D. (2011). *Making is Connecting: The social meaning of creativity, from DIY and knitting to YouTube and Web 2.0.* Cambridge, UK: Polity Press.

Glaser, B., & Strauss, A. (1967). *The Discovery of Grounded Theory: Strategies for qualitative research.* Aldine Publishing Comp.

Goffman, E. (1959). *The Presentation of Self in Everyday Life.* Garden City, NY: Doubleday.

Goffman, E. (1967). *Interaction Ritual: Essays on face-to-face behavior*. Garden City, NY: Doubleday.

Gold, R. L. (1958, March). Roles in sociological field observations. *Social Forces, 36*(3), 217-223. Retrieved from http://www.jstor.org/stable/2573808

Gonzalez, S. R., & Bennet, D. B. (2016). *3D printing : a practical guide for librarians.* Lanham: Rowman & Littlefield.

Good, T. (2013). Three makerspace models that work. *American Libraries, 44*(1), 45-47.

Grenzfurthner, J., & Schneider, F. (2009). Hacking the spaces. *monochrom*. Retrieved from http://www.monochrom.at/hacking-the-spaces/

Halverson, E. R., & Sheridan, K. (2014). The maker movement in education. *Harvard Educational Review, 84*(4), 495-504. doi:10.17763/haer.84.4.34j1g68140382063

Hammersley, M., & Atkinson, P. (2007). The process of analysis. In *Ethnography, principles in practice* (pp. 158-190). London, UK: Routledge.

Harper, D. (2002). Talking about pictures: A case for photo elicitation. *Visual Studies, 17*(1), 13-26.

Hartmann, B. (2016). A research agenda for academic makerspaces. *International Symposium on Academic Makerspaces proceedings*, (pp. 32-35). Cambridge, Mass.

Hatch, M. (2014). *The Maker Movement Manifesto: Rules for Innovation in the New World of Crafters, Hackers, and Tinkerers.* McGraw-Hill.

ISAM. (2016). ISAM 2016 Proceedings. *International Symposium on Academic Makerspaces proceedings.* Cambridge, Mass.

Koh, K., & Abbas, J. (2016). Competencies needed to provide teen library services of the future: Survey of professionals in Learning Labs and Makerspaces. *Journal of Research on Libraries and Young Adults., 7*(2).

Kondo, D. (1990). *Crafting Selves: Power, gender, and discourses of identity in a Japanese workplace.* Chicago: University of Chicago Press.

Kostakis, V., Niaros, V., & Giotitsas, C. (2014). Production and governance in hackerspaces: A manifestation of commons-based peer production in the physical realm? *International Journal of Cultural Studies, 18*(5), 555-573. doi:10.1177/1367877913519310

Kurti, R. S., Kurti, D., & Fleming, L. (2014). The philosophy of educational makerspaces part 1 of making an educational makerspace. *Teacher Librarian, 41*(5).

Kyungwon, K., & Abbas, J. (2015). Competencies for information professionals in learning labs and makerspaces. *Journal of Education for Library and Information Science, 56*(2), 114-129. doi: 10.12783/issn.2328-2967/56/2/3

Lave, J., & Wenger, E. (1991). *Situated Learning: legitimate peripheral participation.* New York: Cambridge University Press.

Linsey, J., Forest, C., Nagel, R., Newstetter, W., Talley, K., & Smith, S. (2016). Understanding the impact in university makerspaces. *International Symposium on Academic Makerspaces proceedings*, (pp. 188-191). Cambridge, Mass.

Lofland, L., & Lofland, J. (2006). *Analyzing social settings.* Belmont, CA: Wadsworth Publishing Company.

Martinez, S., & Stager, G. S. (2013). *Invent To Learn: Making, Tinkering, and Engineering in the Classroom.* Torrance, CA: Constructing Modern Knowledge Press.

Massey, D. (1994). *Space, Place and Gender.* Minneapolis: University of Minnesota Press.

Massey, D. (1999). Space-time, 'science' and the relationship between physical geography and human geography. *Transactions, 24*(3), 261-276. doi:10.1111/j.0020-2754.1999.00261.x

Massey, D. (2013). Social Science Bites: Doreen Massey on Space. Retrieved from http://www.socialsciencespace.com/2013/02/podcastdoreen-massey-on-space/

Massis, B. (2013). 3D printing and the library. *New Library World, 114*(7-8), 351-354.

Maxigas. (2013). Hacklabs and hackerspaces - tracing two genealogies. *Journal of Peer Production*(2).

Merriam, S. A., Johnson-Bailey, J., Lee, M.-Y., Kee, Y., Ntseane, G., & Muhamad, M. (2001). Power and positionality: Negotiating insider/outsider status within and across cultures. *International Journal of Lifelong Education, 20*(5), 405-416.

Moorefield-Lang, H. (2015). Change in the making: Makerspaces and the ever-changing landscape of libraries. *TechTrends, 59*(3), 107-112. doi:http://dx.doi.org/10.1007/s11528-015-0860-z

Morocz, R., Levy, B., Forest, C., Nagel, R., Newstetter, W., Talley, K., & Linsey, J. (2016). Relating student participation in university maker spaces to their engineering design self-efficacy. *American Society for Engineering Education*, (p. Paper ID: 16125). New Orleans, LA.

Noel, A., Murphy, L., & Jariwala, A. S. (2016). Sustaining a diverse and inclusive culture in a student run makerspace. *Proceedings of the International Symposium on Academic Makerspaces conference.* Cambridge, Mass. Retrieved from https://project-manus.mit.edu/home/conference

OLA. (2017, May). *Super Conference Archives (Subject: Maker)*. Retrieved from http://www.olasuperconference.ca/subject/maker/

Parten, M. (1932). Social participation among preschool children. *Journal of Abnormal and Social Psychology, 27*(3), 243-269. doi:10.1037/h0074524

Penney, M., Watkins, J., Levy, B., Linsey, J., Nagel, R., Newstetter, W., . . . Smith, S. (2016). 'Making' an impact: An ethnographic approach to university maker spaces. *American Society for Engineering Education Conference and Exposition proceedings.* New Orleans, LA: ASEE.

Plemmons, A. (2014). Building a culture of creation. *Teacher Librarian, 41*(5), 12-16.

Pryor, S. (2014). Implementing a 3D printing service in an academic library. *Journal of Library Administration, 54*(1), 1-10. doi:10.1080/01930826.2014.893110

Radniecki, T., & Klenke, C. (2017). Academic library makerspaces: Supporting new literacies and skills. *ACRL*, (pp. 15-22). Baltimore, MD.

Ratto, M. (2013). *Critical Making: Closing Keynote at CANHEIT 2013.* Retrieved 03 13, 2016, from YouTube: https://www.youtube.com/watch?v=t804VvWfq60

Reimer, J. (1977). Varieties of opportunistic research. *Journal of Contemporary Ethnography, 5*(4), 467-477. doi:10.1177/089124167700500405

Riemer, J. W. (1977). Varieties of opportunistic research. *Journal of Contemporary Ethnography, 5*(4), 467-.

Rogers, A. (2016). Relating student participation in university maker spaces to their engineering design self-efficacy. *International Symposium on Academic Makerspaces proceedings*, (p. 124). Cambridge, Mass.

Ryan, G., & Bernard, H. (2003). Techniques to identify themes. *Field Methods, 15*(1), 85-109. doi:10.1177/1525822X02239569

Sivek, S. C. (2011). "We need a showing of all hands": Technological utopianism in MAKE Magazine. *Journal of Communication Inquiry, 35*(3), 187-209. doi:10.1177/0196859911410317

Slatter, D., & Howard, Z. (2013). A place to make, hack, and learn: makerspaces in Australian public libraries. *The Australian Library Journal, 62*(4), 272-284. doi:10.1080/00049670.2013.853335

Spradley, J. (1979). *The ethnographic interview.* New York: Holt, Rinehart and Winston.

Spradley, J. (1980). *Participant Observation.* New York.

Stanley, L., & Wise, S. (1993). *Breaking out again: Feminist ontology and epistemology (2nd rev. ed.).* New York: Routledge.

Stebbins, R. (2001). *Exploratory research in the social sciences.* Thousand Oaks, CA: Sage.

Taylor, J. (2011). The intimate insider: Negotiating the ethics of friendship when doing insider research. *Qualitative Research, 11*(1), 3-22.

Toombs, A. L., Bardzell, S., & Bardzell, J. (2014, 10). Becoming makers: Hackerspace member habits, values, and identities. *Journal of Peer Production, 5*.

Toombs, A. L., Bardzell, S., & Bardzell, J. (2015). The proper care and feeding of hackerspaces: Care ethics and cultures of making. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (pp. 629-638). Seoul, Republic of Korea: ACM.

Van Holm, E. J. (2014). *What are makerspaces, hackerspaces, and fab labs?* doi:10.2139/ssrn.2548211

Wang, F., Wang, W., Wilson, S., & Ahmed, N. (2016). The state of library makerspaces. *International Journal of Librarianship, 1*(1), 2-16.

Watters, A. (2013, Feb 06). *The Case for a Campus Makerspace.* Retrieved Feb 2017, from Hack Education: http://hackeducation.com/2013/02/06/the-case-for-a-campus-makerspace

Wenger, E. (1999). *Communities of Practice: Learning, meaning, and identity.* Cambridge: Cambridge University Press.

Wenger, E., McDermott, R., & Snyder, W. (2002). *Cultivating Communities of Practice: A guide to managing knowledge.* Boston, Mass.: Harvard Business School Press.

Whyte, J. (2016). *About 307*. Retrieved May 18, 2017, from Semaphore Studio307: http://studio307.github.io/consultation.html

Whyte, J. (2016). Makerspaces in libraries: play, discovery and collegiality. *The iJournal: Graduate Student Journal of the Faculty of Information, 2*(1). Retrieved from http://theijournal.ca/index.php/ijournal/article/view/27535

Wilczynski, V. (2015). Academic maker spaces and engineering design. *American Society for Engineering Education (ASEE) Annual Conference.* Seattle, WA. doi:10.18260/p.23477

Willlett, R. (2016). Making, makers, and makerspaces: A discourse analysis of professional journal articles and blog posts about makerspaces in public libraries. *The Library Quarterly, 86*(3), 313-329. doi:10.1086/686676

Wong, A., & Partridge, H. (2016). Making as learning: Makerspaces in universities. *Australian Academic & Research Libraries, 47*(3), 143-159. doi:10.1080/00048623.2016.1228163