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# How Do Makerspaces Communicate Who Belongs?

# Examining Gender Inclusion through the Analysis of User Journey Maps in a Makerspace

Marijel Melo
University of North Carolina
Chapel Hill

The tension between cultivating inclusive library makerspaces and the gender biases rooted in the spatial configurations of makerspaces are examined in this article. This case study outlines a pilot study that investigated the relationship between gender identity and the decisions that study participants made regarding how and why they navigated a library makerspace in a certain way. Specifically, the guiding research question asked: "How does gender identity potentially impact the creation processes and behaviors of students in tech-centric environments such as makerspaces?" The study yielded three preliminary findings: men-identified users were more mobile in the makerspace than women-identified users; conventional makerspace technologies were readily coded as being either associated with men or women; participants pointed to gender identity as a factor informing their decisioning during their collaborative making experience.

## Introduction

Documenting and examining the journey maps of users within a library makerspace can offer critical vantage points for investigating the persistent underrepresentation of diverse communities within makerspaces. While conventional maps illustrate the layout of a library, they do very little in terms of predicting how users will navigate a space. For example, the spatial map of a library makerspace could indicate where and how the technologies are arranged in that environment, but it cannot fully forecast how users will experience that space. The journey maps that users create unwittingly within a makerspace can communicate "a user's experience of a product, service, or process from beginning to end, by comparing an expected journey to the actual journey experienced by the user" (McKelvey & Frank, 2018). An examination of user journey maps can further reveal the culturally situatedness of makerspaces: makerspaces do not exist outside of an ideological vacuum, but are comprised of socio-political beliefs, assumptions, and values. Journey maps are an important feature of a spatial analysis, but alone do not holistically represent an environment—it is critical for user experience to be documented as well.

Marijel Melo is Assistant Professor, University of North Carolina Chapel Hill.

Although the physical layout of a makerspace remains relatively static, each user experiences the same makerspace differently. Users arrive with their own set of subjectivities and lived experiences that inform their decisions around how they engage (or not) within a space. In this article, the user experience is explored through the joint examination of the spatial layout of a makerspace and the journey maps created by users. This relationship will be framed and informed specifically through gender. An institutional review board (IRB) approved pilot study was conducted to capture this preliminary data on the way that users interacted with select variables of a library makerspace: the people, technologies, and with the environment at large. The study had two parts including the observations of the making processes of 29 students within a library makerspace and a post-observation survey. The analysis of the preliminary data centers on the foundational argument emerging from the data analysis from the study: the desire for inclusive makerspaces does not to drive material changes in these environments; to cultivate more diverse and inclusive makerspaces, equitable and affective interventions need to occur on a systemic level.

### *Background*

Making is an inherent part of the human experience since time immemorial; however, since the mid-2000s a specific niche of making became popularized through the emergence of the social phenomenon, the maker movement. While making could be defined in various ways, the maker

movement has re-defined making around the use of STEM-rich technologies and approaches (Calabrese Barton & Tan, 2018). The impetus of the maker movement is often attributed to the publication of Maker Media's *Make:* (Why did Maker Faire start?, 2019). The magazine is described as "[T]he leading voice in the maker movement, *Make:* publishes projects, skill-building tutorials, in-depth reviews and inspirational stories, accessible by all ages and skill ranges" (*Make:,* 2019). In this sense, the maker movement did not invent making, but instead *branded* it.

The maker movement spurred palpable enthusiasm across the world. This excitement manifested in maker-centric events such as make-a-thons, *A Week of Making* under the Obama administration, and most notably through the global integration of makerspaces within communities and universities (Turner, 2018). Makerspaces continue to grow in popularity. At the beginning of 2019, data was collected on U.S. state colleges and universities (784 institutions total) to determine whether that institution had at least one makerspace. It was reported that 41% of state universities and colleges have (or plan to have) one or multiple makerspaces (Melo & Rabkin, 2019). The criteria used to identify a makerspace is as follows: the primary audience is ta university community (students, staff, faculty, and/or immediate local community); the makerspace is interdisciplinary; the users can use the tools equipment directly; and the technologies embody the conventional makerspace configuration (i.e. the space directly embodies *Make:*'s brand of making). While makerspaces do exhibit variation in spatial configurations and offerings, they often achieve their legibility as a maker movement-branded makerspace through the collection and arrangement of specific technologies within an environment.

A makerspace achieves its branded signification through the configuration of technologies and tools popularized by *Make:*. Maker Ed. released a report on the top 21 tools and materials in a makerspace. The list included familiar makerspace staples including 3D printers (40% reported), laser cutters (26% reported), circuitry tool kits (18% reported), and general hand tools (12% reported) (Peppler, Maltese, Keune, Change, & Regalia, 2016). These technologies become physical signifiers that extends an environment's "makerspace" legibility, while also inadvertently purporting a set of beliefs, values, and assumptions around who can make, why making occurs, and what counts as making within a makerspace (Melo, 2019). These perceptions of making are "baked into" the architecture of the makerspace and are often in odds with the diverse communities that makerspace leaders strive to attract. This contention is further elucidated when looking at the average profile of a self-identified maker for *Make:*'s flagship event, Maker Faire.

In 2015, Maker Faire conducted an attendee survey at their World Maker Faire in New York. The average attendee profile is as follows: male, homeowners, married with children, with a median age of 42. More so, participants were on average more affluent and well educated: 96% of participants have attended or graduated with college and have a median household income of $124,500 ("Attendee Study," 2015). Another interesting data point is that attendees noted "entertainment" as being the top reason why they engage with the maker movement and faire ("Attendee Study," 2015). The profile of the average maker faire attendee (and by extension the average maker) is at odds with the diverse communities the maker movement seeks to attract. This is one of the challenges that confronts the potential for meaningful community development within makerspaces. Makerspaces are both physically and ideologically are at odds with serving racially, economically, and gender diverse communities.

The spatial map of a makerspace supports the workflow of the typical maker as identified through *Make:,* a technological savvy, male-identified user with significant financial resources and time. Specifically, Susan Faulkner explores this gender disparity in makerspaces in her article "Women Who Make: Undercounted as Makers and Underwhelmed by Makerspaces" by stating: "Women are undercounted because of the type of making they do, and many of them avoid collaborative learning spaces, the community-operated workspaces that tend to be dominated by men." She further supports her argument by noting a study that was conducted by *Make:* magazine that revealed that the Maker community was 81% male. The gender gap that Faulkner and others have identified served as an impetus for this pilot study.

## Methods

For this case study, I captured the extent to which specific technologies encouraged or welcomed the movement of women-identified participants in an academic library makerspace. The pilot study advanced this research question: "How does gender identity potentially impact the creation processes and behaviors of students in tech-centric environments such as a makerspace?" The study had two main components: the observations of students' collaborative making in the library makerspace and a post-observation survey reflection. I designed three observation student groupings that included groups of all self-identified men, all self-identified women, and with both men and women. I observed three groupings within each category; a total of nine observations were conducted. During the observation, participants (undergraduate and graduate students) were asked to collaboratively create an object. In this section, I outline the approaches and methods used

during the study and offer an analysis of the study's findings.

## *Call for Participants: The Pre-Observation Survey*

I used a couple of approaches to recruit participants for the pilot study. I sent out a Google Form to the Writing Program, Journalism, School of Information, and the College of Humanities to solicit participation for the study; students indicated their interest by filling out the Google Form entitled "Participant Registration for Study on Making: Pre-observation Form." The form contained the following questions:

| **Table 1.** |
|---|
| **Participant Registration for Study on Making: Pre-observation Form** |
| • Name<br>• E-mail address<br>• Academic year<br>• Major<br>• Current gender identity<br>• Have you visited, worked in, or participated in a collaborative learning space before?<br>• If you answered "Yes" to the previous question, please respond: Describe what you did in the makerspace (i.e., the projects you worked on, the tech you used, etc.)<br>• Please check which observation dates/times you're available[3] |

The responses to the questions guided the scheduling process for the observations. Once I received the completed forms, I grouped participants according to availability and gender identity. The second method I used to solicit participation was visiting classrooms, with the instructor's permission, to personally ask students to join the study. In this scenario, I distributed hard copies of the registration form to the students to complete. To help further incentivize students, I informed them that each participant would receive a $15.00 *Visa* Gift Card for their participation. Notably, some students were more interested in signing up for the study once they found out that their professor would give them extra credit.

## *Participants*

After sending out numerous email invitations and after conducting several class visits, I invited 65+ undergraduate and graduate students to participate in the study. In total, 29 students joined. A participant's gender identity informed the way I organized the observation groups; a relatively small number of interested participants identified as men, which made it tricky to arrange participants with similar gender identities in equal sized groupings. In terms of gender identity, 21 of the 29 participants identified as women, while the remaining 8 participants identified as men. The following chart offers more detail about the participants including major, their academic year, and whether they had been to a makerspace prior to the study.

| **Table 2.** | |
|---|---|
| **Participant Demographics** | |
| Majors represented | ● Studio Arts<br>● Illustration<br>● Biology<br>● Computer Science<br>● Chemistry<br>● Communication<br>● French<br>● Finance<br>● Photography<br>● Material Sciences and Engineering<br>● Mechanical Engineering<br>● Music Education<br>● Neuroscience<br>● Cognitive Science<br>● Molecular and Cellular Biology<br>● Optical Sciences<br>● Rhetoric, Composition, and the Teaching of English<br>● Nursing<br>● Physiology<br>● Public Policy and Management<br>● Teaching, Learning, and Socio-cultural Studies<br>● Biochemistry<br>● Undecided |
| Academic year | ● Freshman - 20 participants<br>● Sophomore - 0<br>● Junior - 1<br>● Senior -3<br>● Graduate - 5 |
| Have you been to a makerspace? | ● Yes - 7<br>● No - 21<br>● Unsure - 1 |

There were a couple of unique features distinguishing the participant pool. Overall, the group dynamics of the collaborations were overwhelmingly collegial. This was the case because so many students signed up to do their observations on the same dates as their class colleagues. Moreover, another unique feature relating to the participant pool is that seven participants were comprised of student

workers and regulars (users who visited the makerspace at least twice a week over the course of a 16-week semester).

## *Procedure*

Before beginning the observation, I oriented each participant group to the library makerspace. After signing acknowledgement forms, each student group was given a ten-minute tour of the makerspace. During the tour, I discussed the available technologies, tools, and equipment that participants could use during the study and informed them that I would be available for any questions during the session. Some technologies, such as the 3D printers and laser cutters, were not made available due to the time constraints of the activity; however, participants were encouraged to use failed 3D prints and laser cutter materials (e.g., acrylic, plywood, or medium density fiberboard) for their projects. I ended the tour by answering any questions participants had and by reminding the group of the post-observation survey. I observed participants engage in an ideation activity called "Half Baked."

Half Baked is a prototyping activity where students are asked to collaboratively create a made-up product/idea that was inspired by two random words. During the observations, I presented each student group with two cups. One cup had paper strips with adjectives listed on them, and in the other cup there were paper strips with nouns on them. The group chose a random slip from each cup, and from those two words emerged the product or idea they were to build out for the next 30 minutes. As soon as a group drew a product idea, I also informed them that their project was going to culminate in an informal share-out. I asked participants to take a sheet of chart paper to summarize the description and function of their product, why they thought it was innovative, and to describe their product's target audience. I also asked them to use their responses from their chart paper for their informal presentation. Once I had completed the tour, ran through the instructions, and reminded participants about the post-study survey, I started a 30-minute timer.

Over the course of 30 minutes, and as the students were collaboratively making, I was recording their interactions via web, laptop, and tablet cameras. To ensure that I captured each participant's path and interactions in the library makerspace, I rigged cameras throughout the makerspace to achieve the vantage point of three perspectives. I began recording on all three cameras before the observation groups entered the room. I recorded with keen attention to specific interactions: participants' movement across the space, participants' interactions with the various technologies, and whether the latter interactions changed depending on the gender makeup of each group (e.g. all women-identified or both men and women).

Half Baked culminated with brief presentations. Participants provided some context on their projects and demonstrated of how their products worked. For example, one student group drew the two words "Intelligent Container" for their product idea. The product was comprised of five glass panels that were glued together and then fortified with brown satin ribbon. The inside of the box included a row of LEDs and light sensor (these were prefabricated circuits from a *LittleBits* kit) to illuminate the contents in the box. The group placed a dry erase marker inside of the container so that users could use it to write notes and reminders onto the glass surface. The transparency of the box represented the "intelligent" element of the product: instead of having to open a box, users can simply see the box's contents through its glass surface.


***Figure 1.*** **Completed "Half Baked" Products**

**Table 3.**

**Post-observation Survey**

| | |
|---|---|
| *Questions about the library makerspace* | |
| What did the library makerspace "feel" like? What was your first impression of the library makerspace when you walked in? | |
| To what extent does the library makerspace foster creativity and innovation? What would you add to and/or remove from the space to heighten creativity and innovation? | |
| The following is a list of library makerspace stations that are available to the campus community. Which gender identity do you feel predominantly uses each station? (Participants were asked to choose one of the following options for each station entry: Men \| Women \| Gender Nonconforming Persons \| This Station Is Used By All Gender Identities)<br>• 3D printing<br>• Virtual reality<br>• Electronic textiles<br>• Sewing<br>• Micro-computers (Arduino and Raspberry Pi)<br>• Laser cutter<br>• Computer Numerical Control (CNC) Router<br>• Pegboard with tools (e.g. hammers, screwdrivers, pliers)<br>• Craft supplies (e.g. pom poms, popsicle sticks, glitter, rubber bands) | |
| *Questions about the group project* | |
| 4. | What materials/equipment did you use? Why did you choose those materials? |
| 5. | If you worked with someone on your project, why did you choose to work with them? |
| 6. | What was your individual contribution to the group project? |
| 7. | How well did your group do? Successes? Areas for improvement? |
| 8. | Describe the making experience if it were to be overwhelmingly attended/inhabited by one gender in particular. (*e.g.* If your group had men and women in it, describe the experience if your group was instead all women or all men) |
| 9. | Additional comments? |

The second part of the observation, the post-observation survey, rounded out the study. Each participant was asked to complete the survey on a computer in the library makerspace and was encouraged to ask any questions they had about their experience during the survey. The survey was comprised of nine questions, not including basic demographic questions such as name, date, major, and academic year (see Table 3).

Participants who completed the survey were encouraged to reach out to me if questions about the study experience arose. I then compensated each participant by giving them their $15.00 Visa Gift Card and, when applicable, e-mailed their professor to confirm their attendance so that the student would receive extra credit. After completing all nine observations (three women-only groups, three men-only groups, and three with men and women gender groups), I began to document each participant's movement within the library makerspace.

I reviewed the paths that each of the 29 participants traversed in the library makerspace by reviewing their own unique pathways from the camera footage. To document the affective maps consistently, I designated 14 areas of the library makerspace, and denoted these areas as "touchpoints."

For example, some touchpoints included the collaborative tables, craft supplies, microcomputers, and (unused) 3D printers. On a spreadsheet, I recorded the pathways each participant took in accordance to these touchpoints. After reviewing the footage for each individual, I generated a collection of journey maps that detailed both collectively and individually the touchpoints that each participant interacted with, the time each participant spent at any given touchpoint, their walking time to and from a touchpoint, and the number of unique touchpoints they amassed. Their unique mappings captured how the technologies interanimate a participant's individual and collective experience. Each participant had two maps that were in dialogue with another: the spatial map of the library makerspace where each participant was encouraged to interact with and their journey map that they charted in the space in real-time.

## Results and Discussion

At the end of the observations, I had a journey map for each participant and a spreadsheet with the participants' survey responses to analyze. I approached my analysis with two aims: 1.) to understand the extent to which an academic library makerspace cultivates an equitable and inclusive

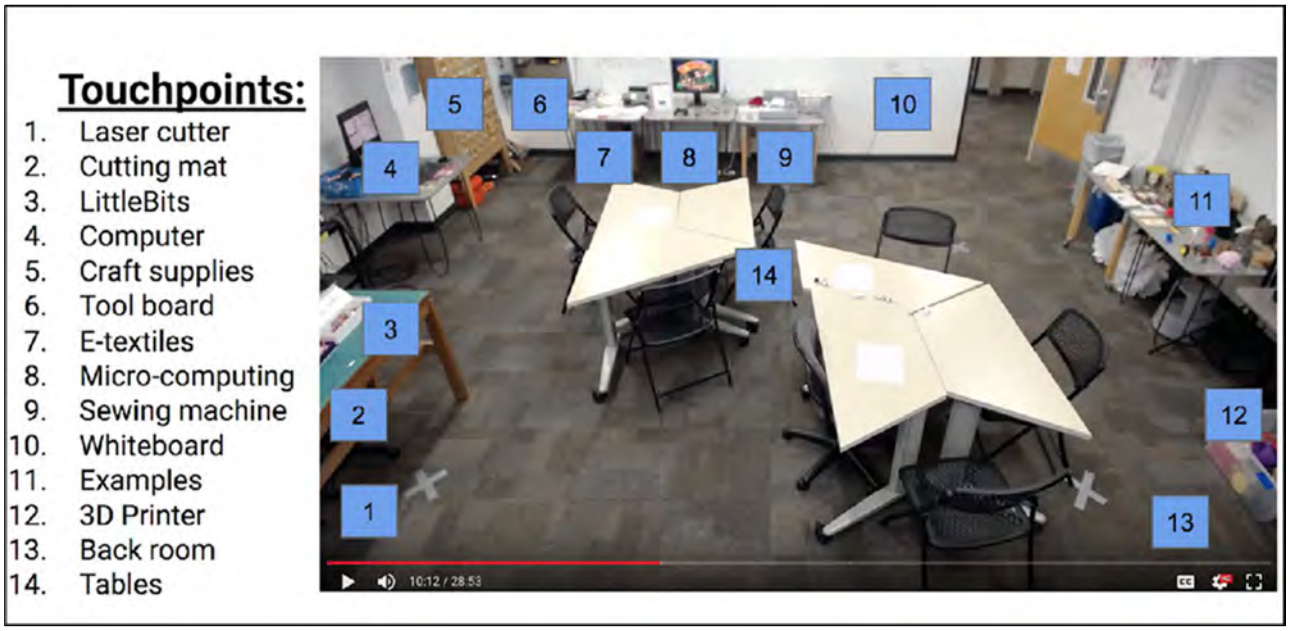


*Figure 2.* **Image of the library makerspace with the designated "Touchpoints"**

learning environment for women-identified participants, 2.) and to gain an understanding of how the participants' journey departed from and aligned with current "maker" ideologies. My preliminary findings show that the makerspace, with special attention to the technologies therein, does impact the way men and women navigate the environment.

The pilot study reinforces the understanding that makerspaces are not neutral and that the environment plays an active role in the participants' collaborative making processes. The technologies in the makerspace seemed to influence the decision making and wayfinding of participants in the library makerspace. In this section, I will outline three preliminary findings from this study: the average touchpoints of men and women in the library makerspace, the attribution of genders to technologies/stations in the library makerspace, and how gender identity informs the collaborative making processes in a makerspace.

Firstly, the average number of touchpoints each participant generated drew my attention to the level of engagement for men and women participants in the library makerspace. Data points related to the number of touchpoints and movement of the participants according to their gender identity are shown in Table 4.

While makerspaces encourage collaboration through "doing" and making with tech, it was curious to note how the pilot study's men were significantly more mobile compared to the women. The observation footage shows that among people new to the library makerspace, men were 22% more transitory than women. These data offered one perspective on engagement according to gender, but as a co-founder and researcher in the library makerspace, I recognize that many students and faculty enter collaborative learning spaces, like the library makerspace, with no previous experiences in such spaces; in this pilot study, such novices represented 72% of the participants. This is data point is important to highlight since many makerspaces will welcome first time users.

**Table 4.**

**Number of Touchpoints Based of Participants' Gender**

| *Average Touchpoints* | | | *Average Touchpoints* | |
|---|---|---|---|---|
| With staff & regulars[1] | | | **Without** staff & regulars = 5 women[2] | |
| **Men** | 18 (+22% more active) | | **Men** | 18 (+33% more active) |
| **Women** | 14 | | **Women** | 12 |

[1] This average is representative of the entire sample size for the study. There were 29 participants total.

[2] N = 5 indicates the number of makerspace staff (3) and regular users of the makerspace (2). This average is representative of the sample size when the makerspace staff and regular users are factored out of the average.

As mentioned, a handful of participants (all women-identified) worked at the library makerspace or frequented the space regularly. This group of women were highly familiar not only with the spatial layout of makerspace, but also brought with them a level of expertise and familiarity that other participants did not possess during the study. The regulars and student staff members knew how each tool functioned, how to operate the technology, and were confident in troubleshooting or fixing any problems that came up. Aware of the small population of staffers and regulars represented in the sample size, I wanted to get a sense of how touchpoint averages would be impacted if this specific group was removed from the averages. 3 Interestingly, while the men's activity stayed the same, there was a discernible difference in the women's average: the touchpoint average significantly decreased by 11%. According to that finding, men were more active/engaged in the makerspace in comparison to the women. This preliminary finding offers a compelling argument around a participant's gender identity and their familiarity with the technologies in the space. The next finding builds from this section with a focus on the post-observation survey.

The post-observation survey was a chance for participants to reflect on their experience collaboratively making in the library makerspace. Moreover, it presented me with an opportunity to capture the participants' evaluation of their experiences engaging within the makerspace configuration. The assessment provided insight regarding the affective dynamics amid the users and objects in the space. As such, the post-observation survey allowed participants to distill their making experience in a way that lends insight regarding affect and the decisions they made during the activity. Specifically, I want to highlight a finding from one of the survey questions: "Which gender identity do you associate with each station in the makerspace?"

Participants were given a list of stations, and were asked to assign a gender identity that they readily associated with each. The list of stations is as follows: 3D printing, craft supplies, electronic textiles, laser cutting, micro-computing, virtual reality, sewing, and tool board. According to participant responses, there were only three library makerspace stations that were primarily associated with women: the sewing machine, electronic textiles (embedding circuits in textiles), and craft supplies. This is a troubling preliminary finding. If bodies, spaces, and objects affectively interanimate an experience for users, what does it mean when a small percentage of technologies in the space "welcome" women-identified makers? This contention is further understood through the last finding, a post-observation survey where participants unpacked the library makerspace in relationship to gender and the technologies they used.

The technologies in the space were communicating mixed (and gendered) signals to participants; more accurately, signaling who is welcome to the makerspace. To extend the metaphor, in comparison to men, the women were receiving a weaker 'welcome' signal when considering the organization of the tech-environment and the technologies present therein. Building from the analysis on the post-observation survey responses, two participant answers will be detailed below. The two responses are representative of a pattern of responses that spoke to how gender identity informed participants' rationale for working with specific technologies over others. The first response is from a woman-identified participant who was assigned to an all-women observation group. The response theorizes the potential difference in team dynamics if her project team were to be overly attended by men:

> "Our group was all women and we had a very collaborative environment where everyone contributed equally. I think if the group were to consist of both men and women, there would have been issues with establishing leadership. I think our project would have never been built in a group of men as well, as cupcakes are viewed as stereotypically feminine objects and many men would find building a project like that emasculating. Additionally, I think if men were involved the materials used would have been significantly different. Our group used mostly craft items and hardly any tools or stereotypically 'masculine' items. I think if men were involved, the project would have not been made entirely out of craft materials and would have had other objects incorporated into it."

The second response is like the previous one, but is more explicitly self-reflective of the "gendered stuff" that took place during the creation of the team's product, "Sophisticated Protection." Unlike the first respondent, the second respondent is reflecting on her experience collaborating with a group of both men and women:

> "Hm. I was fascinated by the gendered stuff that was happening in our session. i think if more men were involved, 'sophisticated' would have been interpreted differently. aesthetics wouldn't have been valued. which is bullshit because quality design (hello, Apple! hello, successful apps & social media interfaces!) are intuitively designed. i also found myself promoting gendered notions of tech when i said 'we could use the sewing

[3] An interesting note: two women participants had one total touchpoint— they both sat at the table for the entire duration of the study.

machine, but its less techy' as we were brainstorming initially."

These two responses represented a theme of responses that pinpointed moments of contention amid gender and technology in the makerspace. Such contention does not unfold in real-time, but instead stems from past affective experiences that shape present and future engagements with technology like Flatley argues: "In an important sense, we never experience an affect for the first time; every affect contains within it an archive of previous objects" (81). Together, these two participant responses alongside the two other preliminary findings for this analysis (the gendering of technologies and the discernable movement that men had compared to women in the makerspace) offer burgeoning evidence around the tendency for makerspaces to be experienced as more welcoming to men than women. Moreover, it also adds to the larger conversation around the persistent underrepresentation of women in makerspaces. The preliminary findings reveal that simply promoting inclusive and equitable makerspaces are not enough: at its core, the makerspace is imbricated with gender biases. Affective and physical disruptions of the makerspace configuration are critical to foster collaborative learning spaces that are more equitable and diverse.

## Limitations and Next Steps

The pilot study has generated three preliminary findings that contribute to the larger conversation on gender identity, technology, and makerspaces; however, and perhaps even more importantly, the pilot study has also helped to identify some of the thresholds, gaps, and limitations in this study and other similar studies with this scope. In the next iteration of this study, where generalizable knowledge will be created, I will address the following research gaps discovered during the pilot project.

### *1) Sample Size*

While I invited the same number of men and women to participate in the study, I noticed that a significant number of men did not show up for the study, or they e-mailed me saying that they could not attend any longer. Despite efforts to recruit a comparable number of men and women, the sample size of the pilot was lopsided with 21 women and 8 men. This outcome prompted me to re-think my recruitment approaches for the next iteration of the study. Specifically, I am thinking through how I pitched and framed the study to participants, while also contemplating why women were more likely to respond and attend than men.

### *2) Survey questions*

Several participants had difficulty responding to some of the survey questions because they were afraid of appearing judgmental. For example, in response to the question "Describe the making experience if it were to be overwhelmingly attended/inhabited by one gender in particular?" (e.g., If your group had men and women in it, describe the experience if your group was instead all women or all men), one participant stated his discomfort with responding to this query:

> [Our group] liked the robot aspect and it was fairly "manly", whatever that means in today's society! If it was more feminine or created by an all-girl group it might've served a different purpose or physically looked more feminine (more colors, more decorations, etc.). It is hard to make these predictions without sounding rude, stereotypical, or judgmental.

I heard similar responses from participants as they were leaving: they did not want to respond honestly because they did not want to come off as judgmental and/or that they decided to respond to certain questions by conveying how they *wish* the collaborative learning space was constructed.

### *3) Recording Equipment Vantage Points—The Library Makerspace's Back Room*

Some key interactions were not captured during the observation because they took place in the library makerspace's back room. The back room is primarily a storage area for supplies for the makerspace, but does have a few computers and virtual reality equipment. I gave each observation group a tour of the makerspace's main room with the assumption that participants would work and use the materials solely in the main room area; however, I was surprised to find that a handful of participants (mostly library makerspace staff and regulars) ventured into the back room for supplies and other tools. One of the limitations of this study was not knowing what happened in the back room since there was not a camera in the room.

### *4) Gender Non-Conforming, Non-Binary Persons — Lack of Analysis*

In its current state, the study examines the engagement of students who currently identify as men or women. This leaves a critical gap in the research: a concerted consideration of how students with non-binary gender identities engage within the makerspace. It is critical that this demographic is accounted for, especially in this line of work that seeks to promote equitable and gender inclusive makerspaces. According to the pilot study, women were associated with only three stations in the makerspace, yet

gender non-conforming persons were only associated with two stations: sewing (1 respondent) and craft supplies (1 respondent). Moreover, the option "gender non-conforming persons" was selected significantly less than the other gender options. Table 5 shows the number of attributes each gender category on the post-observation survey received:

**Table 5.**

**"The following is a list of library makerspace stations that are available to the UA campus community. Which gender identity do you feel predominantly uses each station?"**

| *Options* | *Number of times selected by respondents* |
|---|---|
| This station is equally used by all genders | 144 |
| Men | 71 |
| Women | 43 |
| Gender non-conforming persons | 2 |

Even more bleak and unequal than the representation of women in the collaborative learning space was how non-binary persons were not only underrepresented but discernibly absent in the conceptualization of the makerspace.

## Conclusion

The socio-technical relationships formed in collaborative learning spaces emerge in part from a participant's past relationships with makerspaces and the technologies therein. Participants' experiences align or depart with prominent ideas of innovation. The participants who were most familiar with makerspaces and/or the staple technologies featured in Make, exhibited a more comfortable relationship with the technologies that they experienced in the pilot study: "We are moved by things. In being moved, we make things. An object can be affected by virtue of its own location (object might be here, which is where I experienced this or that affect) and the timing of its appearance" (Ahmed, 2004). Affectively, for these groups, the technologies signaled a sense of familiarity that emerged from the past impressions the participants had of these technologies and vice versa: "But forming an impression also depends on how objects impress upon us…. We need to remember the 'press' in impression. It allows us to associate the experience of having an emotion with the very affect of one surface upon another, an affect that leaves its mark or trace" (Ahmed, 2010). Men and women staffers and regulars had a considerable advantage in terms of navigating and engaging the makerspace. The impressions they have cultivated with technologies had equipped them with a degree of motility that other participants (predominantly women) did not exhibit.

Without an accompanying journey map to complement (and disrupt) the spatial mapping of the library makerspace, it is difficult to devise action plans for creating collaborative learning spaces that are more equitable for and inclusive of women-identified makers: "Just as the lack of a cognitive map of one's social space is crippling for effective political activity, so too is the lack of an affective map" (Flatley, 2008). While makerspaces are founded on professed values of inclusion and diversity, the preliminary findings from the study show that certain genders are afforded motility in a library makerspace, while other(ed) genders are restricted: "Spaces extend the mobility of some bodies; their freedom to move shapes the surfaces of spaces…. It is the regulation of bodies in space through the uneven distribution of fear which allows space to become territories, claimed as rights by some bodies and not others" (Ahmed, 2004). Notably, there have been concerns around equity and gender representation in makerspaces. While many scholars and advocates have called for more women in the spaces, for more technical training for women, or to fix the 'pipeline' issue, I call for a close examination of the way makerspaces are affectively and materially designed (Kanny, et al., 2014). This pilot study points to the makerspace as a site comprised of specific technologies that signals and facilitates and/or inhibits the mobility of women in the environment. The spatial mapping of a makerspace conceptualizes only a narrow illustration of making and the maker.

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