
The Maker Factory
Minneapolis, MN
Exterior Rendering
Brian Glur

Thesis Proposal

A Design Thesis Submitted to the
Department of Architecture and Landscape Architecture
of North Dakota State University

By

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In Partial Fulfillment of the Requirements
for the Degree of
Master of Architecture

Primary Thesis Advisor

Thesis Committee Chair

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Thesis Abstract

Creativity, innovation and social interaction are key elements of being human. How can architecture influence these traits and create an environment that not only inspires but allows for expression of these by means of crafting and collaboration? This thesis focuses on creating a large scale Innovation Center/Makerspace for a major university. The typology also includes social spaces, modular working and meeting spaces, multipurpose classrooms, and commons areas with a coffee shop and cafe.

"Think left and think right and think low and think high. Oh, the thinks you can think up if only you try!"

-Dr. Seuss

Creativity. It is something we are born with and it stays with us until the day our hearts stop beating. Our inspiration and means of expression of creativity changes and evolves over time. We are always learning and our sense of who we are and what interests us expands and adapts to our surroundings: it is part of being human.

As time and technology evolves, new opportunities emerge. The industrial revolution gave us new ways to produce goods at a massive scale, something that had never been possible before. The current revolution at hand is one currently known as the "Maker Movement."

"Throughout the world, individuals calling themselves "makers" learn together, educate others, and openly share their innovative ideas so that others can build on their innovations."

-www.TheMakerEffect.org

This movement is centered around the idea of "learning-through-making." These "Makers," form a community that prides itself on collaboration and exploration.

Within this movement are local entities known as "Makerspaces" or "Fab Labs." These Makerspaces are workshops that act in a similar manner as a gym membership. People pay for a membership and have access to the lab. They feature technology such as 3d printers, laser cutters, CnC mills, etc, as well as power tools and woodworking equipment. Often these spaces are non-profit.

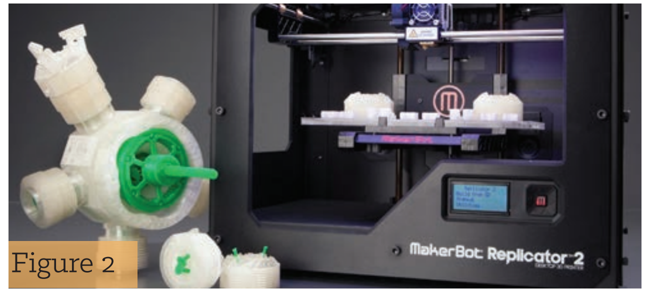


Figure 2

I became aware of this community while working on developing our department's 3d printing lab. We got involved in Fargo's emerging maker community, participating in local panels and demos, introducing the public to these Maker technologies. Many people had heard or seen them online but had never gotten to see them firsthand. These types of workshops and experiences hopefully sparked their interest.

My experiences working with these technologies at a college level is what inspired my thesis topic. In a discussion with our department's technology specialist, Ben Bernard, I realized that a large scale Makerspace in a college setting could be supported by and inspire college students while giving the university and the public a creative outlet to create and share their work. Students and faculty with experience could educate others on campus, creating it's own "Maker Community."

Figure 3

Architecture ties into this topic in several ways. On the surface these types of spaces need to be efficient, maximizing workspace while minimizing the building's footprint. These spaces also need to feel welcoming. They need to subconsciously encourage the users to channel their creativity and allow them to focus. One of my most productive spaces is my studio desk. It feels like home without being too distracting.

As architecture students we need a place to work and store our belongings, a place we can make our own. These adaptive spaces are exactly the type of concept that could be utilized in a large Makerspace. The average university student has a small apartment that lacks the extra space for working on and storing projects, making this an integral part of the design of my thesis. Another aspect of our studio space is that it is a very social environment. Everyone is there with a common purpose and is willing to help and educate each other. Upon doing research I've come to realize that the average Makerspace resembles our studios. Architecture is about creating spaces that make others feel the way we feel. I want to design a project that would make others feel the way we do when we're working in studio, with a sense of purpose, community and exploration.

Project Typology

Figure 5.1

Multi-use University Workshop

The typology of this project is a university building with a focus on being a multipurpose workshop, including a metalshop, woodshop, technology labs, social commons areas and general classrooms. The building will serve the entire campus as well as having specialized classes take place.

Figure 5.2

Similar Typology

Educational facilities, memorial union style commons, architecture studios, technology labs and IT, coffee shop, cafeteria

Thinkbox is an "Innovation Center" at Case Western Reserve University in Cleveland, Ohio. This 50,000 square foot facility designed by StudioTechne Architects is a digital fabrication and entrepreneurship center featuring seven stories of workshops, meeting/presentation spaces, manufacturing equipment, high end technology and open work space.

The $30 million project takes the existing Lincoln Storage Building and renovates it, as well as adding a modern addition and bridge connecting it to its neighboring building, the university's athletic center, via the second floor. Ground breaking is set for mid to late October and construction is expected to take between 12 and 16 months.


Figure 6.1


Figure 6.2

As a pilot project, Thinkbox opened up a temporary "Innovation" or "Makerspace" housed in an existing 4,500 space on campus. Since its opening they have attracted more than 50,000 visitors in just over 18 months. They currently have several different models of 3d printers, laser cutters, routers, and a large ShopBot that anyone in the community can access for free, as they as they are trained by one of the staff members.

The spaces are reminiscent of modern, open offices, with Google and other major software companies coming to find. These types of spaces allow for the furniture and modular walls to be moved to accommodate different meeting sizes or gathering spaces.


Figure 7

The first phase of this project will include:
- -Floor 1: ***Community***; presentation/workshop areas, a hall of fame, social meeting spaces,
- -Floor 2: ***Collaboration***; open space, a range of informal, re-configurable spaces, multi-media equipment
- -Floor 3: ***Prototyping***; a range of state of the art digital manufacturing equipment such as 3d printers and milling machines
- -Floor 4: Fabrication; traditional fabrication and manufacturing workshops

The second phase includes a large, open project floor, a floor devoted to start-up assistance, and a floor for incubating start-up companies.

The proposal for this building features open workspaces similar to our studios, modern modular meeting spaces, stairs that double as social gather spaces, open computer labs, and clustered seating. Many of these spaces appear to be designed to encourage and assist collaboration between students and users of the building.

The existing building currently known as Lincoln Storage is brick and concrete construction. The open plan of the current floors are being utilized in the renovation, similar to Renaissance Hall.

The modern expansion to the existing building uses steel, concrete and glass construction. The two main features are a large enclosed glass and steel stair that extrudes from the building and a spiral-eque bridge made of steel and glass, connecting the neighboring athletic center to the innovation center.

In a rendered video walk through of the building, it is evident that the open floor plan utilizes all available space, not wasting space on circulation but instead dividing areas with white boards, shelving storage units or movable, modular elements.

Noisebridge is a non-profit Hacker/Makerspace in San Francisco, California. It features a 5,200 square foot space located at 2169 Mission St, housing a woodshop, metalshop, photography, programming, hardware, science, art, 3d printing and more. The space has an electronics lab, machine shop, sewing/crafting, a conference area, two classrooms, a library, darkroom and kitchen.

Figure 8.1

Noisebridge operates on a membership system, with a full membership at $80 ($40 for a "starving hacker" discount). Associate members don't pay dues but cannot vote at meeting sand have limited benefits. They have a meeting every Tuesday at 8pm which is typically used for organizational and planning purposes.

"The 350 people who come through Noisebridge each week have a habit of leaving a mark, whether by donating a tool or building something that other visitors add to bit by bit. Anyone can be a paid member or a free user of the space, and over the years they have built it into a place where you can code, sew, hack hardware, cook, build robots, woodwork, learn, teach and more." (Brewster, 2013)

Everything at Noisebridge has been donated, from tables and chairs, to Makerbot 3d printers. While the space isn't anything architecturally special, it features large open workspaces with large windows on each end of the main space that allow for natural lighting.

The image below is a SketchUp model that was made by one of the members showing their current space. The majority of the space is an open plan with many collaborative spaces.

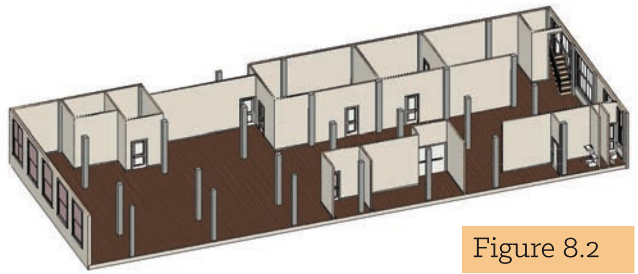


Figure 8.2

In what can only be called controlled chaos, Noisebridge is influenced and made into home by its members. The main work spaces are very reminiscent of our studio desks, filled with current projects, computers and personal artifacts. This encourages collaboration, creating a social atmosphere.

Noisebridge has 24/7 access to members and comes complete with a "living room" style area with couches and a TV, as well as a kitchen with a fridge, stove, oven, microwave and a commercial sink. One of the side rooms has several bunk beds for "napping." They also have an extensive library, large storage areas and a wall full of bins of parts that members have access to use for free.

Figure 9.2

Figure 9.1

On the technology side, Noisebridge currently has a laser cutter, several Makerbot and RepRap 3d printers, a small CnC mill, a vinyl cutter and a range of electronic tools such as: soldering irons, racks of components, oscilloscopes, multimeters, etc. They host a class weekly that teachers members how to solder and allows others to help each other on current projects.

Noisebridge was created by a small group of people that grew into a larger community. They've outgrown several spaces and are on pace to do the same with their current location. This is a prime example of collaboration, community and dedication, something the members of Noisebridge share and embrace.

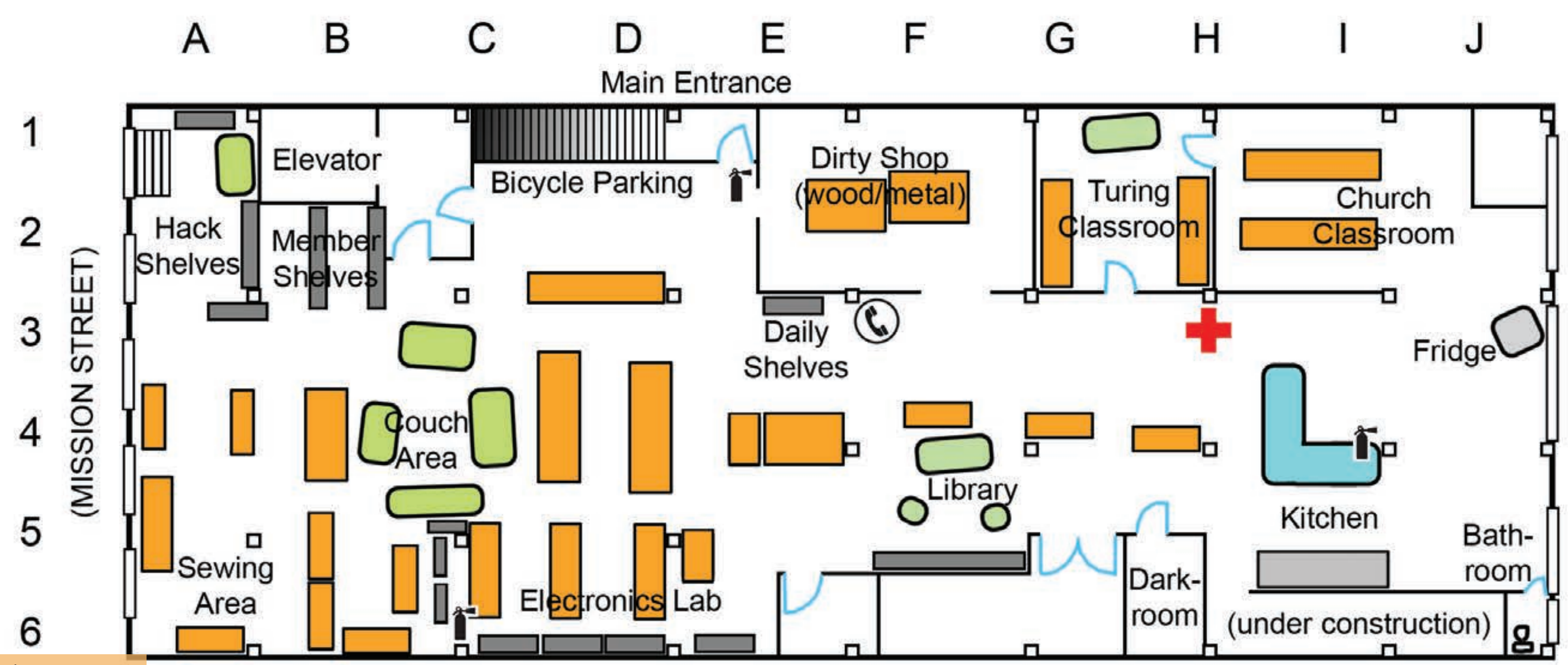


Figure 10

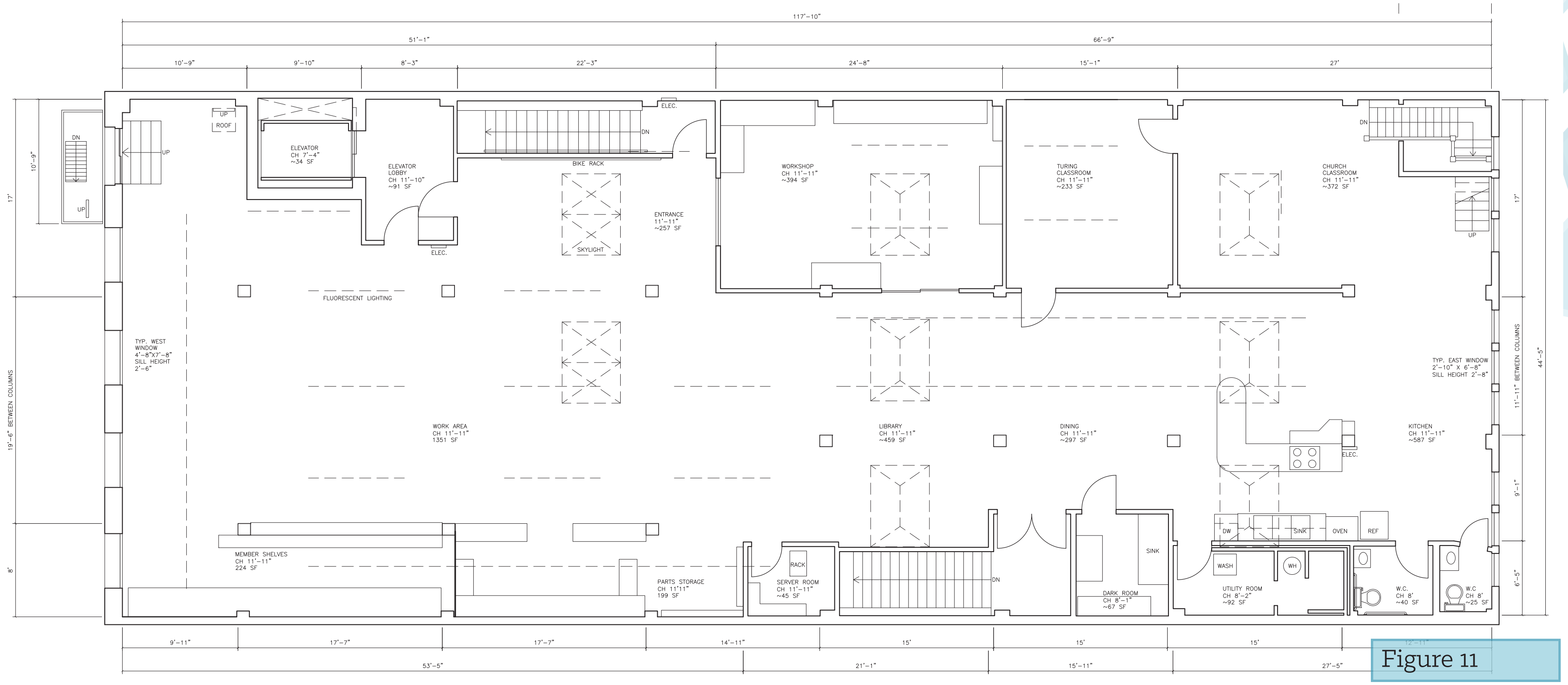


Figure 11

TechShop is a chain of Makerspaces that currently has eight locations with two more in the planning phases. Each location features access to over $1 million worth of professional equipment and software and over 15,000 square feet of space. This line of Makerspaces is the first commercial series of its kind and is available to everyone from students to corporate members.

"TechShop is a vibrant, creative community that provides access to tools, software and space. You can make virtually anything at TechShop. Come and build your dreams!" (TechShop.ws, 2014)

They offer safety and usage training, with classes and workshops available to people of all skill levels.

Figure 12

Part fabrication and prototyping studio, TechShop locations feature laser cutters, plastic/electronics labs, machine shops, wood shops, metal working shops, a textiles department, welding stations, CnC mills, 3d printers, waterjet cutters, welding equipment, indoor automotive work bays and much more. Members also have access to design software, featuring the Autodesk Design suite. Each location has large classrooms, huge project areas with large work stations, a break room with a kitchen, storage spaces and a large retail area where supplies for projects are readily available for purchase.

Similar to the other case studies, TechShop features large, open plan workspaces. These encourage collaboration and allow members to work on projects in a more social setting. Members have access to storage areas for their projects and locations are open from 9 am to midnight seven days a week, excluding holidays. Each location has high speed wifi and fresh-brewed coffee and freshly popped popcorn.

Expert staff members are always on hand for assistance, training and supervision. Membership fees range from $100 to $175, depending on discounts (educational, monthly versus yearly).

TechShop is different from the previous case studies in that it is a commercial Makerspace. This allows for a wider range of high end technology, newer and cleaner facilities that are climate controlled, and trained staff. This also means that monthly/yearly costs are going to be significantly higher but it can be said that you get what you pay for.

Each location has a different floor plan but each has similar layouts. A centralized area of workstations is surrounded by the various individual lab rooms. This creates less wasted space for circulation and allows for ease of access. For example, let's say a member is working on a project that involves 3d printing, wood working and laser cutting. Since the workstations are centralized, the member doesn't have to travel across the building to access the different equipment, it is easily accessible from one or two locations.

The maker community is a very social group and TechShop has various meet-ups each month for varying interests, appealing to the different groups of members. As I'm writing this the Detroit location is having a "Ladies Night," bringing women together that have interests in DIY and maker culture together.

The interiors are well lit, utilizing natural lighting for workspaces and labs. TechShop uses a color scheme centered around white walls with blue and red as accent colors. The spaces have a modern mixed with industrial feel, using light wood furniture that is reminiscent of "modern styled Ikea products.

The San Francisco location has a virtual tour online, showcasing each of the labs and workspaces. The two story space has vaulted ceilings, large walls of windows that light the main areas with natural lighting and a large conference room that overlooks the main work areas. The main area also has a lounge with several couches and a large computer bay.


Figure 13.1.


Figure 13.2

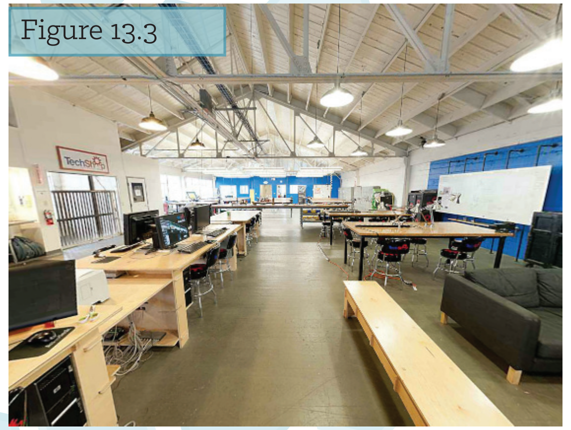


Figure 13.3

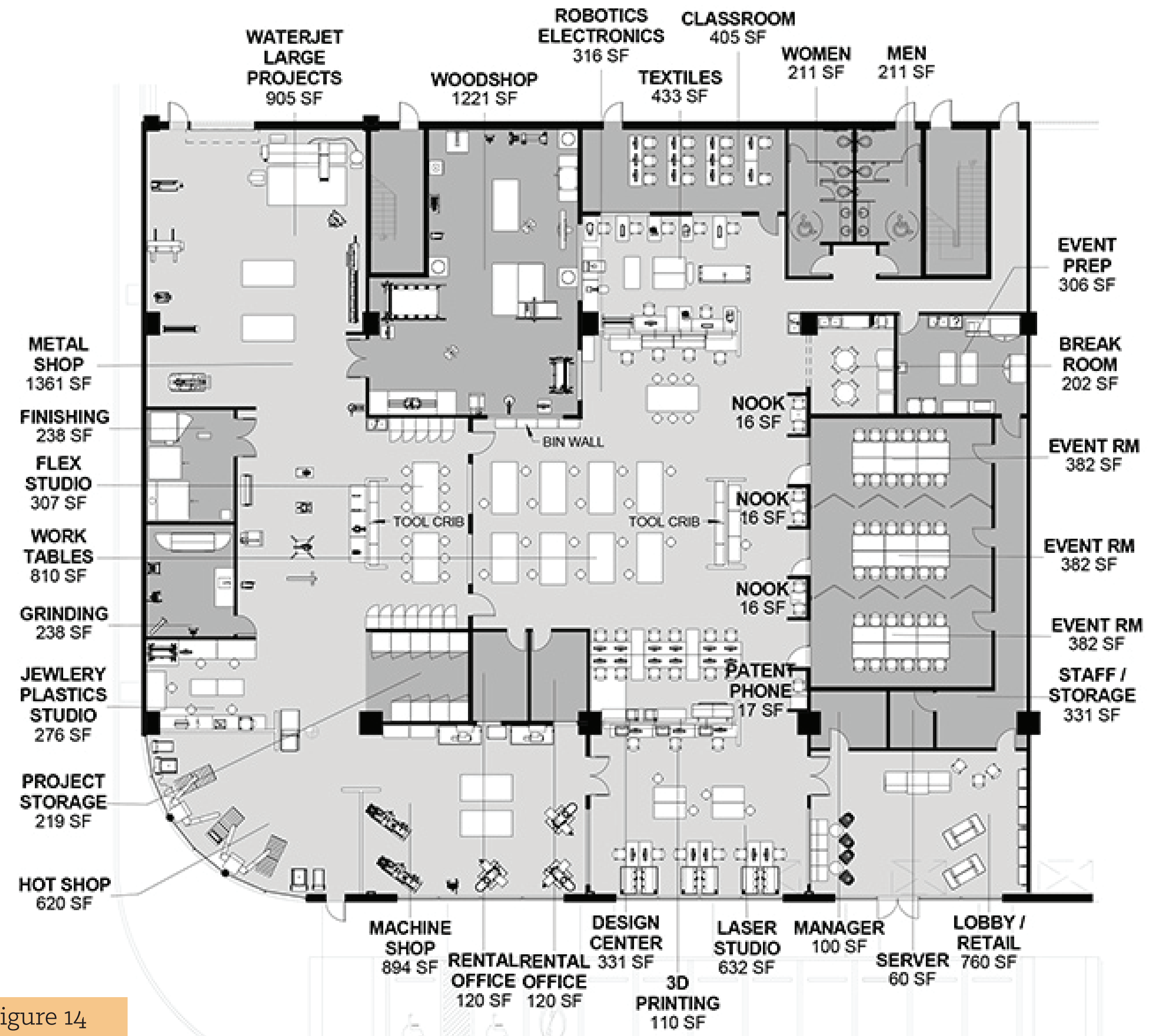


Figure 14

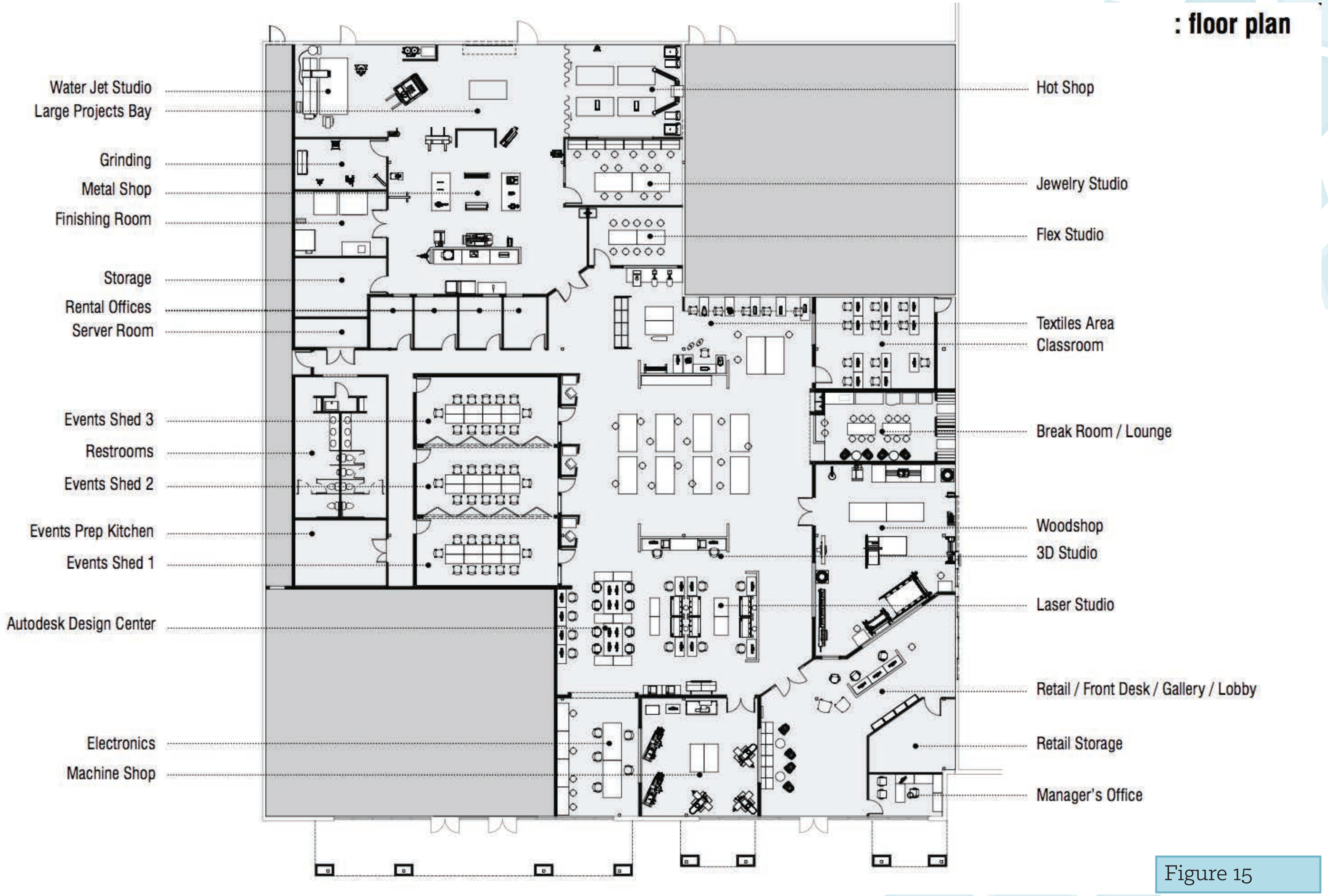


Figure 15

This series of case studies examined three different types of "Makerspaces." The first examined the educational side, the second was a look at the non-profit side and the third looked at the commercial side. Each type offered a different look at the same concept, bringing forth new ideas to influence my thesis.

While each type of makerspace had the unifying idea of bringing people together in a collaborative setting to create, each space had varied methods behind their operation and execution. Each type had a different source of funding that did tend to effect the available space and technology.

One common characteristic among them included large, open plan work spaces. These spaces allowed members to work in an open and social collaborative environment, similar to our architecture studio spaces. Another common theme was limiting circulation space. The work areas tended to act as circulation into the individual labs with spaces broken up with tables or shelves. Each case study had a tendency to utilize natural lighting, especially in the large, work areas. This improves moral and gives the space a brighter, natural feel, as well as cutting down on lighting costs.

The first case study was ThinkBox, a large, seven story "innovation center" at Case Western Reserve University. This study brought up the concept of having a large scale makerspace available at a university level, the idea that my thesis is focused upon. Due to university and private funding, this allows for a large scale (50,000 square feet) project that features many different areas aside from the typical maker technologies. It has an emphasis on prototyping, innovation, and entrepreneurship.

ThinkBox has seven stories with very modular set ups for meeting rooms, common areas and work areas, allowing the users define spaces, instead of doing it for them. This creates a dynamic, social environment. It also has a plethora of social space, including utilizing area around the stairs as a gathering space and multiple arrangements of lounge and meeting space.

The second case study was Noisebridge, a non-profit "Hackerspace" (5,200 square feet) that was build from the ground up by members.. All of the resources and technology was donated and is more on the dated side. The members form a tight knit community base upon collaboration and educating others. Workshops are done by members donating time and resources.

Noisebridge features 24/7 member access with living areas such as a full kitchen and a room with bunk beds for resting. It has a large library with materials donated by members. The smaller size of this project limits what can be done but the members have definitely made the most out of what they have.

The third case study was TechShop, a commercial chain of makerspaces, averaging 17,000 square feet per location. These locations featured over $1 million of cutting edge technology and software available to members.

TechShop boasts impressive levels and variety of technology as well as clean and modern buildings. Membership fees are higher but with the price comes the high end work space and technology. The locations studied were San Francisco, Austin and Pittsburgh. Each of them featured a centralized work area, a large retail store with easily accessible materials, and a wider range of available technology. These projects featured maker technologies as well as machine shops and automotive shops.

[Owner] University of Minnesota

[User Groups]

The users of this building fall into two main groups: Students and the general public. Additional users of the building include but are not limited to faculty, janitorial staff, administrative staff, instructors, kitchen staff and professionals.

Students

This group consists of any student enrolled at the University of Minnesota (approximately 48,000), from any major, undergraduate or graduate. Peak usage would most likely be after main class hours (6pm to 10pm) as well as mid-day (12pm-2pm). Parking requirements are covered by campus parking.

General Public

The general public consists of any of the citizens of the twin cities area that is interested in learning how to create and innovate using maker technologies (approximately 3 million). While that is a staggering number, the number of interested parties would be far lower. Peak hours would most likely be after normal work hours (6pm-10pm).

[Types of Spaces]

Administration
- *reception*
- *board room*
- *offices*
- *storage*

Workshops
- *wood working*
- *machining*
- *metal working*
- *3d printing*
- *laser cutting*
- *CnC milling*
- *sewing*
- *electronics*
- *innovation*

Cafe
- *seating*
- *kitchen*
- *storage*
- *storefront*

Social areas
- *lounges*
- *meeting rooms*
- *breakout spaces*
- *kitchen*
- *dining area*

Media Center
- *presentation spaces*
- *computer labs*
- *storage*
- *meeting space*

Restrooms
- *1/50 occupants*

Mechanical

Custodial

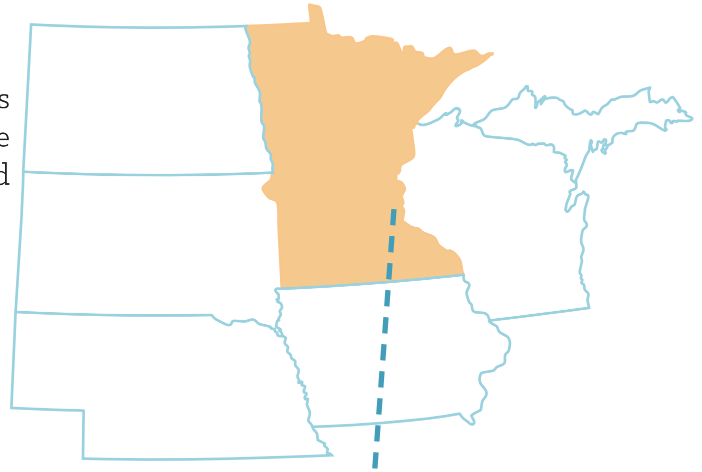
Gallery
- *display area*
- *storage*
- *reception*

Locker Room
- *showers*
- *lockers*
- *storage*
- *restrooms*

Work Areas
- studio space
- desks
- modular meeting spaces

[Region]

Located in the Upper Midwest, Minnesota is bordered by Wisconsin to the east, Iowa to the south, North and South Dakota to the west, and Canada to the North.



[City]

The site is located in Minneapolis. MN within Hennepin County, in the area known as the "Twin Cities." It is the 14th largest metropolitan area in the United States, containing approximately 3.8 million residents. Minneapolis itself has approximately 400,000 residents.

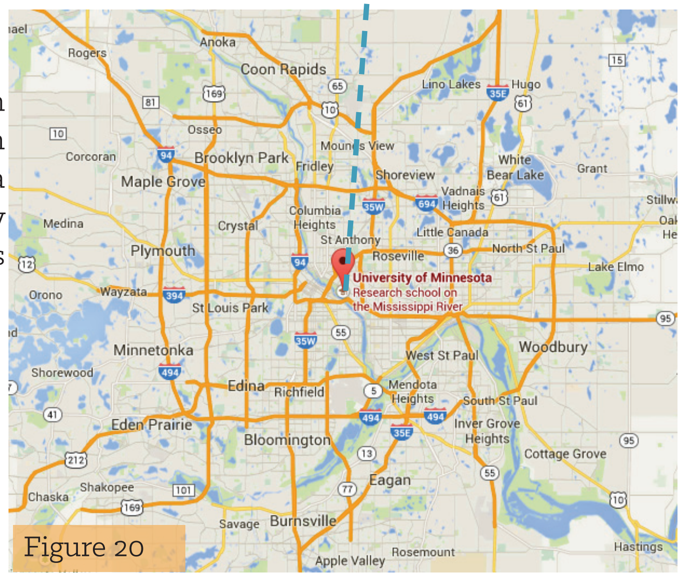


Figure 20

Figure 21.1

Both maps courtesy of maps.google.com

Figure 21.2

[Site Information]

Address: 199 Pleasant St. SE

Neighborhood: University

Boundaries: The site is bounded on three sides by university buildings. To the east is Northrop Memorial Auditorium, to the north is Nicholson Hall, to the south Johnston Hall and to the west it is bounded by Pleasant St. with Scott Hall on the opposite side of the street.

Zoning: OR3 Institutional Office Residence District

[Importance]

The importance of this site has two main factors: traffic and space. This site is right next to one of the highest areas of foot traffic on campus known as "the Mall." This project needs to be easily accessible to be successful and this site is a very busy area of campus. The U of M campus doesn't have much usable space but this is one of the few areas on campus that is unused and isn't a major green space. After finishing recent construction on Northrop, this lot was left bare, besides grass and sidewalks.

This thesis aims to explore the influence and relationship that architecture has on the creativity, innovation and collaboration of its inhabitants by creating an overall space that allows for creation and exploration in some of the many fields of crafting and making. It also seeks to create an environment that is social, welcoming and encourages the collaboration of others, from friends to strangers. Many of the spaces will be modular, taking the shape required by the users.

[The Academic]

This thesis project is the capstone to the end of five years of formal study of architectural education and is a reflection of where I am at this current stage of my life. My goal is to design a project that challenges and pushes me to my full potential while allowing me to explore architecture as a design student. My end goal is to create a comprehensive design that I am proud to stand by and call my own. It should be an accurate and positive representation of my skills as a graduate student, designer and professional.

[The Professional]

This thesis is a direct reflection of who I am and how I am able to use my skills to succeed. The experience I've had in an architecture firm should be reflected into this project as well, making it something I would be proud to show off to the professionals I work with. My goal as a professional is to use this thesis to explore architecture and be able to adapt what I have learned into my professional work.

[The Personal]

For the last five years I have dedicated a majority of my life to architecture and design. Architecture has become my passion and my life. The people I've met here, the friends I've made, and the faculty I've worked with have all helped shape my life and who I am as a person. This thesis allows me to focus everything I've learned and all of the experiences I've had into a single project. I'm not just doing this thesis for myself, it is for my friends, family and loved ones that have supported me on this wonderful journey. My goal is to put every bit of myself into this project and create something that I am proud to call my own, proud to show to others, and grateful to have experienced.

[Research Direction]

Research for this thesis will be an ongoing process that is done throughout the entire process. Research will be conducted more extensively to gain a better understanding of the theoretical premise, project typology, historical context, site analysis and programmatic requirements. Resources that will be utilized include online journals, books, periodicals, case studies, interviews and online information.

[Design Methodology]

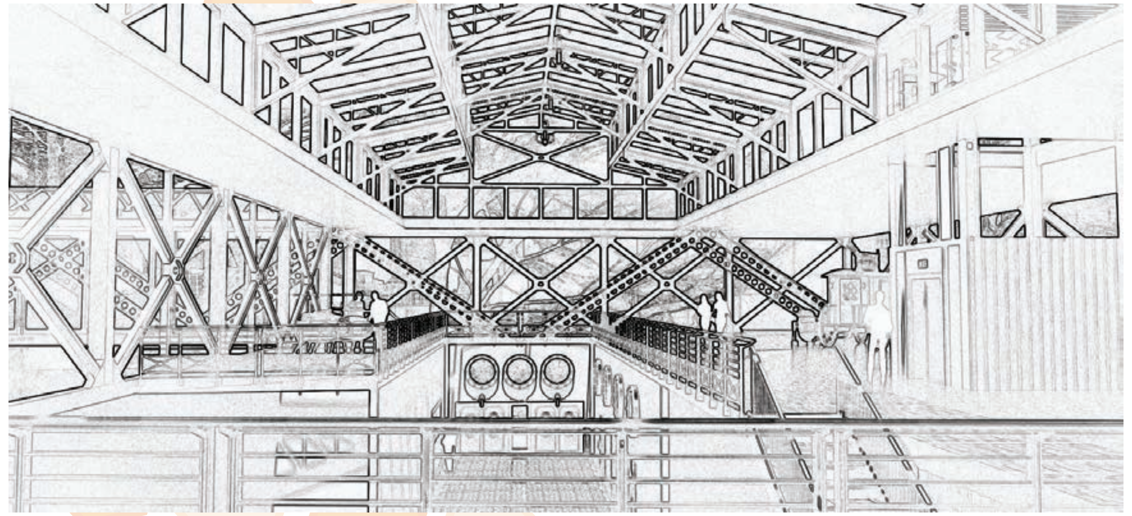
The research for this thesis be done using a mixed method quantitative/qualitative approach and will be executed using a concurrent transformative strategy. Priority will be assigned by the requirements of the theoretical premise. Integration of the data will occur at several stages in the process of the research and will depend on the requirements of the examination of the theoretical premise. Quantitative data, including statistical data and scientific data, will be gathered locally, obtained through an archival search, obtained through instrumentation/experimentation, or gathered directly.

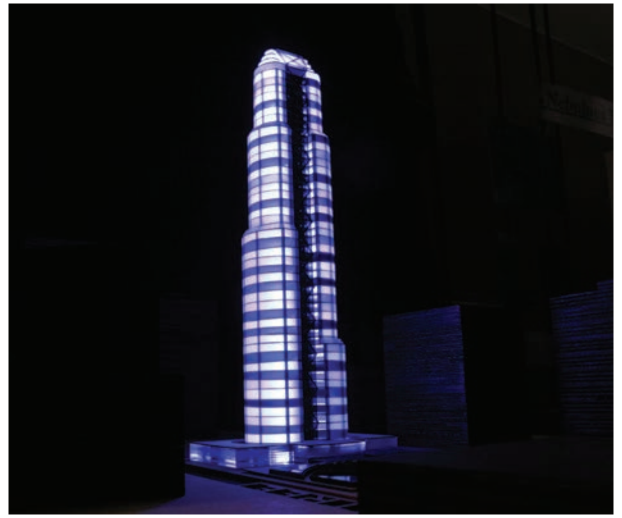
Qualitative data will be gathered from direct observation, a local survey, through an archival search or from direct interviews.

[Documentation of the Design Process]

Documentation of research and the design process will be done throughout the academic year through scans and digital compilation. Documentation will be available for others through the institutional repository. The final project will consist of a physical book, presentation boards, digital and physical models and a possible animation.

Figure 26





[Fall 2011]

Instructor: Rhet Fiskness
Tea House
Minneapolis Rowing Club Boathouse

This studio was an introduction to architecture studio and focused on the importance of sketching, hand-drafting and beginning programming.

[Spring 2012]

Instructor: Darryl Booker
Dance Studio
Birdhouse
Dwelling

Booker's spring studio continued with hand-drawing and beginning programming as well as introducing us to our first group project located in Marfa, Texas.

[Fall 2012]

Instructor: Steve Martins
YMCA Camp Lodge
Funeral Chapel

Fall 3rd year studio was an introduction to wood and masonry structure. This was also the first studio where an attempt was made at digital rendering.

[Spring 2013]

Instructor: David Crutchfield
Virgin Galactic Hotel
Folk Art Museum

This studio focused on concrete and steel structure. I spent a heavy part of this semester working with rendering techniques with Maxwell Render and photoshop.

[Fall 2013]

Instructor: Don Faulkner
High Rise

High rise studio was a group project that focused on comprehensive design with an emphasis on structure, programming, planning and HVAC.

[Spring 2014]

Instructor: Don Faulkner
Fargo Master Plan
Marvin Windows Competition

Spring studio of 2014 was a group urban design project located in downtown Fargo as well as Marvin Windows. I learned the rendering style I would use on my final thesis boards during this time.

[Fall 2014]

Instructor: Mike Christensen
Oil Patch

Our final undergraduate studio focused early on using Rhino and Grasshopper to develop housing in the Bakken Oil Field. I furthered my rendering style into what I would use on my final thesis renderings.

Personal

"Life is inherently risky. There is only one big risk you should avoid at all costs, and that is the risk of doing nothing"

-Denis Waitley

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Figure 29

Programming

Beyond the Makerspace

This thesis focuses on creating an environment known as a "Makerspace" or "Innovation Center" that gives college students, faculty and the public access to tools that allow consumers to become makers. With the right tools, inspiration, and collaboration, makers have the potential to change the world.


Figure 32.1

"Across the country, 'maker spaces' are popping up to satisfy demand for affordable access to industrial tools and shared work spaces. These massive fabrication facilities are like a cross between a business incubator and a manufacturing plant, with sprinklings of academia and community spirit thrown in for good measure." (Lynch, 2014).

Makerspaces give the users access to low-cost powerful tools and studio space but what makes them even more valuable is the access to the community behind them. Marketers, entrepreneurs, and general makers cohabit under one roof. Everyone brings their unique skills sets and are generally available to teach others. Don't know how to solder? There's class for that. Don't know how LEDs work? There's also a class for that. The possibilities can be endless.

These spaces act in a similar manner to how college architecture studios function. Each student has a general goal in common but brings different skill sets, experience and knowledge to the table. The studio brings forth an environment that both encourages and sets a stage for collaboration, something that is very important to our growth as designers. Explaining "studio" to outsiders comes off as such a foreign concept and a makerspace would give the average person


Figure 32.2

Why the Maker Movement?

The concept of a makerspace has existed for years but recently the "Maker Movement" has jump started these spaces and brought it to the public's attention. Being dubbed the next industrial revolution, this movement filled with makers, designers, artists and entrepreneurs.

"The maker movement has come about in part because of people's need to engage passionately with objects in ways that make them more than just consumers. But other influences are in play as well, many of which closely align the maker movement with new technologies and digital tools. Makers at their core are enthusiasts." (Dougherty, 12)

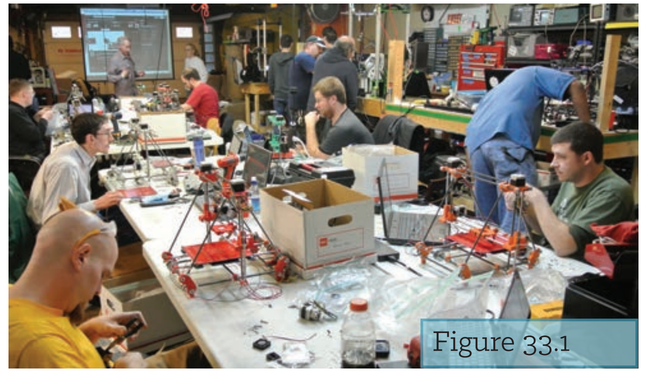


Figure 33.1

This movement is an "industrial revolution" for you and me. Anyone has the potential to be a maker. Children start out as a maker in a sense. Legos and tinker toys are an example how they are inspired to be makers instead of consumers. As we age we enter the realm of being a consumer. The maker movement allows anyone to become what they once were but at a larger scale: a maker.


Figure 33.2

Maker Faires are happening all around the world, with the largest attracting more than 120,000 people. These conventions let individual maker communities gather together and share their knowledge as one. Companies use these conventions to get their products seen and experienced by makers.

Varying Degrees of Separation

Makerspaces all generally have the same base concept but the way in which they operate vary in several major ways. They fall into three main categories; commercial (for profit), community (nonprofit) and educational (schools and universities).

"TechShop is a vibrant, creative community that provides access to tools, software and space. You can make virtually anything at TechShop. Come and build your dreams!" (TechShop.ws, 2014)

Figure 34

Companies such as TechShop, a commercial chain of top tier Maker Spaces, draw their consumer base from these communities as well as college students, offering discounts to nearby universities. Membership fees are generally higher but members have access to more advanced/expensive equipment and trained industry professionals.

"The 350 people who come through Noisebridge each week have a habit of leaving a mark, whether by donating a tool or building something that other visitors add to bit by bit. Anyone can be a paid member or a free user of the space, and over the years they have built it into a place where you can code, sew, hack hardware, cook, build robots, woodwork, learn, teach and more." (Brewster, 2013)

Open-source (nonprofit) makerspaces have been around for years and typically operate on lower membership costs that are put back into the spaces for new equipment and building costs. Noisebridge in San Francisco, California is a prime example of this type of makerspace. They feature a 5,200 square foot space complete with a woodshop, metalshop, 3d printing lab and more. The technology in these types of spaces are typically on the lower end and classes are generally taught by members. Open-source makerspaces are a tight knit community of people that often collaborate and help each other.

"Universities and government agencies are also getting in on the game, with both Arizona State University and DARPA backing new TechShop locations. Rutgers, Stanford and Georgia Tech have all opened similar facilities, and Harvard recently donated a scanning electron microscope to Artisan's Asylum-a first for the maker community." (Lynch, 2014)

The chosen focus category for this thesis is in the education sector. Makerspaces can have problems in smaller markets building a member base but a university has a very large and diverse base of students and faculty to help support a makerspace on a larger scale. Architecture and engineering can greatly benefit from a makerspace but healthcare, education, science, etc, can also benefit from access to maker technology, they just don't often get a chance to. Giving any student access to these tools brings a new element to education and allows students to learn through creating a physical object.

"When you're making something, the object you create is a demonstration of what you've learned to do, thus you are providing evidence of your learning. The opportunity to talk about that object, to communicate about it, to tell a story about it is another way we learn at the same time we teach others." (Dougherty, 13)

Figure 35

Education, especially in the sense of architecture, can be hypothetical. The buildings we design in studio aren't a tangible thing, they aren't actually being built. These maker technologies such as 3d printing, milling, etc, allow a physical, tangible object to be created. Students can hold it, touch it, experience it and learn from it. This is an important element of learning.

Business Up Front Party in the Back

The industry as a whole has created new jobs and businesses from different angles. A local example, Fargo 3d Printing, was born as part of this industry. John Schneider started a makerspace in Fargo called Meld Workshop. After a year of being in operation, John and Jake Clark started a new business venture that focused solely on one part of the industry: 3d printing (sales, maintenance and operation). They currently have clients on a worldwide scale due to the boom of 3d printing and making.

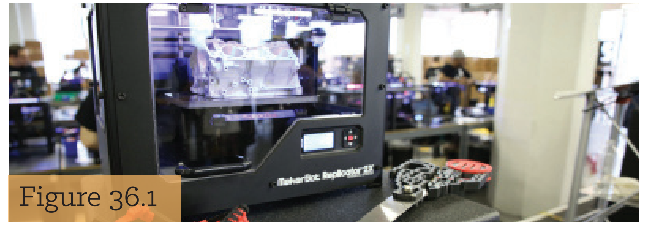


Figure 36.1

"According to Atmel, there are approximately 135 million U.S. adults who are makers and the overall market for 3d printing products and various maker services hit $2.2 billion in 2012. That number is expected to reach $6 billion by 2017 and $8.41 billion by 2020. According to USA Today, makers fuel business with some $29 billion poured into the world economy each year." (Bajarin, 2014)

This expanding market has opened doors for small business owners and large corporations alike. Makerbot was originally made by a hobbyist and was recently purchased by 3d printing giant Stratasys in a $403 million deal. While this level of success is on the rare side, makerspaces allow prototyping at a minimal cost and time that it used to take to create functioning models.

"The catalog of success stories is proof enough: the Square credit card reader, Pebble smartwatch, Coin all-in-one credit card and the Makerbot 3d Printer all came from makerspaces in different parts of the country." (Lynch, 2014)

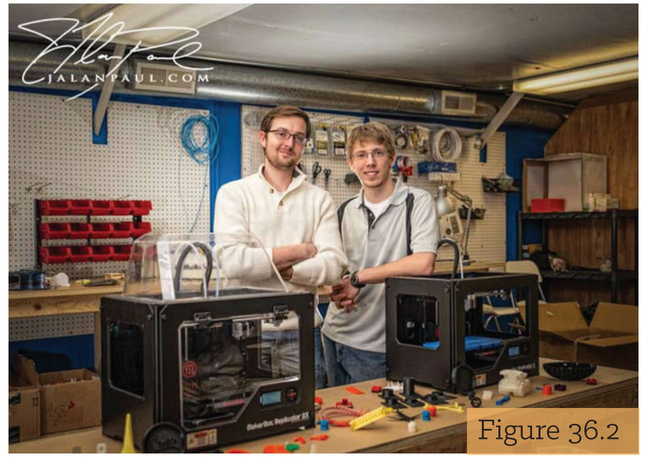


Figure 36.2

Extroverted Architecture

"As an architect, you live in the skin of the people who will daily occupy your buildings. And of course, the impact of physical conditions should never be underestimated, especially in the design of a school. Study after study has cited that the correct environment can greatly improve student engagement, enrollment, and even general well-being." (Quirk, 2012)

This article from Archdaily.com discusses the idea of creating architecture for the educational environment that is extroverted, instead of the usual introverted style that is often used to create a sense of shared identity for students. An extroverted approach encourages a certain level of permeability with the community, encouraging students to interface outward.

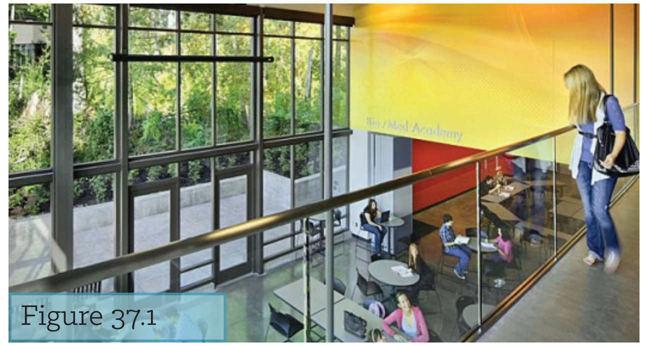


Figure 37.1

This directly applies to my thesis in the sense that this facility is aimed at not just students and faculty involved but to bring in the community as an added element. Minneapolis has a thriving maker community that could greatly benefit from these facilities as well as the students at the University of Minnesota.

Figure 37.2

One of the ideas discussed is creating a "storefront" on the school to give a passerby a visual into the learning opportunities offered within. Students may not completely understand what is going on within a makerspace/innovation center but having heavy foot traffic pass by a "storefront" that shows an example of what can be achieved inside could easily be used to draw students in. This could be a very valuable tool to introduce unfamiliar students into the world of making.

Collaboration Through Architecture

"Furniture and space design plays a critical role in determining how people behave and can have a hugely positive effect on encouraging collaboration and serendipity. Space can be a tool to fuel the creative process by encouraging and discouraging specific behaviors/actions and by creating venues for emotional expression and physical negotiation. The space can be designed to build excitement and inspire creativity in work people." (Paoletti, 2011)

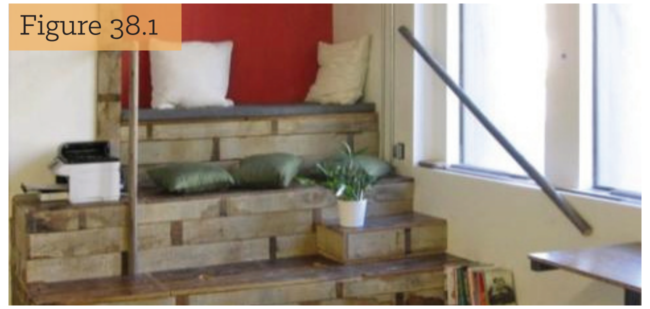


Figure 38.1

Case Western Reserve University's thinkbox Innovation Center is a perfect example of this. The floors have an open plan and the individual spaces are defined by the furniture and multipurpose use of design elements. The main stair is expanded to double as meeting and social space. The lounge areas are reconfigurable for large meetings or small gatherings.

Andrea Paoletti's job is designing spaces that influence collaboration and creativity. She has a list of ten points that make a space more collaborative. **1. People Centered**. The space should be designed for and cater to the needs of the users. **2. Luminous**. Life needs light for energy and growth. The spaces should be open and have plenty of natural lighting. **3. Simple.** The design needs to emphasize simplicity and aim to create an environment that is specifically tailored to the users. **4. Diverse**. The idea is to strike the right balance between order and chaos and design work spaces around common spaces where casual mingling and chatter happens without any formal planning. **5. Randomizing**. Essential to creating and sustaining a sense of community are common informal spaces. They foster an unexpected range of possible solutions.

Figure 38.2

6. Fluid. Fluidity is needed in order to create a space where happy accidents and unexpected discoveries can happen in a spontaneous, irregular space. **7. Adaptive**. Space has to be designed to accommodate multiple functions within. Think in paradoxical ways, using materials unconventionally. **8. Ethical**. The materials should reflect ethical and sustainable choices to create designs that minimize their impact on the environment. **9. Flexible**. Structure has to be modular with walls that can be easily re-configured to match the needs of people when new ideas demand new purposes from the space. **10. Open Ended**. Even when completed, a workspace must retain a degree of flexibility and 'incompleteness', giving the people the ability to accommodate the changing needs of diverse organizations and individuals.

Figure 39.1

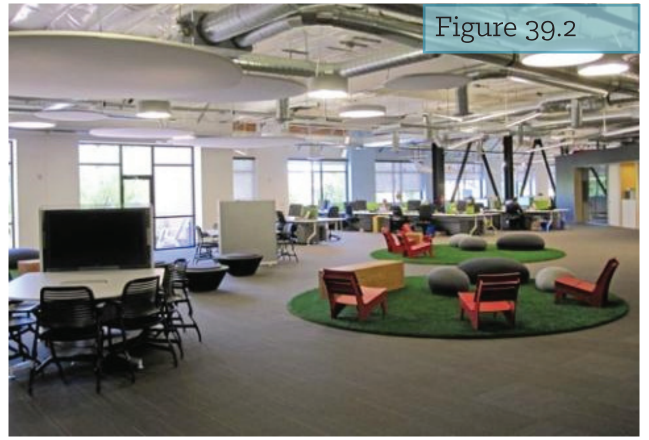


Figure 39.2

As was previously mentioned, architecture studios have many of these characteristics. Renaissance Hall is a great example of reuse for an educational setting. Old wood floors, exposed brick and beams, and incorporation of breakout spaces and modular desk settings. This is my third year (sixth semester) with a studio at Renaissance Hall and not once has the layout of the studio desks been the same. Making the desks and storage cabinets easy to move and rearrange with wheels allows students to create "pods." Our studio desks are typically divided into a grouping based upon individual design studios, creating a micro community.

The previously summarized articles, journals, and websites give a brief look into the history of the makerspace, the maker movement, the business behind this movement, collaboration through architecture and extroverted architecture in the learning environment. All of these topics fit into my topic and have given me a much better background into what my design will be centered around.

Beyond the makerspace discusses the basics and workings of a makerspace and the concept behind the community involved. This thesis strives to create an environment that could cohabitate these existing communities while creating a new community of its own. With a large student base to inspire, the University of Minnesota brings forth an opportunity to create a new wave of makers.

Figure 40.1

Why the Maker Movement? This recent movement has jump started the makerspace and maker community, bringing them to the public eye. This movement has been dubbed the next industrial revolution but this time it is even more relevant, it involves you and me. Anyone has the potential to be a maker, they just haven't realized it yet. These facilities give people access to the tools and means of creating and making. Filled with makers, designers, artists, and entrepreneurs, this movement is here to make waves.

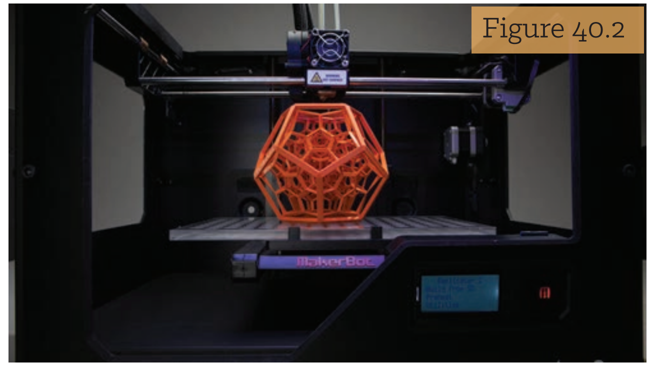


Figure 40.2

Makerspaces are maintained and operated in three general categories. Commercial makerspaces such as TechShop are generally on the higher end of technology and pricing, costing members more but giving them access to more expensive equipment and professionally trained employees.

Open source (nonprofit) have been around for years, sometimes known as "hackerspaces." They typically operate on lower membership costs that are put back into spaces for new equipment and building costs. The technology in these types of spaces are typically on the lower end and classes are generally taught by members. Open-source makerspaces are a tight knit community of people that often collaborate and help each other.


Figure 41

The third category is education. Makerspaces can have problems in smaller markets building a member base but a university has a very large and diverse base of students and faculty to help support a makerspace on a larger scale. Architecture and engineering can greatly benefit from a makerspace but healthcare, education, science, etc, can also benefit from access to maker technology, they just don't often get a chance to. Giving any student access to these tools brings a new element to education and allows students to learn through creating a physical object.

Collaboration through architecture. Furniture and space design plays a critical role in determining how people behave and can have a hugely positive effect on encouraging collaboration and serendipity. Space can be a tool to fuel the creative process by encouraging and discouraging specific behaviors/actions and by creating venues for emotional expression and physical negotiation.

Extroverted architecture discusses the idea of creating architecture for the educational environment that is extroverted, instead of the usual introverted style that is often used to create a sense of shared identity for students. An extroverted approach encourages a certain level of permeability with the community, encouraging students to interface outward.

This expanding market has opened doors for small business owners and large corporations alike. Makerbot was originally made by a hobbyist and was recently purchased by 3d printing giant Stratasys in a $403 million deal. While this level of success is on the rare side, makerspaces allow prototyping at a minimal cost and time that it used to take to create functioning models.

In my time at North Dakota State University I have been given the opportunity to beta test and "pioneer" several technologies that are new to our department. The Makerbot Replicator 2 brought 3d printing to a stable, economical and practical level for us and I, along with several other students, ran the printers through rigorous testing. We created documentation and maintenance routines as well as figuring out how to implement them for use by the majority of our students.

This experience introduced me to "Maker Culture" and I became a maker, creating replica props of video game weapons for display and costuming. I've participated in many demo events to local businesses and the public on 3d printing as well as being a panelist on 3d printing several times. These experiences introduced me to local business owners, makers and people that shared these same passions.

These events inspired me to focus my thesis project on creating a makerspace/innovation center that would allow a large body of people access to these technologies.

Universities around the country are adopting the makerspace idea. Several colleges have built stand alone buildings dedicated to these, ranging from a small single story building to a large seven story complex.


Figure 42

I chose to focus on the educational side for several reasons. Makerspaces can be tricky in certain markets to maintain a membership base large enough to keep afloat. Universities have a large base of students to support a project of this size as well as giving these students an opportunity to experience learning through making. The funding necessary for this type of project is feasible in the educational sector.

This project presents a challenge that will help me grow as an architecture student, designer, and intern. It allows me to draw from all of the skills and resources I have developed in the last five years, as well as pushing me as a designer.

One of the main focus areas of this project is developing spaces that promote and inspire creativity, learning, collaboration and community through the use of architecture. A focus for this is creating spaces that are extroverted instead of the typical introverted educational spaces.

This thesis aims to explore the influence and relationship that architecture has on the creativity, innovation and collaboration of its inhabitants by creating an overall space that allows for creation and exploration in some of the many fields of crafting and making. It also seeks to create an environment that is social, welcoming and encourages the collaboration of others, from friends to strangers. Many of the spaces will be modular, taking the shape required by the users.

The students and faculty at the University of Minnesota would greatly benefit from facilities such as what I am proposing. It would not only give them access to technology that they previously had only read about online but it gives them a space that they can gather together, socialize, collaborate and grow as students, makers and humans.

This is also very beneficial to the city of Minneapolis and the twin cities area. There is a thriving maker community that would benefit from better facilities and a greater body of people to recruit from.


Figure 43

While the early concept of a makerspace has been around since the mid to late 1990s, with its foundation based in Europe. One of the first of its kind was c-base in Berlin, Germany. Americans visited in the mid 2000s, saw the possibilities of these spaces and came back to found Noisebridge and NYC Resistor.


Figure 44.1

The Term "makerspace" didn't really exist until 2005 and didn't gain public popularity until early 2011 with MAKE Magazine coined the term with makerspace.com.

Dale Dougherty founded MAKE Magazine in 2005 taking inspiration to magazines similar to Popular Mechanics. *"They had the attitude, if it's fun, why not do it? Such publications often helped people to start a hobby and learn new skills. Moreover, they helped the new hobbyist find a community of like minded tinkerers to talk with about it."* *(Dougherty, 11)*

Dougherty has been a pioneer to the Maker Movement, bringing makers together through MAKE Magazine and in 2006 he started Maker Faire which originated in the Bay Area. Since the first Maker Faire, they have held Faires in Texas, Detroit, and most recently in New York City, which attracted over 100,000 attendees. With their growing popularity and requests from fans, they are expanding to hold "mini-Maker Faires in cities around North America.

MAKE also has an online community for people interested in starting their own makerspaces, complete with guides on how to build it, fund it and maintain it. They also have a section dedicated to makerspaces in the educational sector and have gotten grants from major companies to build makerspaces in thousands of schools across the country.


Figure 44.2

On the architectural side of makerspaces, they have typically been housed in existing structures with a space large enough and economical enough to sustain. Libraries and individual university departments have set up their own makerspaces, similar to the set up of the ALA Departments 3d printing labs, laser cutters and studio spaces. The NDSU Library just launched a 3d printing lab, following suit of many college libraries around the country. With the dropping prices of 3d printing and similar technologies, it is far more economical and practical for these types of institutions to adopt the makerspace.

Recently, Arizona State University, Stanford, Georgia Tech, and Case Western Reserve University have opened or are opening facilities with maker technologies as a focus.


Figure 45

Thinkbox at Case Western Reserve University is one of the first large scale facilities dedicated to innovation and maker technologies. Part existing structure and part new construction, Thinkbox will be a 7 story, 50,000 square foot facility dedicated to digital fabrication and entrepreneurship, featuring the latest technology including 3d printing, laser cutting and traditional word working.

Aside from fabrication, Thinkbox features many social and meeting spaces, giving students plenty of opportunities for collaborating, whether its planned or spontaneous. This facility could be considered a hybrid of a workshop with elements of a student union. All students at the university as well as the public will have access to these technologies that have been proven a success by their pioneer project that has attracted over 50,000 visitors in just over a year.

The space started as a trial program to see if it could be sustained. It features 4,500 square feet and several 3d printers, CnC, laser cutters, routers, etc, that anyone can used once they have been trained by staff. The program was a success and greatly helped gain funding for the stand alone Thinkbox Facility that recently broke ground.

In the last five to ten years our society has rekindled interest in manufacturing, largely in part to the development of less expensive of fabrication technology and tools. Human nature is that of creativity but as consumers some of that is lost. Prototyping was very expensive and required great time, effort, cost and risk, something most people weren't willing to put forth for their ideas. Traditional manufacturing wasn't available to the general public and to create a product was a long and tedious process.

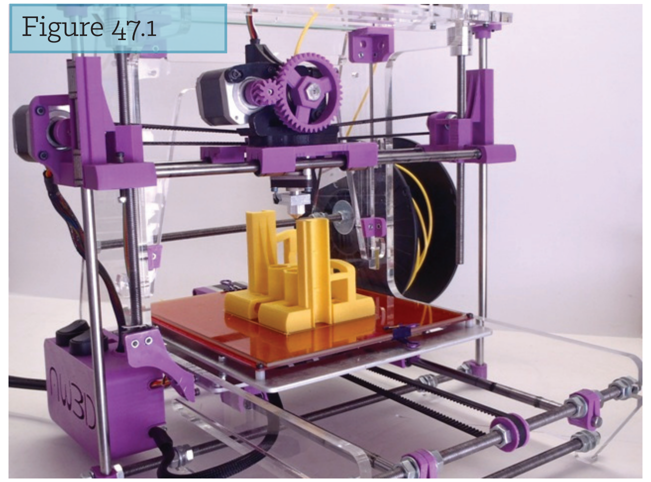
Enter: the Maker Movement. It started off in garages, basements and small maker communities that gathered in rented spaces in the back of buildings. People got together and experimented with hacking of technology, such as 3d printing. The Makerbot 3D Printer was born in such a way and helped lead the movement to cheaper, more sustainable and reliable 3d printing via PLA and ABS plastics. Previous commercially available models cost tens of thousands of dollars and were expensive to use and maintain. Open source 3d printers such as the original Makerbot Replicator and RepRap kits brought forth a cheaper option for hobbyists. The introduction of the Makerbot Replicator 2 changed the 3d printing industry, giving consumers a professional looking and working model for just over $2,000. Operating costs were minimal and production costs were almost nonexistent. Kickstarter brought a new wave of 3d printers that were funded by the public and costs continue to drop with certain kits available for as a little as $400.

Figure 46

These costs made it possible for the average consumer to purchase a 3d printer and introduced the concept of "Rapid Prototyping" to the public. With some basic 3d modeling skills, you could create a prototype for several dollars and just mere hours of printing time. This allows for many iterations of an object without expensive prototyping costs. Was part of it too big, did part of it not fit together quite right? A few quick changes on the computer and a new prototype could be printed. The average person now has the ability to prototype and become an entrepreneur in their free time.

Makerspaces were started by hobbyists and makers to give greater access and create a community for like-minded people. Everyone has the potential to be a maker and these spaces give the public access to the tools needed to do so. The new industrial revolution is here and it's for me and you.

Figure 47.1



"Across the country, "makerspaces" are popping up to satisfy demand for affordable access to industrial tools and shared work spaces. These massive fabrication facilities are like a cross between a business incubator and a manufacturing plant, with sprinklings of academia and community spirit thrown in for good measure." (Lynch, 2014)

Figure 47.2

Figure 47.3

Cultural Context

The previous section of writing discussed the importance of the Maker Movement and how Makerspaces have become a growing trend across the world. This section will focus more on the cultural impact the previously mentioned topics have on Minneapolis and the University of Minnesota specifically.

The Twin Cities have been home to several makerspaces, including TC Maker and The Hive, showing that they have a thriving maker community. Twin Cities Maker is a community of makers in the Minneapolis/St Paul area that run a makerspace known as The Hack Factory. They run off of a membership rate ($55 a month) that helps keep their doors open. They are a nonprofit organization and they host a maker faire every year named Minne-Faire.


Figure 48.1


Figure 48.2

The University of Minnesota is a large public research university in the heart of Minneapolis/St. Paul, Minnesota that boasts a student enrollment of approximately 65,000 students. The site chosen for this project resides in the Northrop Mall, commonly known to students as "The Mall." This is arguably the center of the Minneapolis Campus and has heavy foot traffic from students with the student memorial union anchoring one side of the mall. It is also home to the both the College of Liberal Arts and the College of Science and Engineering.

With the large student body and diverse range of majors, the University of Minnesota seems to be a prime candidate for a dedicated makerspace/innovation center. The architecture department is home to several laser cutters and 3d printers but that is limited to a certain level of architecture students and costs a dollar amount for time used. This thesis aims to create a facility that not only gives students access to maker technologies but also gives them a place to interact with other students interested in the same hobbies.

This facility is applicable to most majors as well as hobbyists and the majority of students could easily find use for it, whether that be making visual aids for projects, starting their own business, prototyping or making Christmas presents for family and friends. The possibilities are endless, especially when you are talking about college students.


Figure 49

College is the time in a person's life where they can experiment and find what they enjoy doing. This would give the students the opportunity to discover new hobbies, potentially start new careers and make new friends, all under one roof.

Site Analysis


Figure 51.1

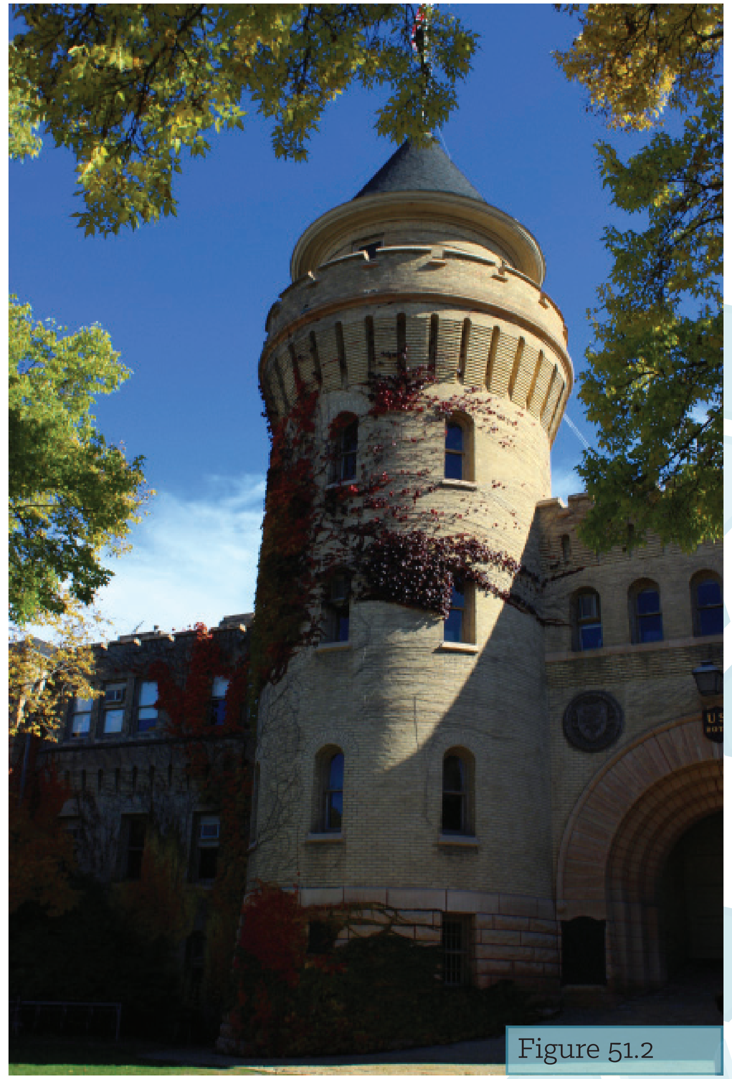


Figure 51.2

The Northrop Mall, arguably the center of the Minneapolis campus of the University of Minnesota, is a section of the East Bank campus that is a favorite of students due to the large, open green spaces. At the time of my visit students were laying out in the sun, playing catch with frisbees and footballs and gathering in groups relaxing and socializing. Also just known as "The Mall," it is home to The Cyrus Northrop Memorial Auditorium anchoring the north and the Coffman Memorial Union to the south. It is also home to both the College of Liberal Arts and the College of Science and Engineering. There are also several residence halls nearby.

It has a welcoming atmosphere that draws students in. I've been here several times and it is always bustling with activities.

Figure 52.1

Figure 52.2

The day I visited this site as part of my thesis, it was a beautiful October day. There was a light breeze and the trees were turning from green to a dark red, filling the campus with beautiful, natural tones. As I sat on a ledge overlooking the site, a feeling of serenity washed over me.

Northrop Auditorium had just recently finished a remodel, giving the building a modern touch while still keep it's historic aesthetics. The recent construction created a large open area surrounded by sidewalks on the west side of Northrop. This is my chosen site for this thesis project.

To optimize the use of a makerspace, a central area with heavy foot traffic would be the most appealing to attract students. The student union is located nearby and the mall is home to the College of Engineer and Science, one of the main colleges that could greatly benefit from these facilities.

Figure 53.1

The University of Minnesota campus has very limited sites with enough open space for a building of a moderate size and even less that are in high traffic areas. This site was recommended to me by local students, with an emphasis on the popularity of the mall.

To the north of the site is Nicholson Hall, a part of the College of Liberal Arts. On the southern side is Johnston Hall, home to part of the graduate program of the College of Liberal Arts. To the west is Pleasant Street South East, with Scott Hall and Wulling Hall across the street. Scott Hall is part of the Psychology Department and Wulling Hall is home to the Department of Organizational Leadership, Policy and Development.

Northrop Mall is home to beautiful, historic architecture, as well as well executed landscape architecture. The entire area is flush with green, including vines covering parts of several buildings. The pathways are lined with lights and trees, giving the area a very cohesive feeling.

Figure 53.2

Figure 53.3

One of the main views featured on this site is the historic Northrop Auditorium. This five story building has a western side entrance that leads onto the sidewalk on the eastern side of the site. The main entry of the building is on its south side, opening out into the mall.

Northrop Hall recently finished a renovation project that aimed to retain its historic character while turning it into a state of the art performance space.

The exterior of the building on the western side features landscaping, a large brick facade and an overhang made of glass and metal that leads into a side entrance.

Figure 54.1

1.Northrop Hall

2. South Eastern Facing North Western

Figure 54.2

This view is from the south east side of the site. There is a stair that leads up to a half story terrace that overlooks the site, giving the viewer a good sense of the overall size of the area.

To the east of this view is Northrop Auditorium, to the south is Johnston Hall and to the north is Nicholson Hall. To the west is Pleasant St. SE with Wulling Hall and Scott Hall on the opposite side of the street.

As seen in the picture, Johnston Hall produces a large shadow over the southern part of the site during certain times of the day. This photo was taken at approximately 12:20.

3. North Facing South

Figure 55.1

This view is from the north eastern side of the site, looking towards Johnston Hall. The site is surrounded by large, concrete sidewalks that were recently finished as part of a remodel. The edge of the grass on the eastern side of the site is lined with lamps and trees, alternating every five feet or so.

To the south the five story building Johnston Hall has a strong presence, casting shadows at certain times during the day over the southern part of the site.

Even though this site is surrounded by large, historic buildings, it still has a very open feel.

To the western side of the site is Pleasant St. SE. This view is from the North eastern corner looking west. Across the street from the site is Scott Hall with Wulling Hall to the south of it. Both of the buildings are only a couple stories tall and are relatively blocked from view by large trees lining the sidewalks.

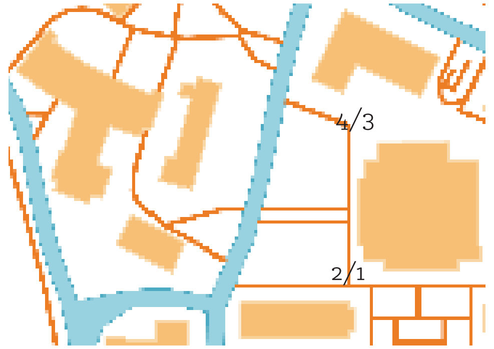


Figure 55.2

4. North Eastern Facing West

Light Quality

I visited the site at noon on a Saturday in October and despite being surrounded by buildings that were four plus stories the shadows that were cast didn't cover very much of it. In the picture bottom right the shadow caused by Johnston Hall is visible.

The natural light on the site was a comfortable level. At no point while sitting or walking around the site did I need sunglasses or felt the need block sun from my eyes.

The walkways on the site are lined with lamp posts that light up the paths at night, adding a feeling of security as well as adding to the aesthetics of the site.

Southern side of the site looking west

Figure 56.1

Figure 56.2

Top: Newly installed lamp posts

Bottom: South looking north west

Figure 56.3

Vegetation

The site itself doesn't have much vegetation, aside from grass and a large tree on the south side but the surrounding edges of the site have small, newly planted trees that line the edges.

This site was visited in mid October when the leaves were mid season change (see bottom right) and the campus was filled with beautiful colors.

Northrop Auditorium has newly planted landscaping (pictured top right) on the eastern side of the site.

On the eastern side of the site new small trees were planted, alternating trees and lamp posts every 5-10 feet.

Across Pleasant St. SE to the west of the site is Scott Hall. Outside of the building and lining the street is heavy vegetation, making the building blend in with the trees.

Figure 57.1

Figure 57.2

Figure 57.3

Wind/Water

The site is surrounded on all sides by large multiple story buildings as well as trees that are dense enough to block wind. During my visit to the site there was no indication of wind on site.

According to windfinder.com,which uses data from the Minneapolis/St. Paul airport, the two main directions that the wind blows (based on percentage) is south east and north west. For this site there are buildings located in each of those directions to act as a shield to the wind.

On site there is no visible water.

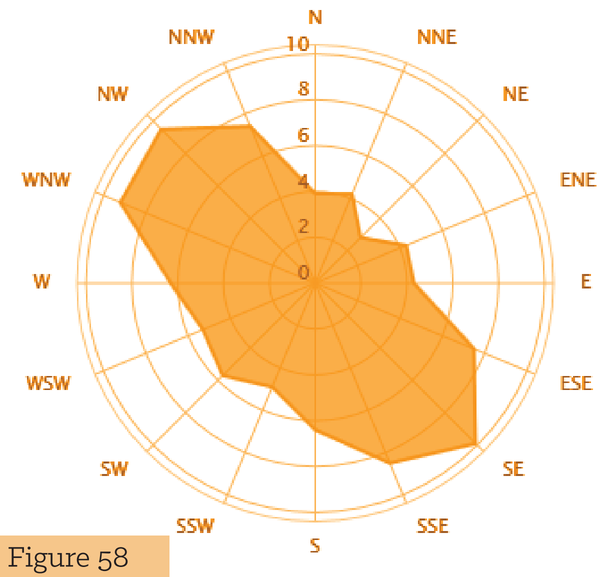


Figure 58

Human Characteristics/Distress

This site has heavy foot traffic and human interaction. Bordering the edges and the middle of the site are large, concrete pathways to allow for multiple people to walk on at once. The walkways are lined with trees, plants and lamp posts, adding an element of security at night.

The site is surrounded by large, old buildings which are an added human characteristic. When I visited the site it was a Saturday and a football game was going on at the time, so foot traffic was light but there were still plenty of people walking through the site. In the mall area adjacent to this site there were groups of students sitting the grass or playing catch with a football or frisbee.

This site was recently remodeled as part of the Northrop Auditorium renovation and just shows no current signs of distress. It has new paving, grass and landscaping.

Figure 59.1

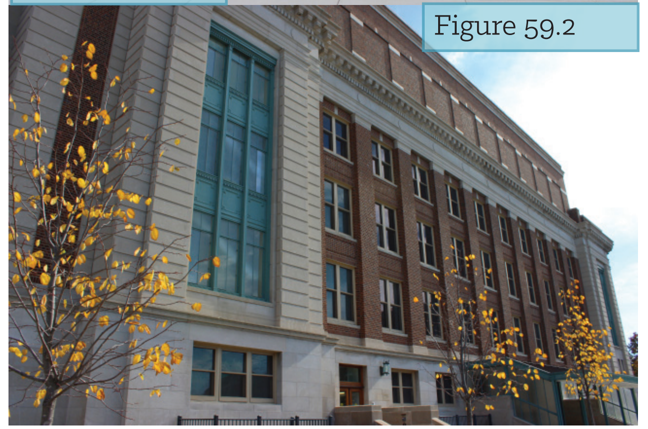


Figure 59.2

On the west side of this site is Pleasant St. SE, a road that runs through campus and links to Washington Ave SE.

On the map to the right, roads are showing in blue. There are many options for vehicles to travel to the site, as well as many parking options available nearby, including one underneath part of the Northrop Mall.

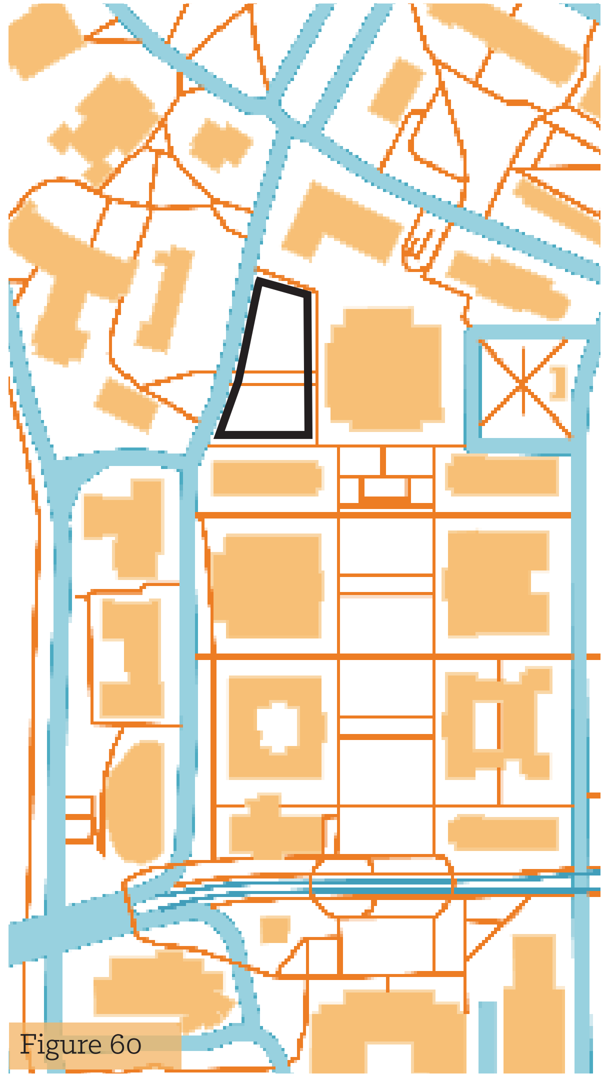


Figure 60

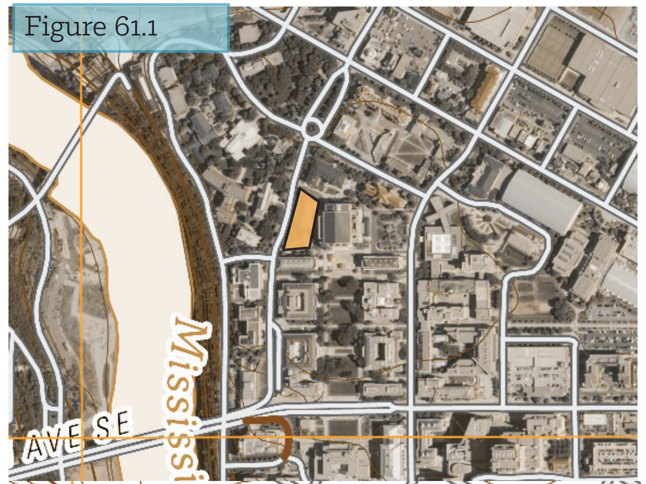


Figure 61.1

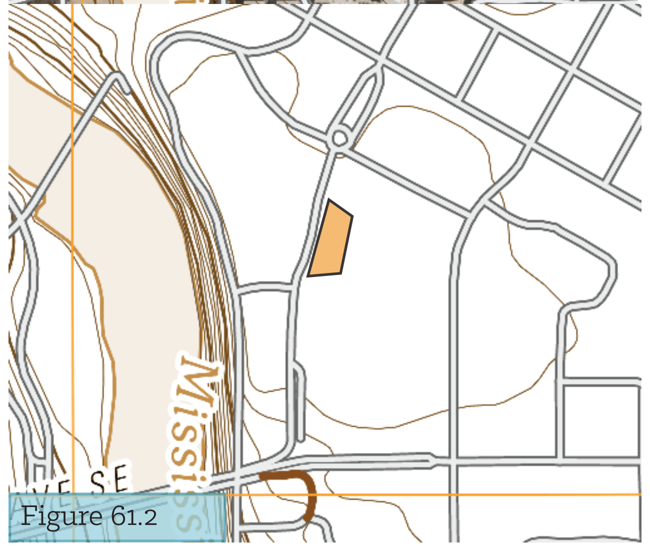


Figure 61.2

This site lies within a very flat area of land off of the Mississippi River and has a slope of less than 4%. Walking from one side of the site to the other had a very limited change of elevation.

To the south east of the site, the north end of Northrop Mall is elevated and is accessible via a stone stair.

The University of Minnesota's campus is very reliant on pedestrian foot traffic due to the majority of parking being off of the main campus in large ramps.

Pictured on the map to the right in dark orange are the walking paths nearby the site. Northrop Mall has extensive walking paths set up in a grid that are heavy traffic for students and faculty during the week.

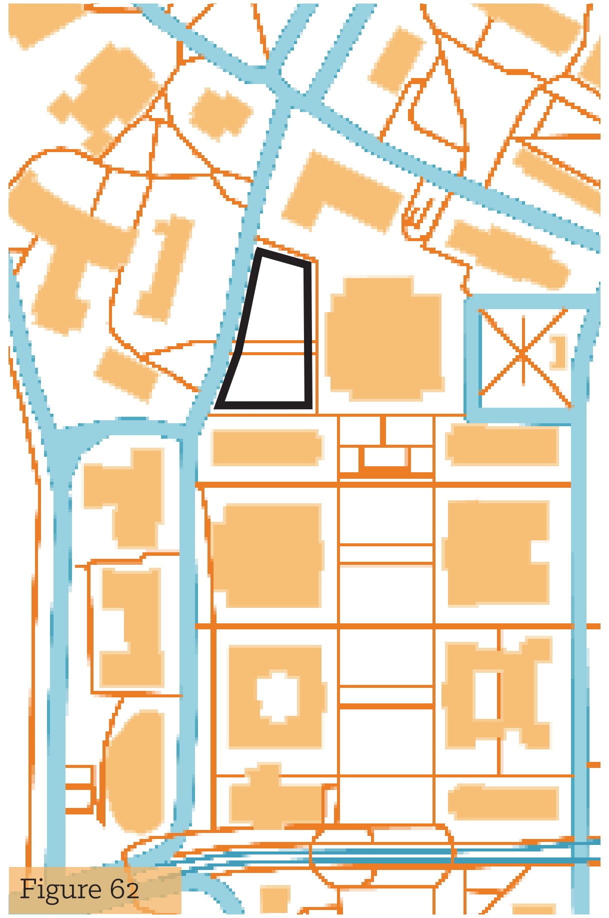


Figure 62


Figure 63

This site was once home to Wesbrook Hall that was torn down in 2011 due to the costs involved with making it economically viable. Because of this the site was recently redone, putting in new landscaping and concrete pathways. There is no erosion or decaying landscape, just new trees beginning to grow.

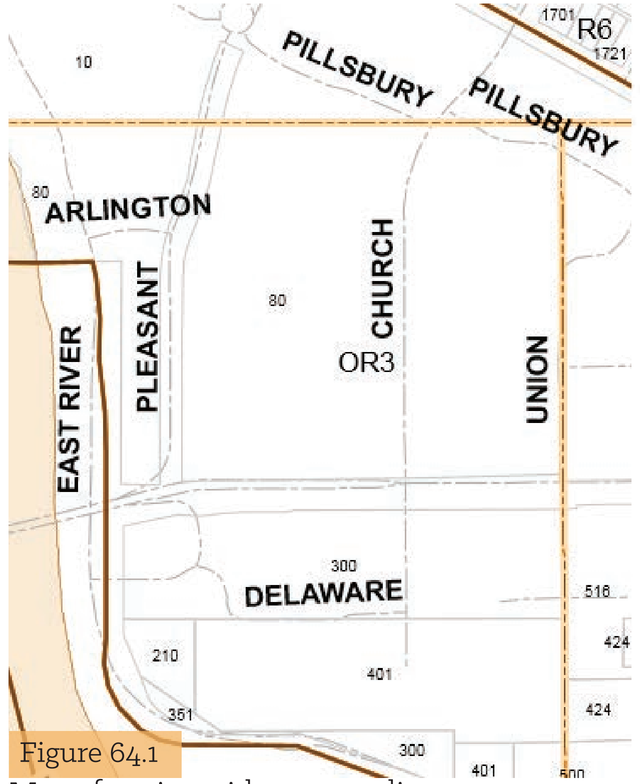


Figure 64.1
Map of zoning with property lines
Courtesy of the City of Minneapolis

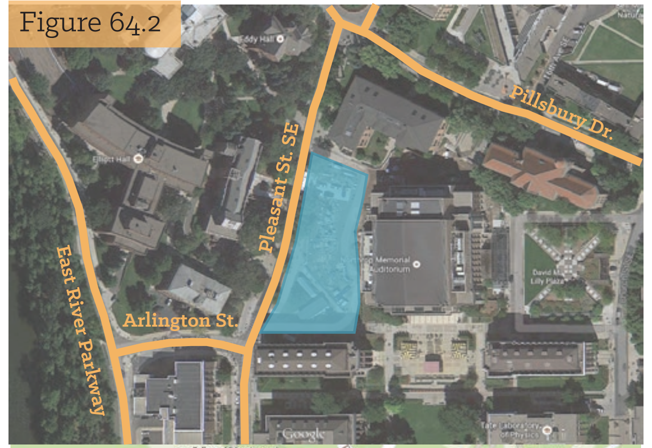
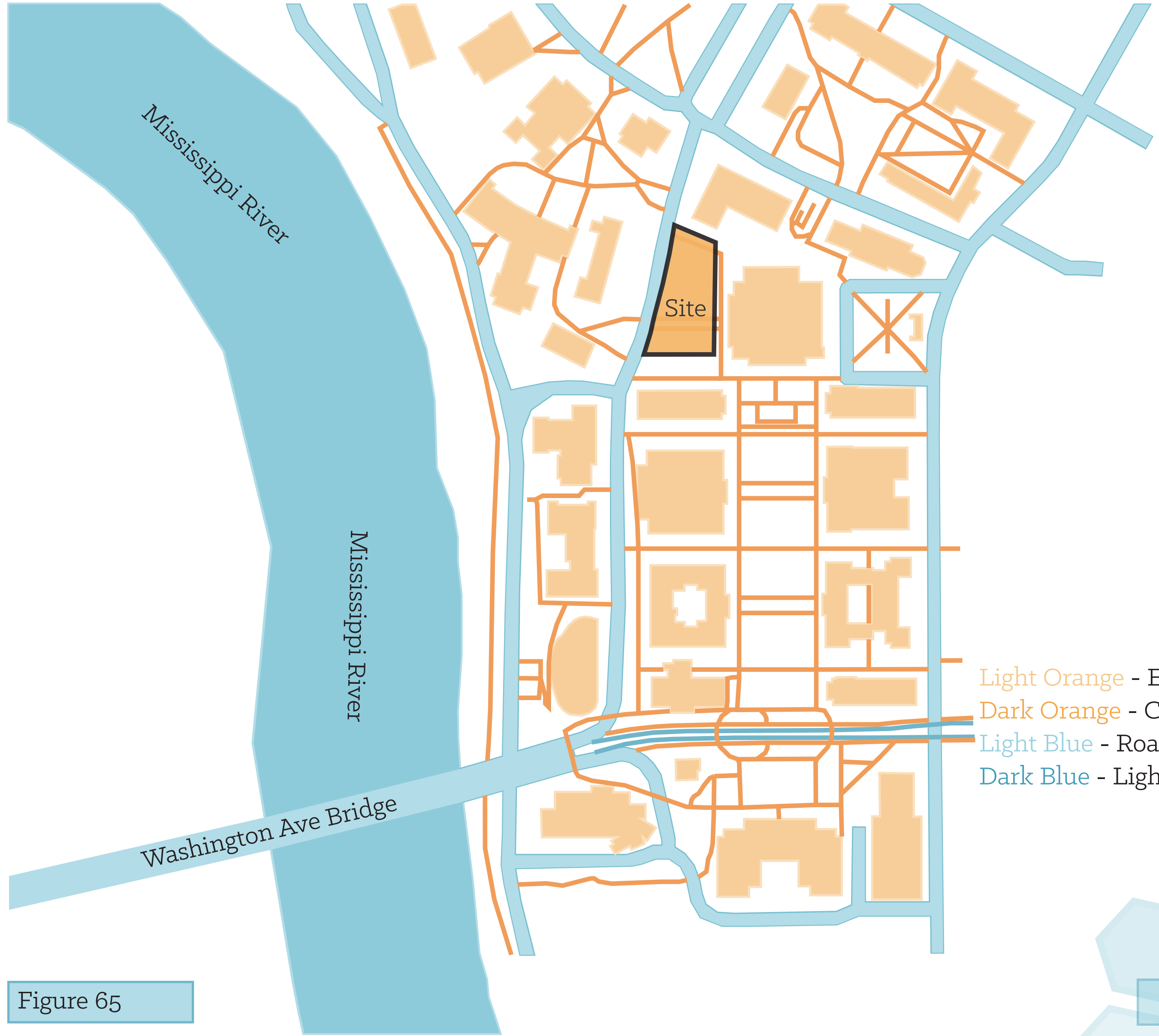


Figure 64.2

Figure 64.3
Top: Satellite Image with emphasis on site/roads
Bottom: Google Figure Ground
Both maps courtesy of maps.google.com



Light Orange - Existing Buildings
Dark Orange - Concrete Walkways
Light Blue - Roads
Dark Blue - Lightrail

Figure 65

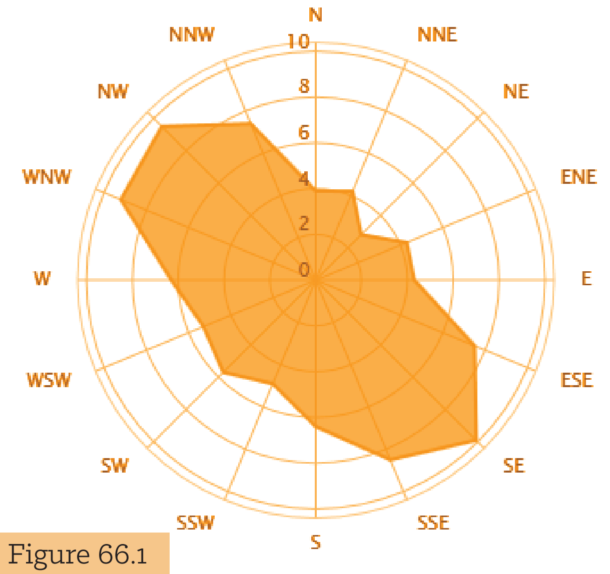


Figure 66.1

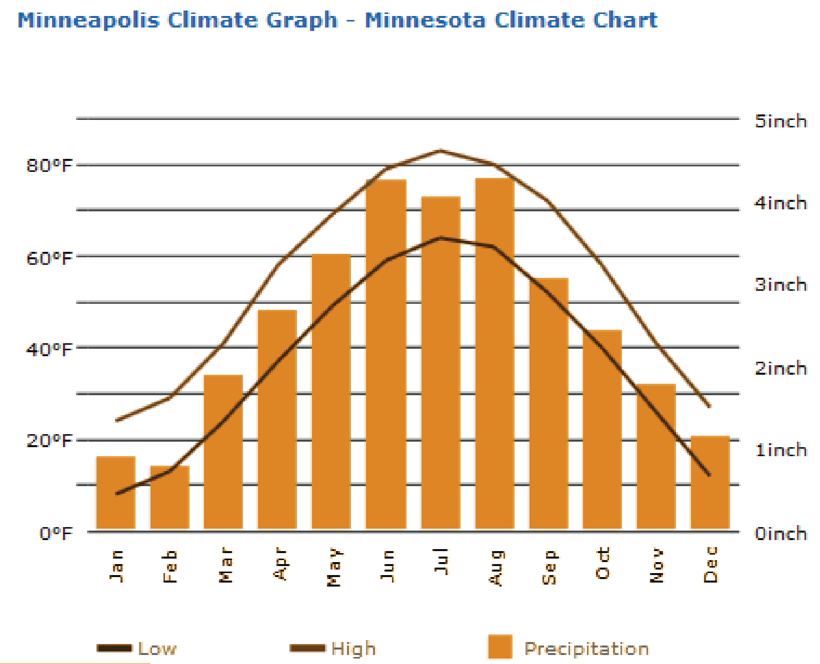
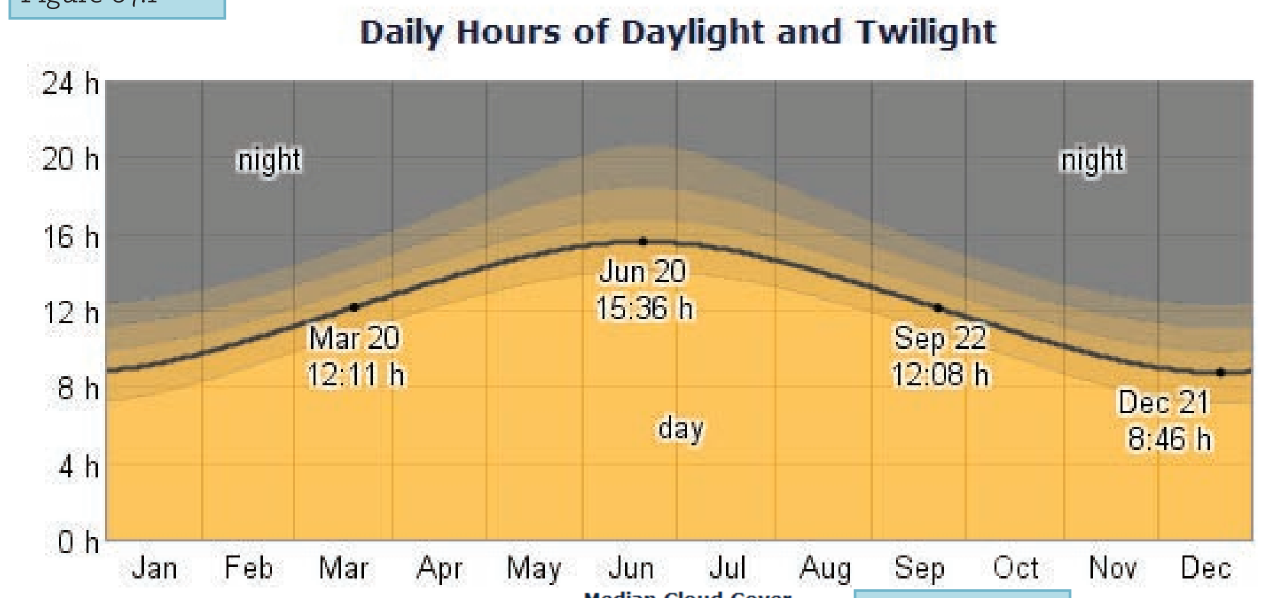


Figure 66.2

Figure 67.1



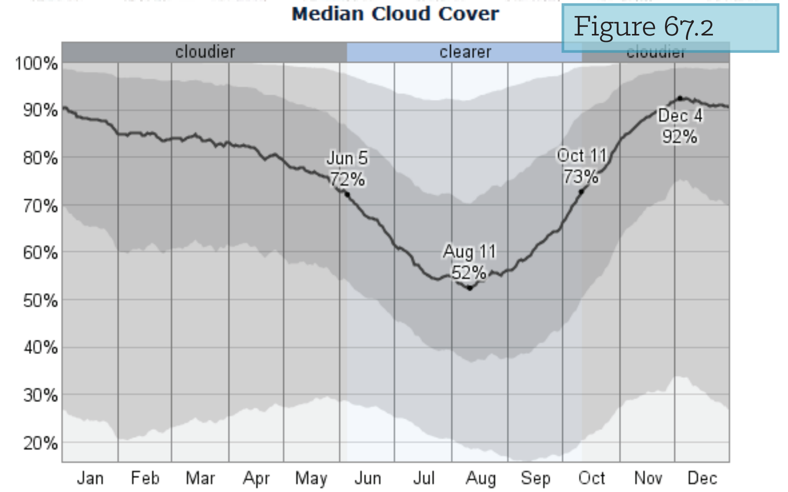


Figure 67.2

Figure 68.1

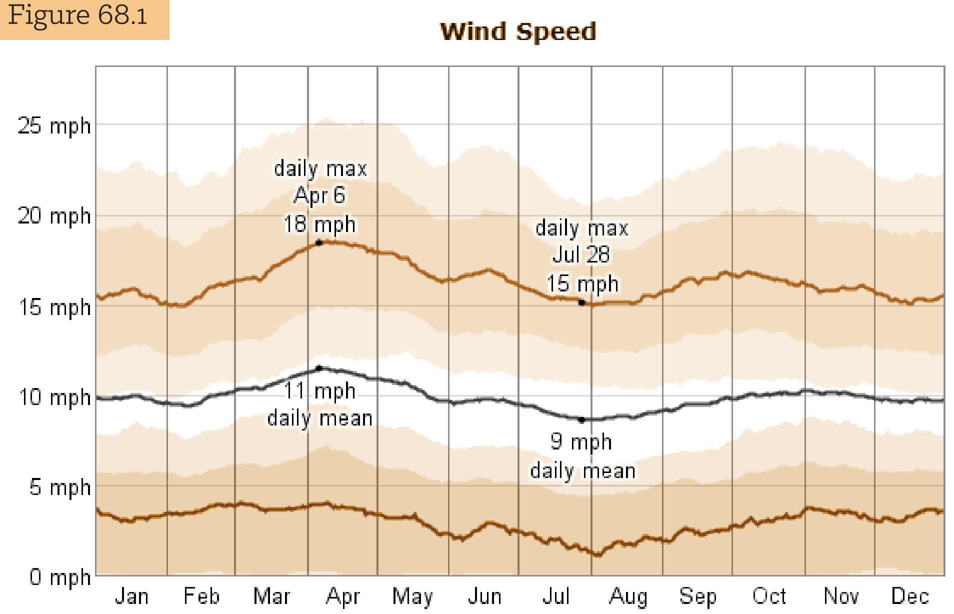


Figure 68.2

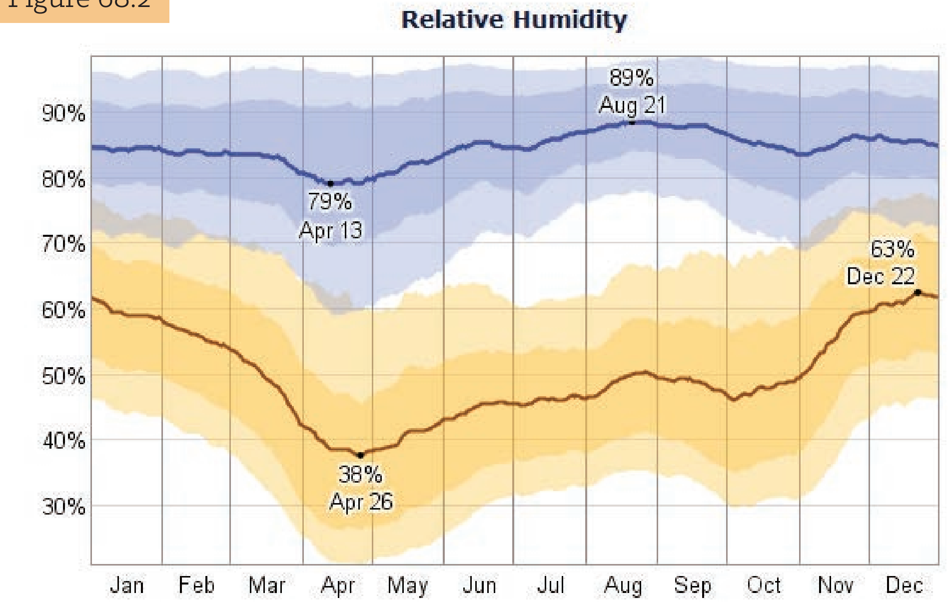


Figure 69.1

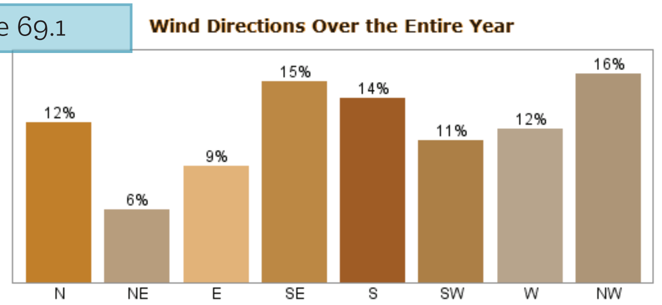
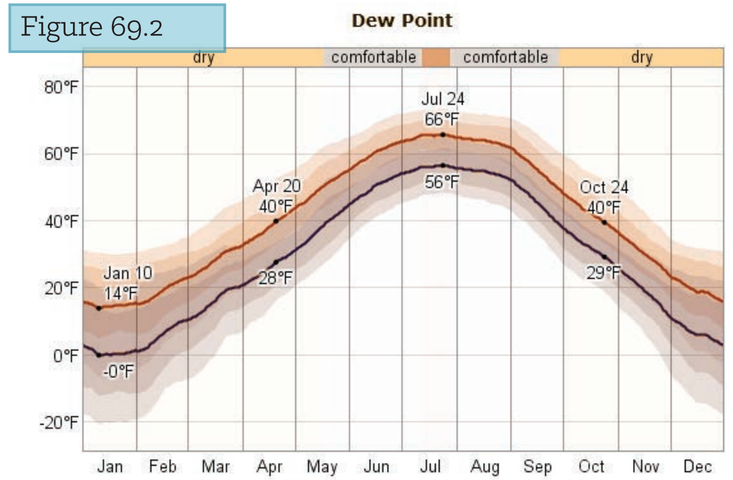


Figure 69.2



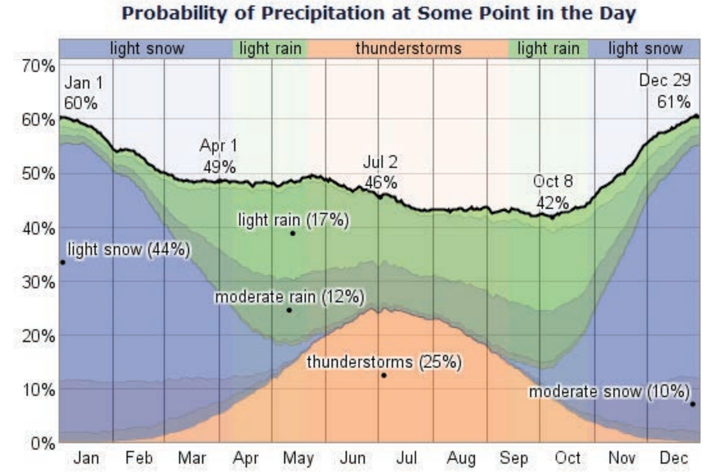


Figure 69.3

Types of Spaces

Administration
- *reception*
- *board room*
- *offices*
- *storage*

Workshops
- *wood working*
- *machining*
- *metal working*
- *3d printing*
- *laser cutting*
- *CnC milling*
- *sewing*
- *electronics*
- *innovation*

Cafe
- *seating*
- *kitchen*
- *storage*
- *storefront*

Social areas
- *lounges*
- *meeting rooms*
- *breakout spaces*
- *kitchen*
- *dining area*

Media Center
- *presentation spaces*
- *computer labs*
- *storage*
- *meeting space*

Restrooms
- *1/50 occupants*

Mechanical

Custodial

Gallery
- *display area*
- *storage*
- *reception*

Locker Room
- *showers*
- *lockers*
- *storage*
- *restrooms*

Work Areas
- studio space
- desks
- modular meeting spaces

Educational	
Administration	3,500 sq. ft.
Offices	3,000 sq. ft.
Workshops	15,000 sq. ft.
Lecture Rooms	8,000 sq. ft.
Community	
Cafe	1,000 sq. ft.
Lounges	3,000 sq. ft.
Computer Labs	2,000 sq. ft.
Presentation Spaces	2,000 sq. ft.
Breakout Spaces	2,000 sq. ft.
Restrooms	3,500 sq. ft.
Mechanical	4,000 sq. ft.
Custodial	1,000 sq. ft.
Shared	
Gallery	1,500 sq. ft.
Locker Rooms	2,500 sq. ft.
Studio Space	10,000 sq. ft.
Auditorium	3,000 sq. ft.
Total:	~65,000 sq. ft.

Interaction Matrix

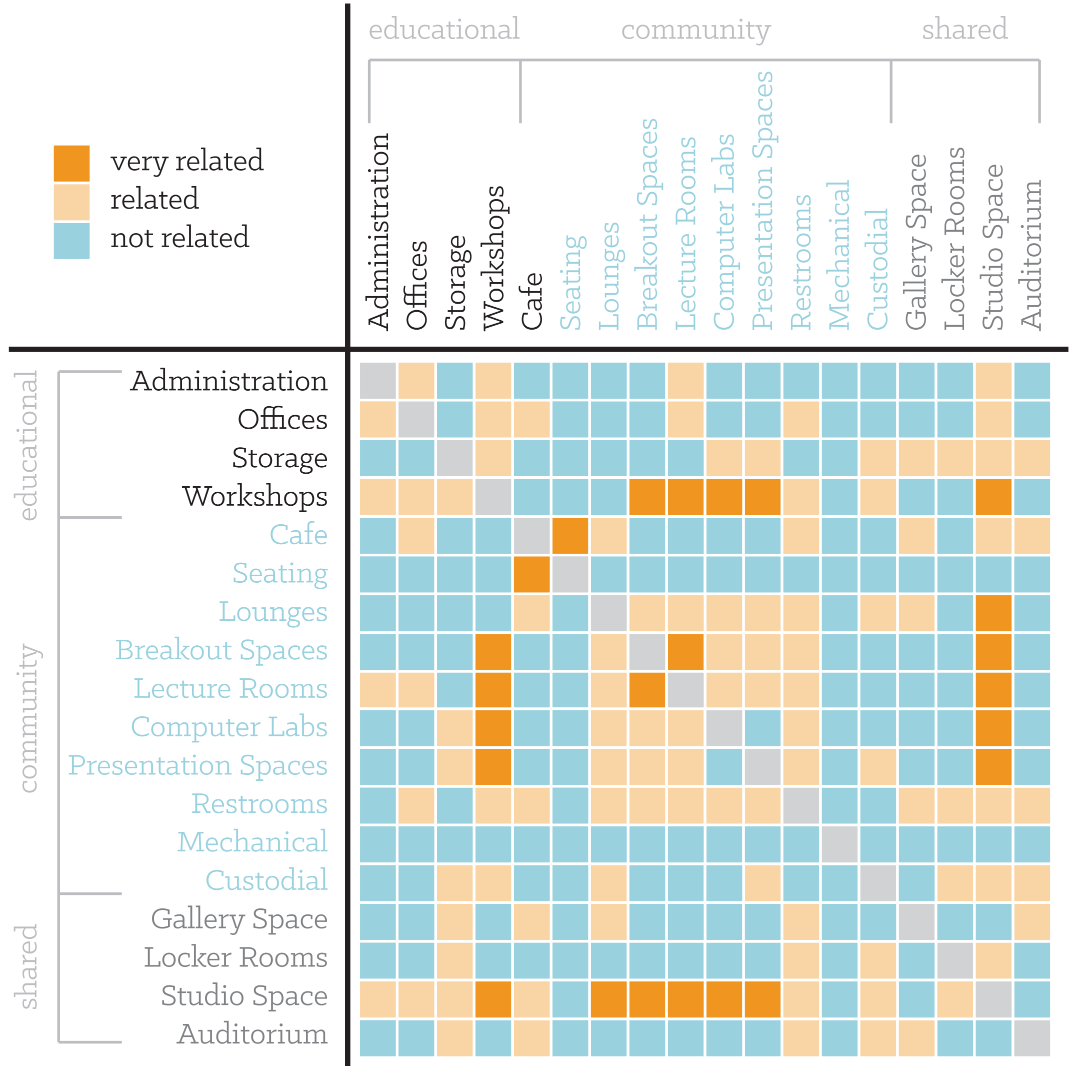


Figure 72

Interaction Net

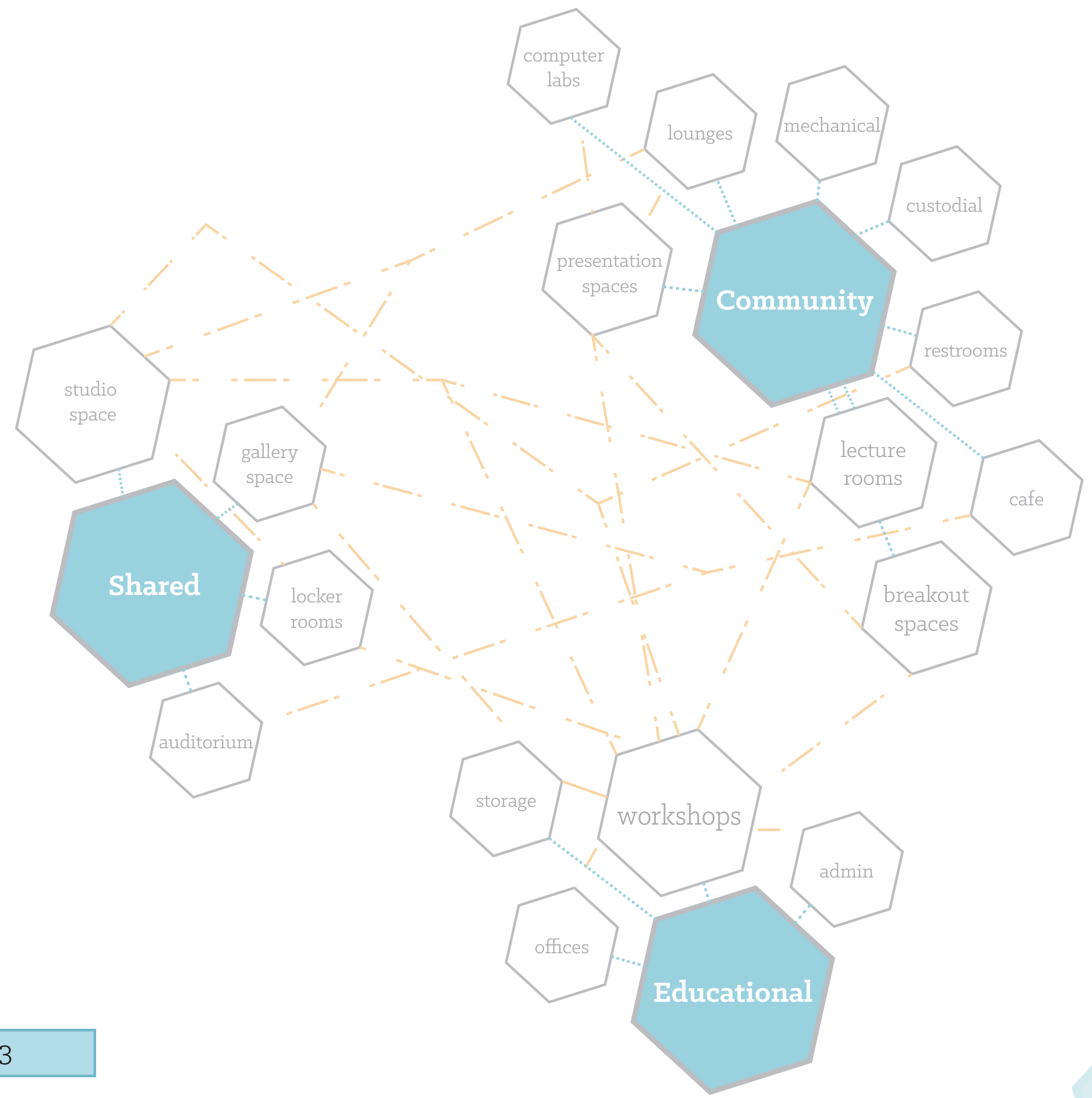


Figure 73

Spatial Utilization

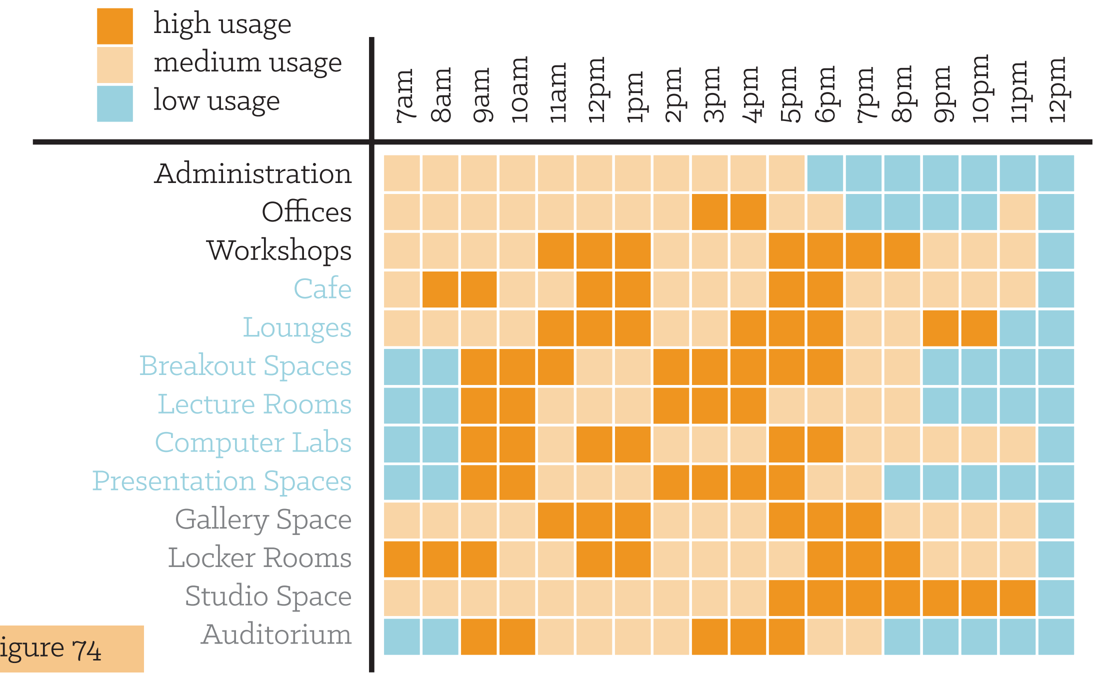
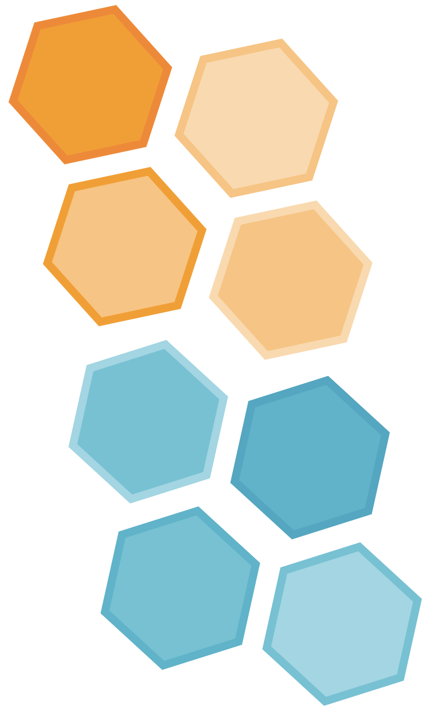


Figure 74

This facility is designed to be operated similar to a campus wellness center, with facilities open from 7 am until 11pm, allowing students with varying schedules access to the building to fit their best interests.

Staffing could work in a similar manner, with certain classes/ workshops held at certain times during the day and the facilities and equipment would be monitored and run by trained students.

Thinkbox is operated in a similar manner in which trained students are employed to supervise equipment and space

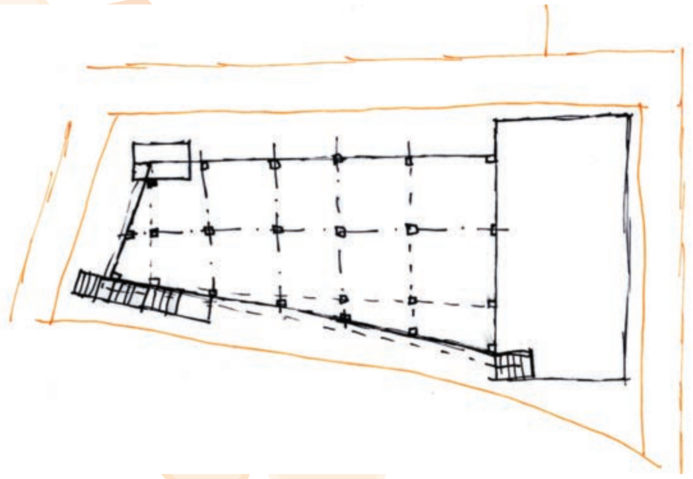


Exterior building materials include exterior brickwork mixed with modern glass facades, concrete, possible stone work and metal paneling.

Interiors will utilize a mix of brick and stone work, with gypsum walls, glass metal and reused wood, with a color scheme similar to the colors to the left.

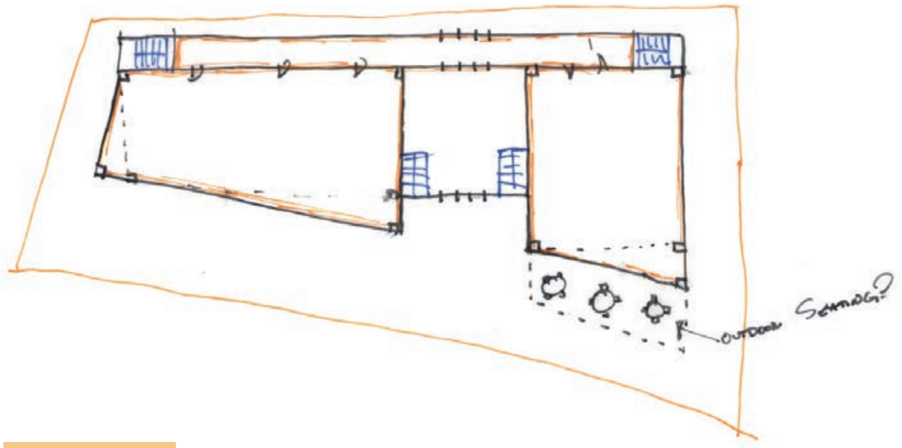
The design of the facility will feature an open plan, utilizing natural lighting with overhead, recessed lighting as a compliment.

Figure 75



My process started with general floor plan layouts and sketchup massing with consideration to site.

I went through many different iterations and layouts of the initial design process until deciding on what would be come the final layout.



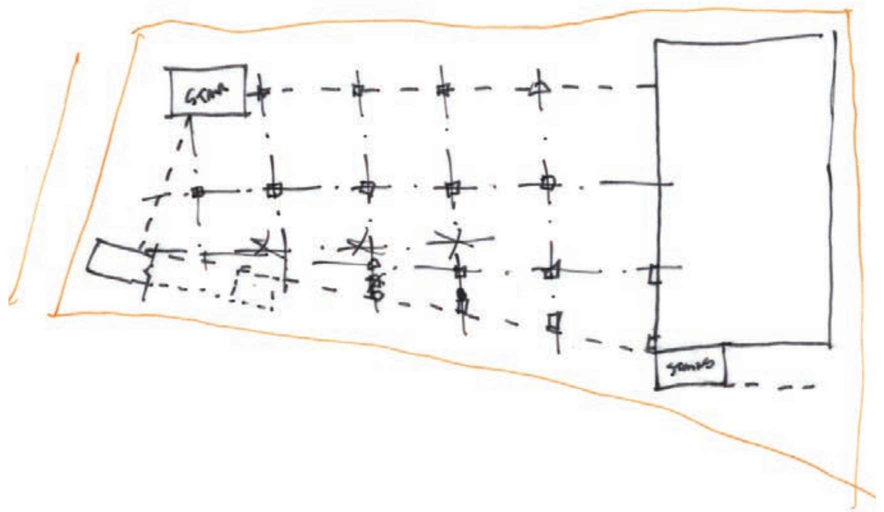
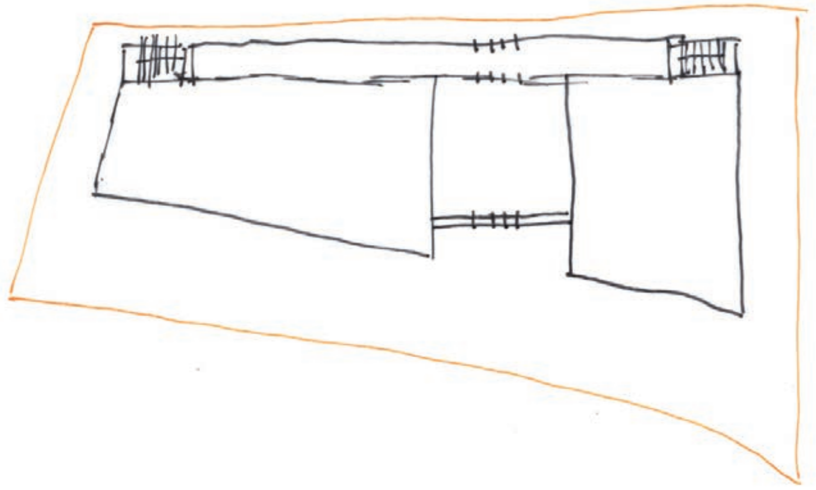


Figure 76



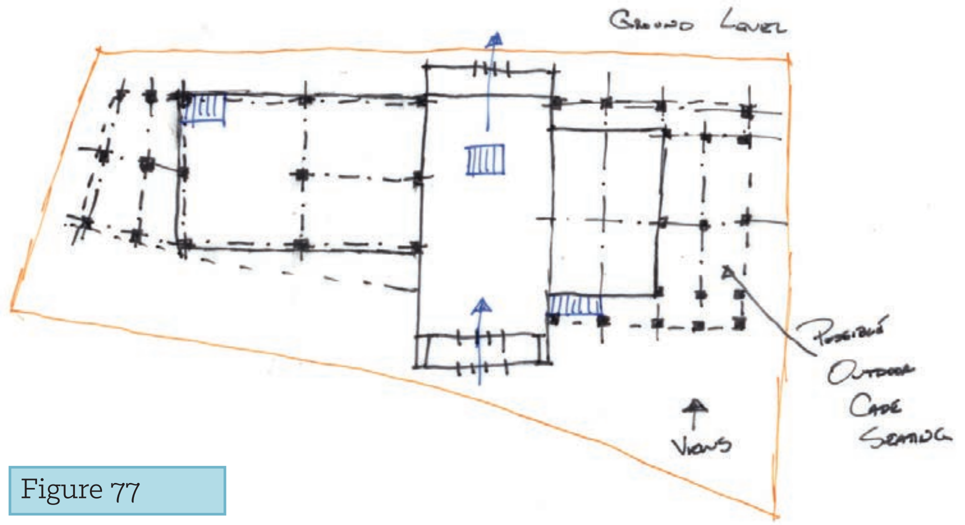


Figure 77

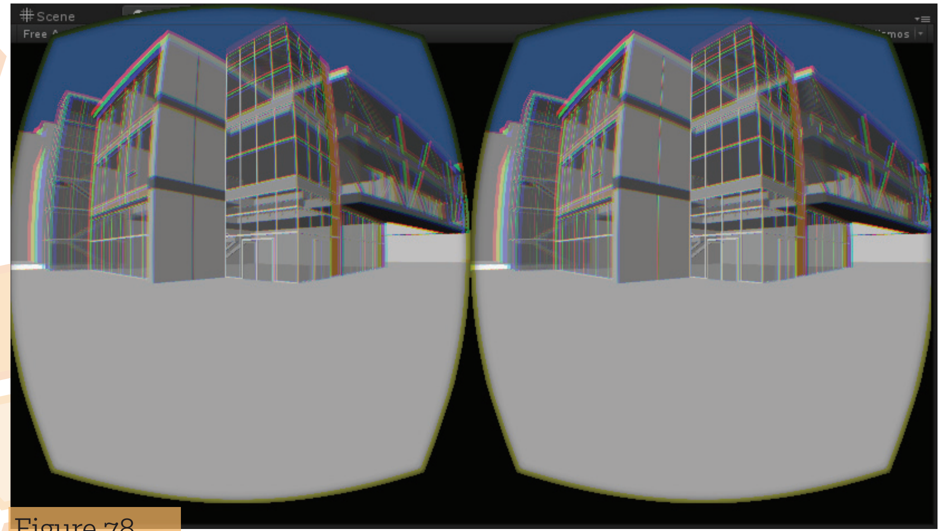
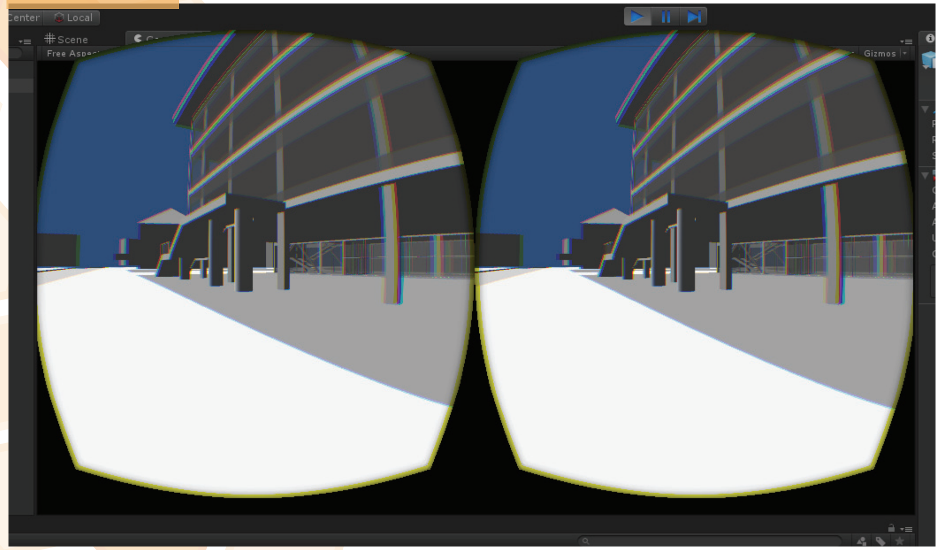


Figure 78



As part of my process I wanted to utilize the Oculus Rift Virtual Reality Headset as a design tool.

This involved creating a workflow from Sketchup and Revit to a game creation software called Unity. The first several weeks were spent learning how to use the software efficiently with design software.

The first test of the Oculus for design purposes was viewing the building massings in their context with the surrounding site.

This created an extra element in determining if the building size and spacing was appropriate. It's one thing to view this on a screen and a completely different thing to view it in virtual reality.

In the design professional this could be used a design tool as well as a visualization tool for clients.

I used the Oculus throughout my design process, working on exteriors and interior spaces.

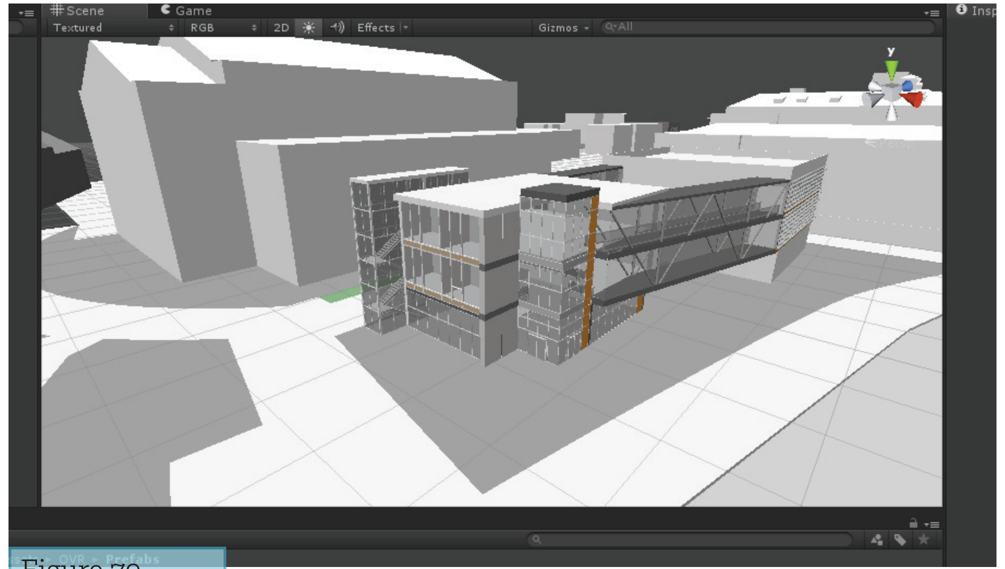
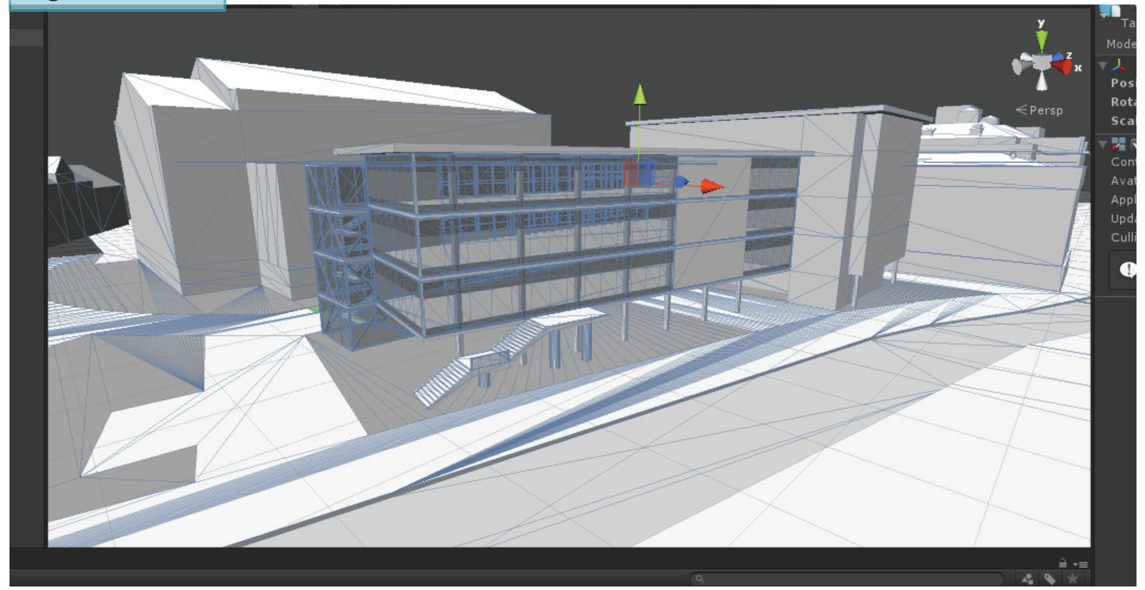


Figure 79



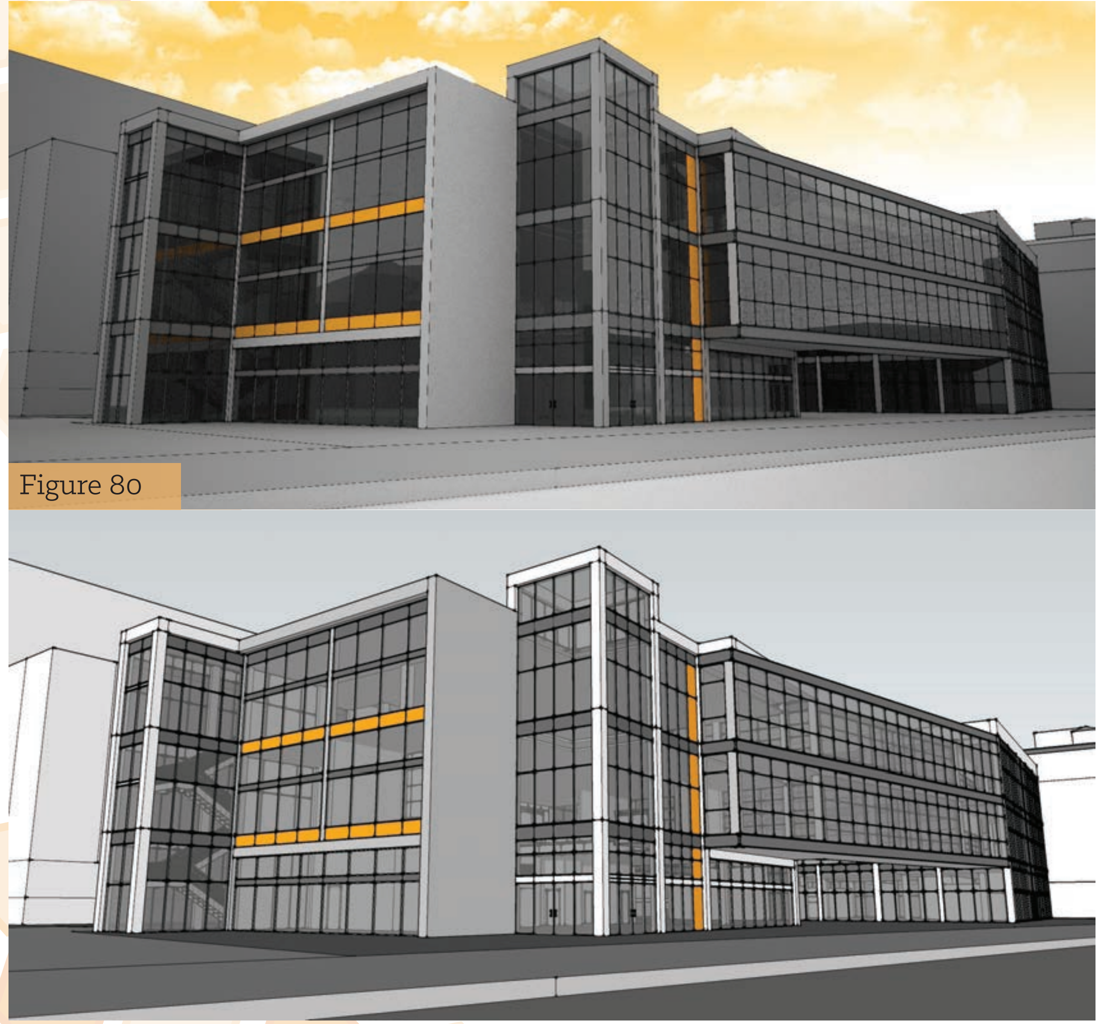


Figure 80

During the design process, AutoCAD, Sketchup, Revit, Unity, Maxwell Render and the Adobe Creative Suite were used on the digital end.

In the initial design process, Sketchup and Revit were used heavily along side the Oculus Rift.

After midterm reviews it was pointed out that the initial concept design stages were rushed a bit to get to the digital side so I went back to hand sketching.

For the final design and production, Sketchup and Maxwell Render 3 were primarily involved. Sketchup was chosen for its easy integration with Unity as well as a high skill level with the software.

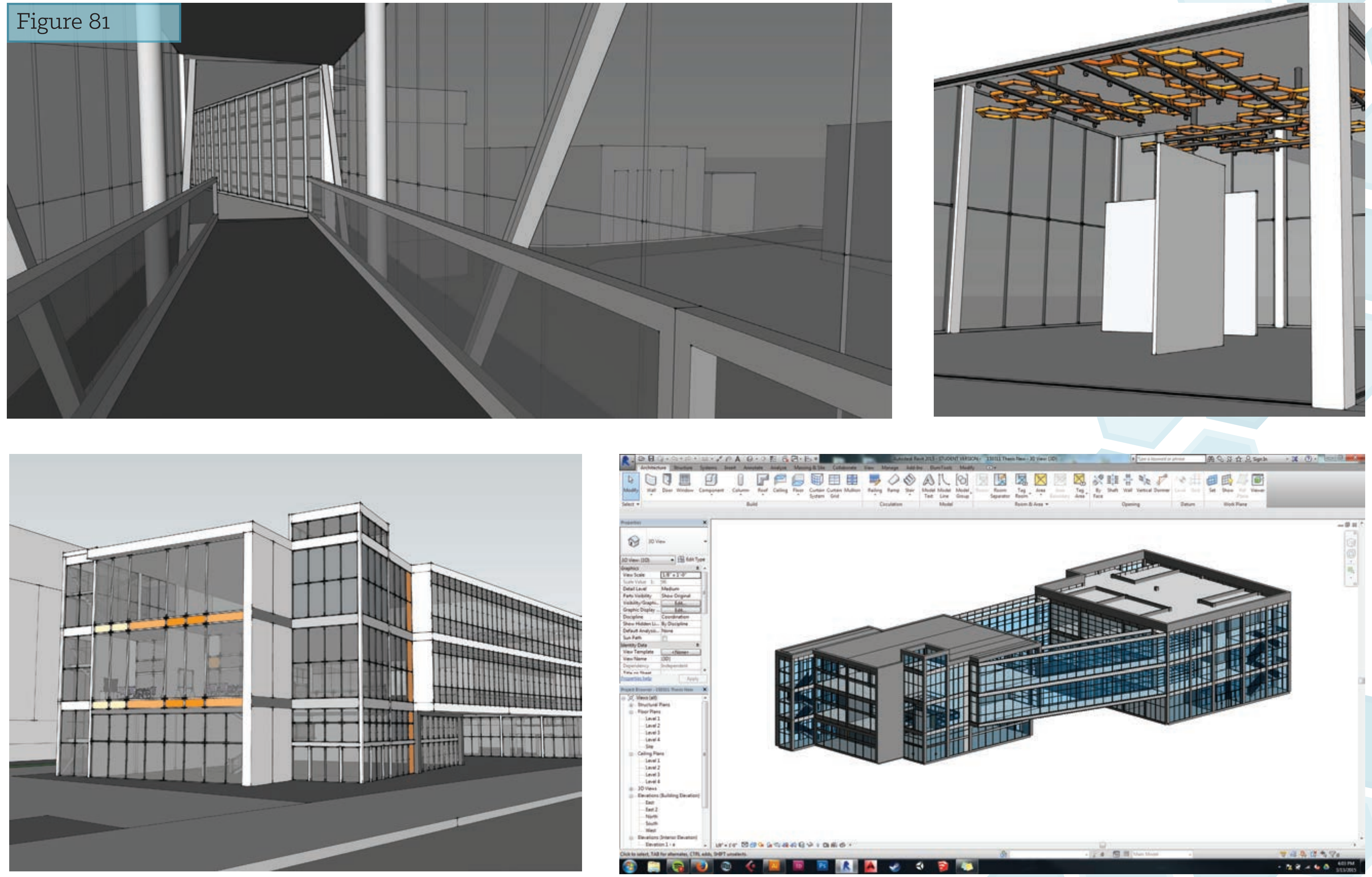


Figure 81

Sketching was done throughout the design process, emphasizing facades and programming.

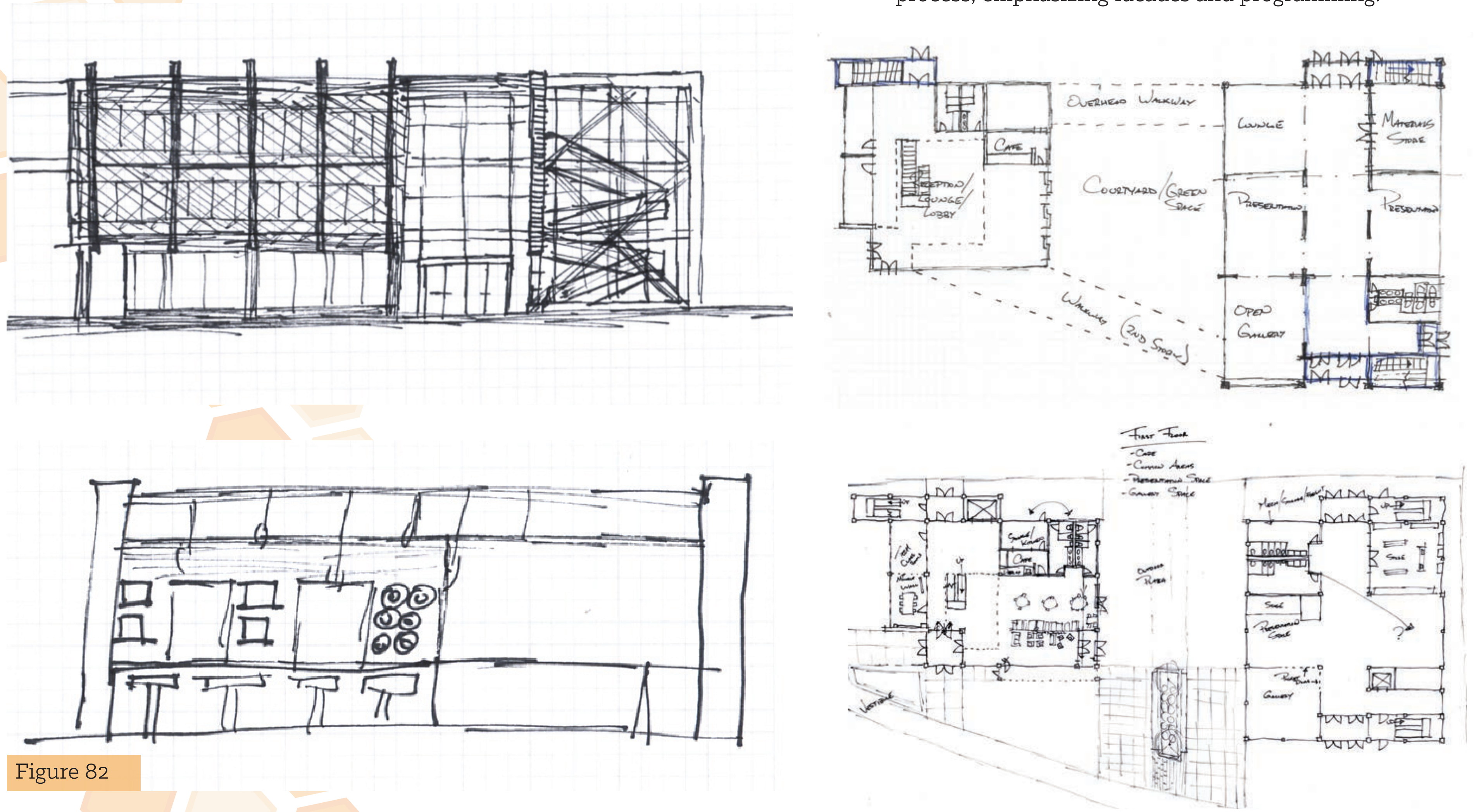


Figure 82

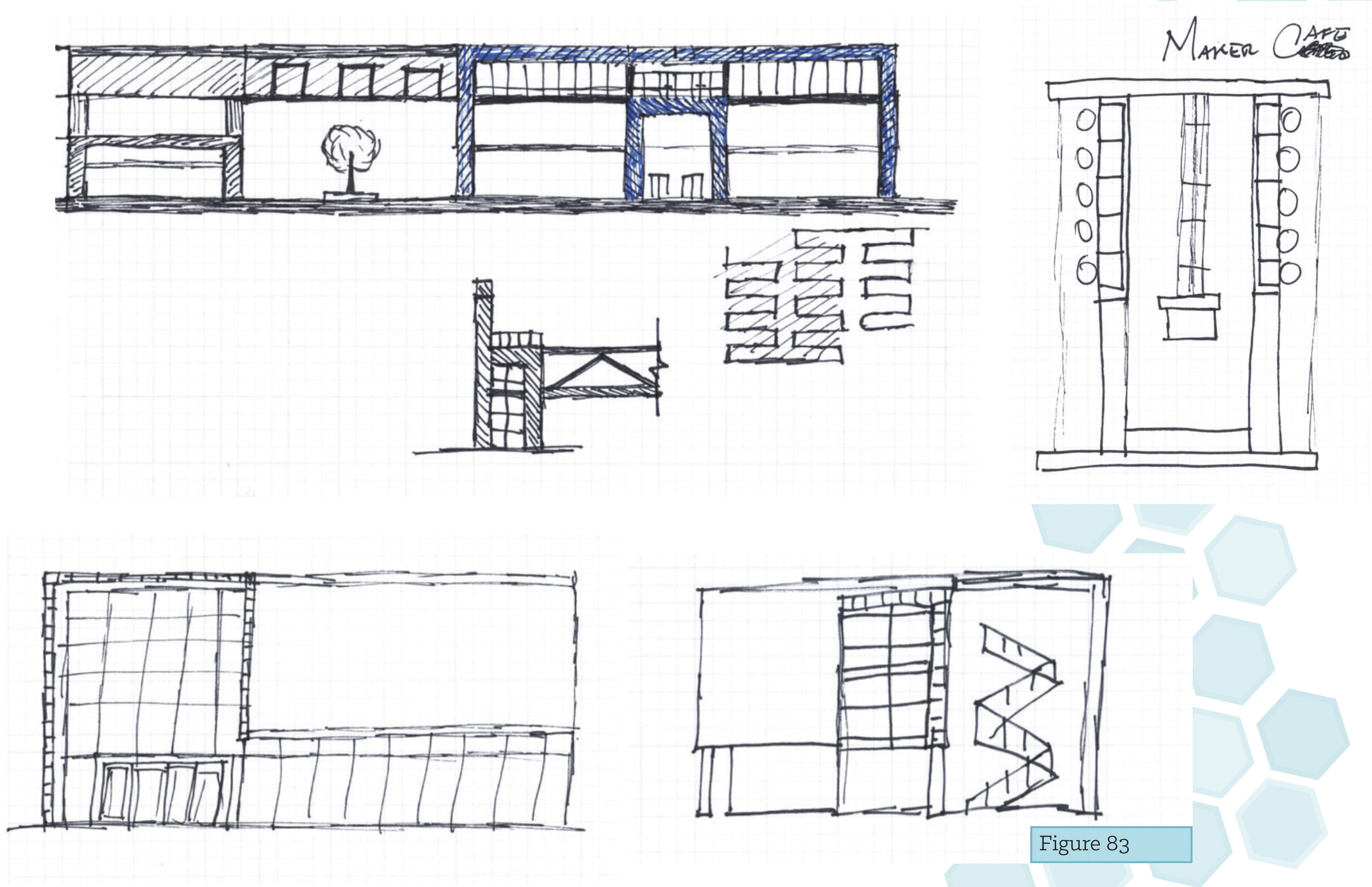


Figure 83

Project Solution

Figure 84

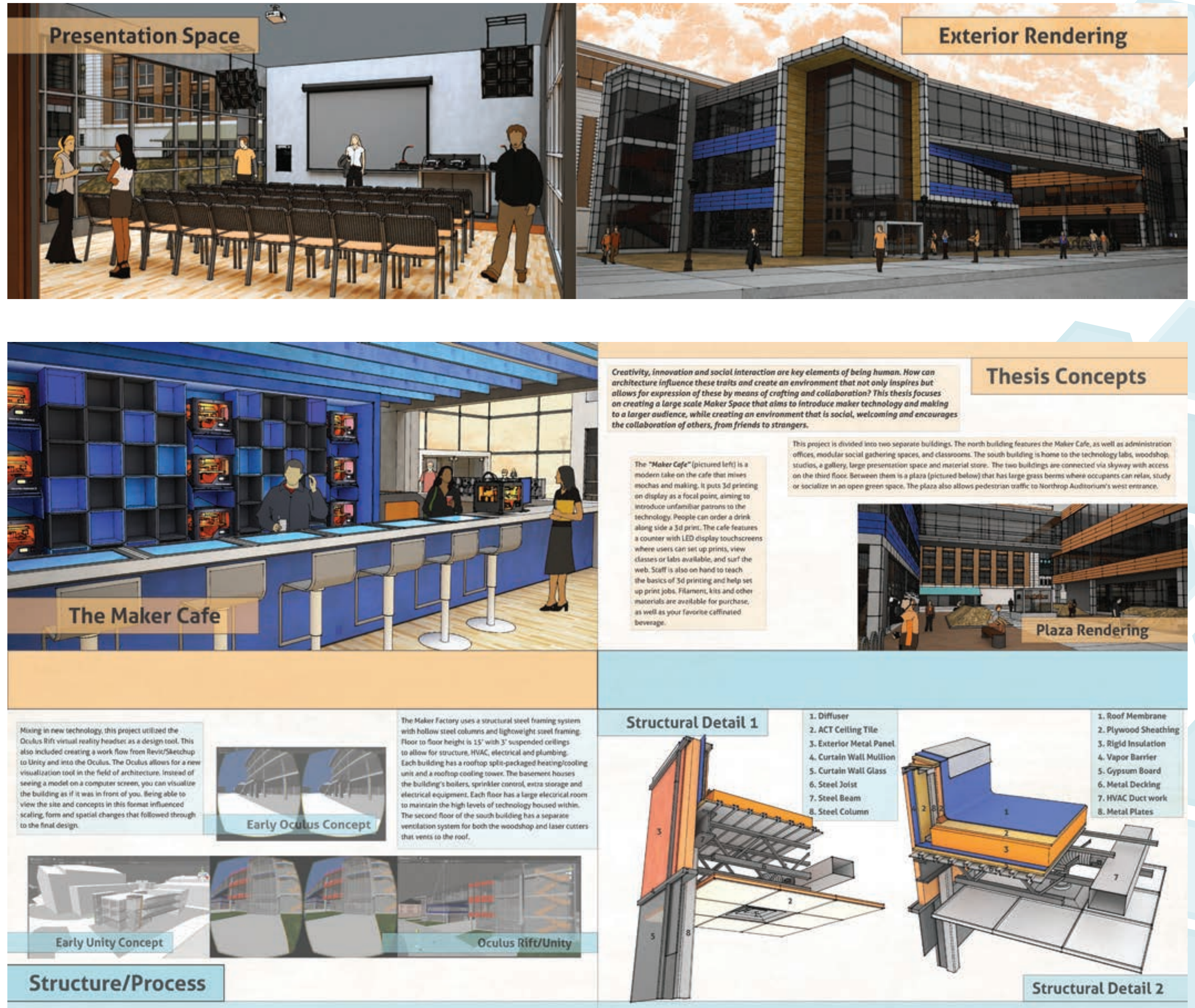


Figure 85

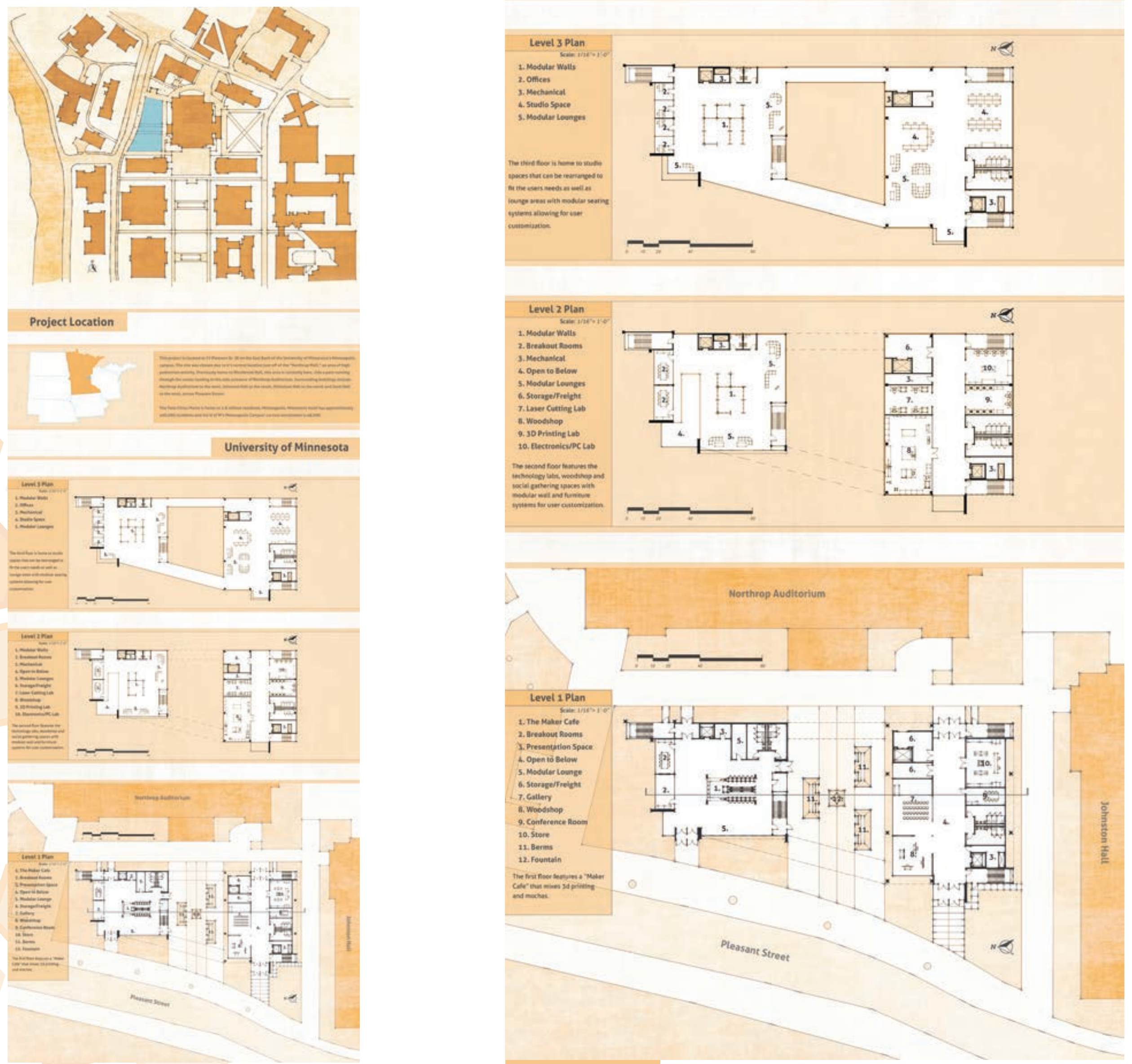


Figure 86

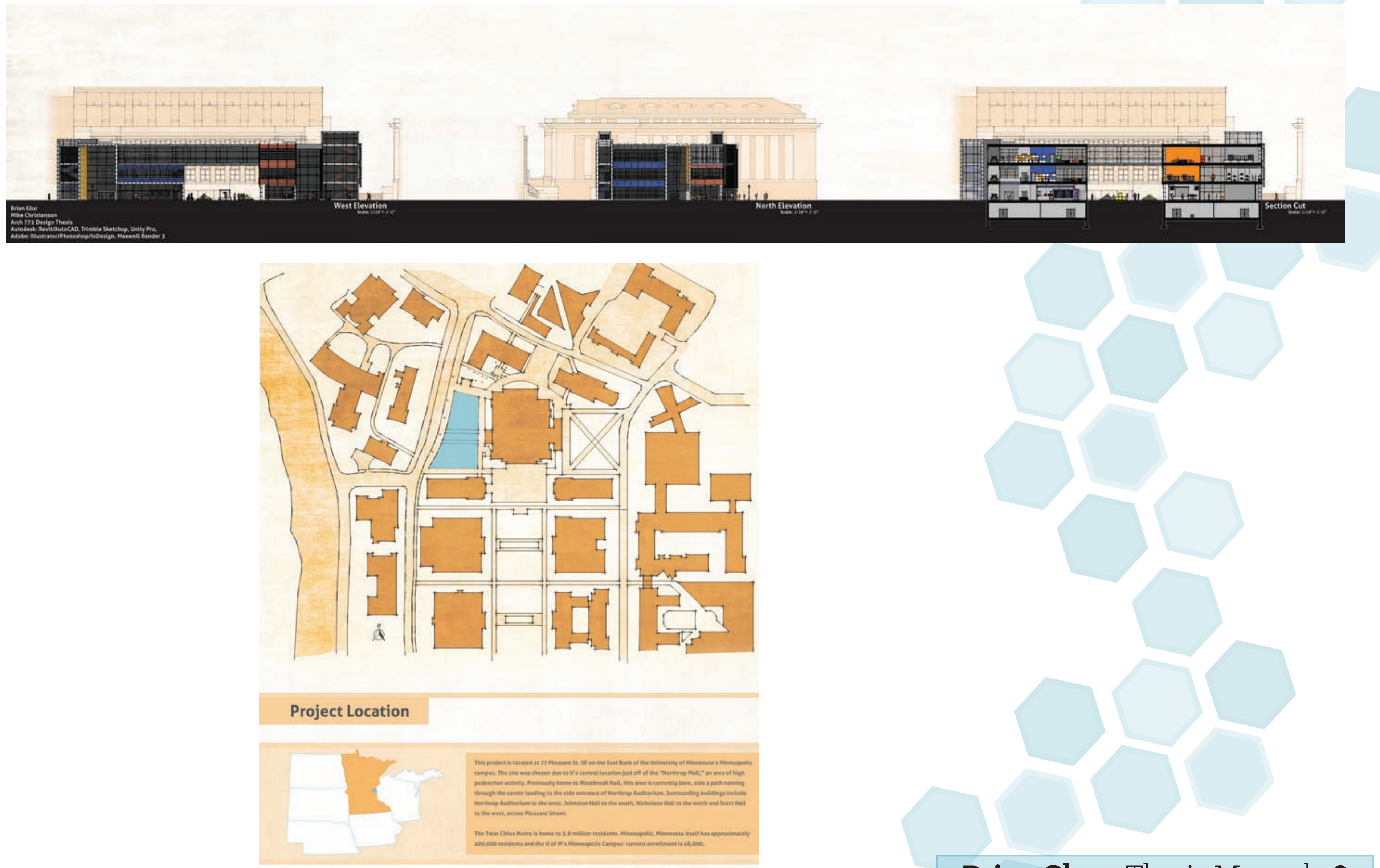


Figure 87

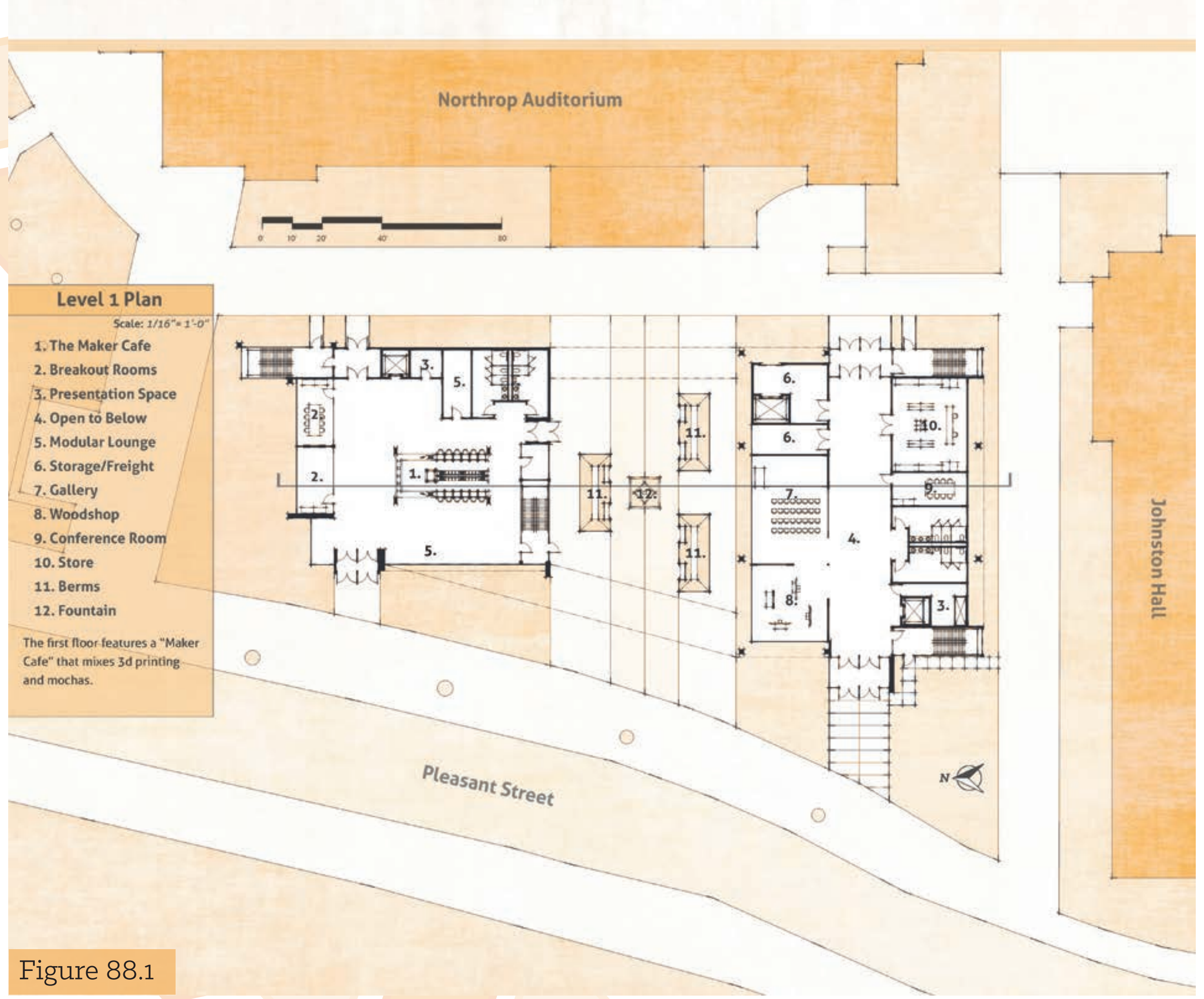


Figure 88.1

The final design kept the current site circulation and utilized the existing central path to Northrop Auditorium's west entrance as a plaza with large berms for social interaction and gathering.

The main entrances of each building are at main points of pedestrian circulation on the site.

The site itself is surrounded on all sides by existing buildings. One of the goals of the design was to create a building that wasn't overwhelming of the surrounding buildings. The final design has a smaller footprint and was limited to three stories above grade.

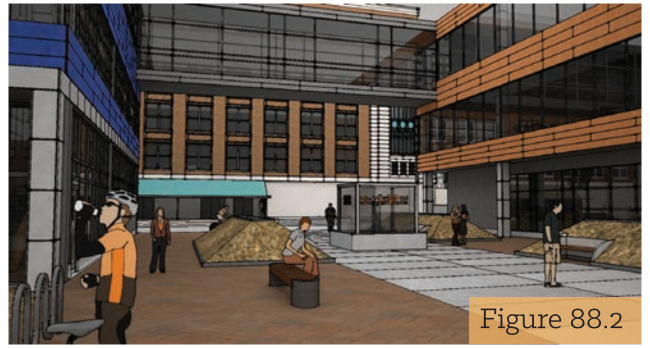
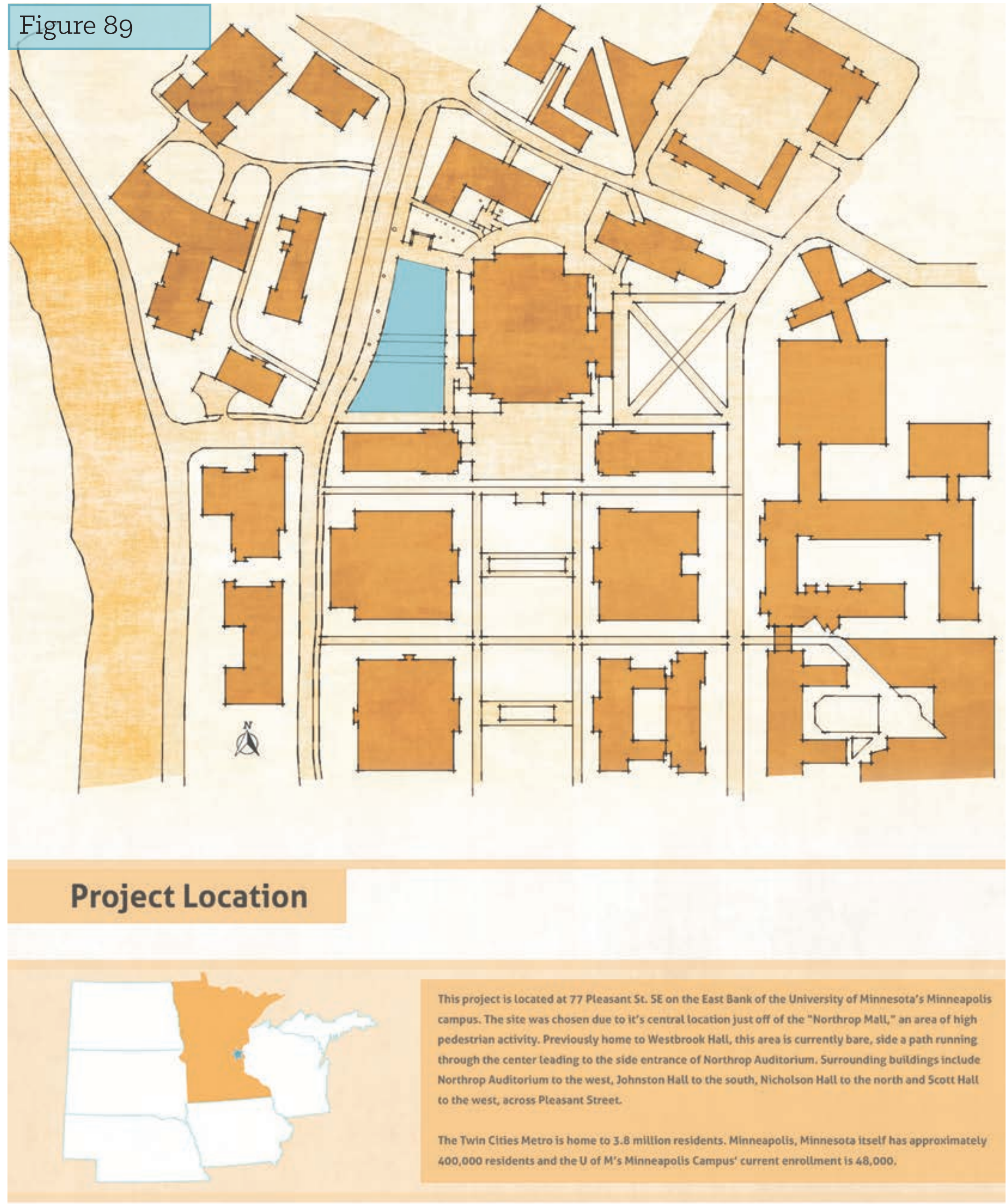


Figure 88.2

Figure 89



In my typology research I found three main types of maker spaces; the DIY, commercial and educational. I decided to focus on the educational maker space and chose the U of M for a site.

Studying various maker spaces around the country helped with programming in seeing which spaces they put near each other and what seemed to work and didn't work. I chose to keep the labs on one level and very open to allow for easy collaboration and viewing of others work.

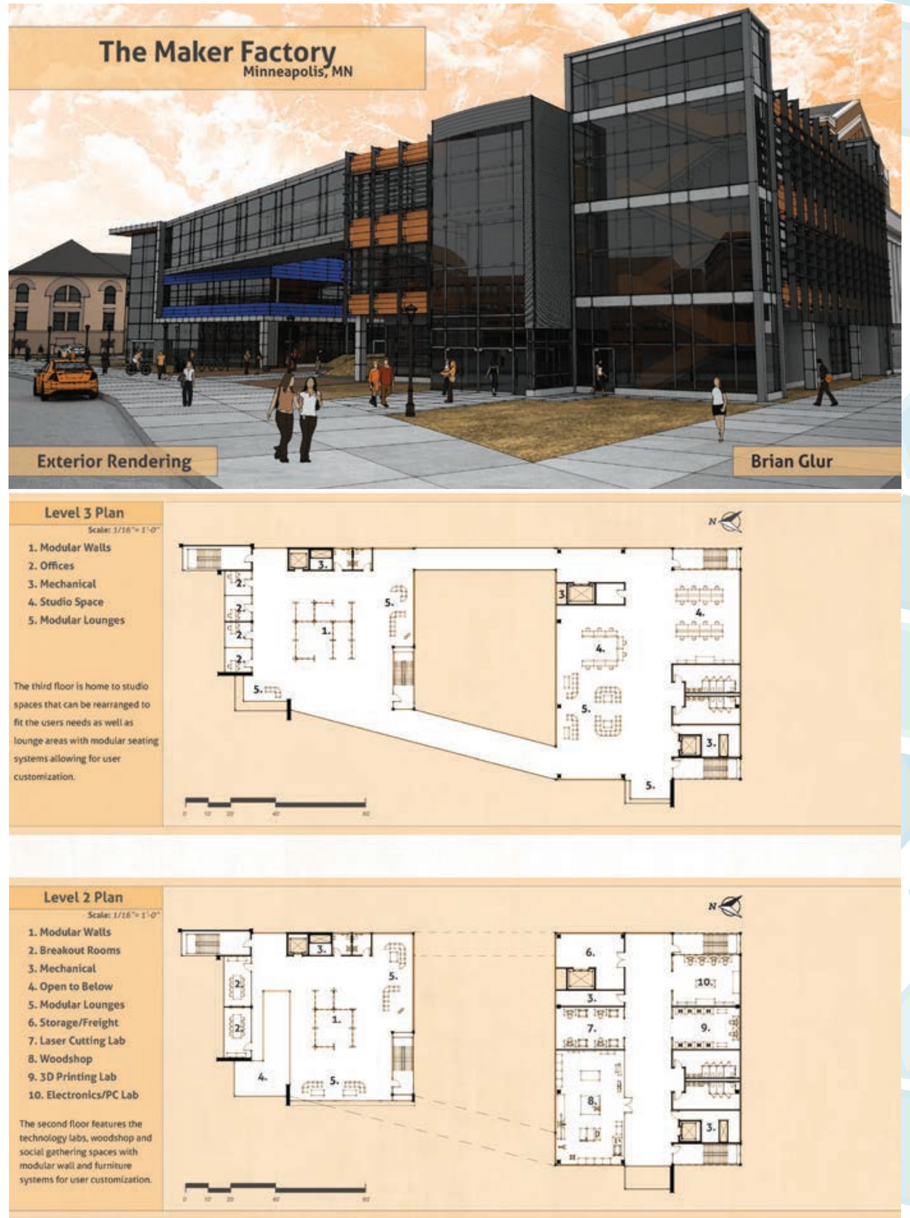
The main level in each building is kept fairly open and what is going on in the inside is easily viewable outside, allowing passing pedestrians to see the interior activities.

The studios are very open and customizable, allowing the spaces to be arranged according to the user. The open space allows for users to see what others are working on, opening the door for conversation, collaboration and teaching.

On the programmatic side of the design, the main levels were designed to attract the average student with the maker cafe in the north building as well as breakout spaces and a gallery, bookstore and presentation space in the south building.

The second level on the north building is home to modular wall systems and movable modular furniture. This floor is general social and meeting space. The south building's second floor features a 3d printing lab, large woodshop, laser cutting lab, and electronics lab with pc workstations.

The third level on the south building is home to the studio space as well as studio lounge. The north building's third floor is similar to the second but has administration/faculty offices.



The Maker Cafe creates a space that draws in the average person looking for coffee and introduces them into the culture of making. The counter features LCD touchscreens with internet access similar to a cyber cafe as well as information on 3d printing, making and classes offered.

Staff is on hand to assist and teach 3d printing while also crafting delicious mochas. Users can order a 3d print and wait for it while enjoying a beverage from the cafe.

The goal of this thesis project was to create a space where students could gather and collaborate while learning about maker culture. This final design featured collaborative studio and social spaces and open lab space.

The main level on each building was designed to be easily utilized by anyone on campus, regardless if they are there to create. This attempts to draw in the general population and allows them a glimpse at what making is about.

The labs and studio space are very open to allow for users to see what others are working on, to spark conversations that can lead to collaboration and learning.

The Maker Factory uses a structural steel framing system with hollow steel columns and lightweight steel framing. Floor to floor height is 15' with 3' suspended ceilings to allow for structure, HVAC, electrical and plumbing. The bathrooms are all arrange along a plumbing wall that connects with each level. Each building has a rooftop split-packaged heating/cooling unit and a rooftop cooling tower. The basement houses the building's boilers, sprinkler control, extra storage and electrical equipment. Each floor has a large electrical room to maintain the high levels of technology housed within. The second floor of the south building has a separate ventilation system for both the woodshop and laser cutters that vents to the roof. This facility utilizes LED overhead lightening to increase efficiency and decrease power usage.

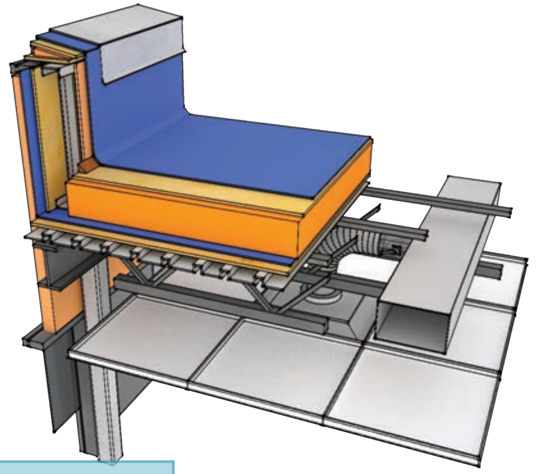


Figure 93

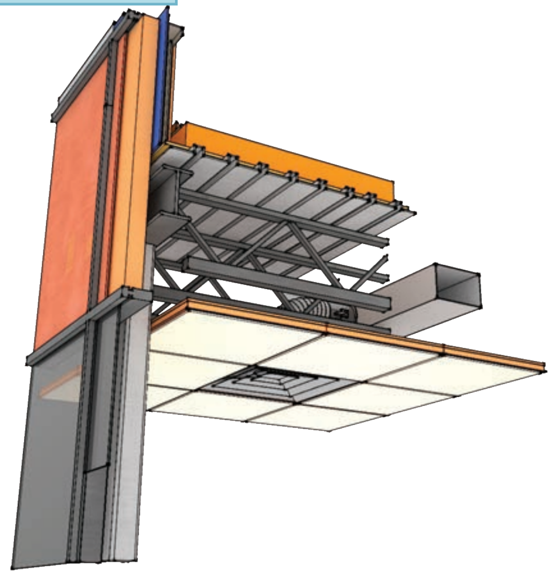



Figure 94.1

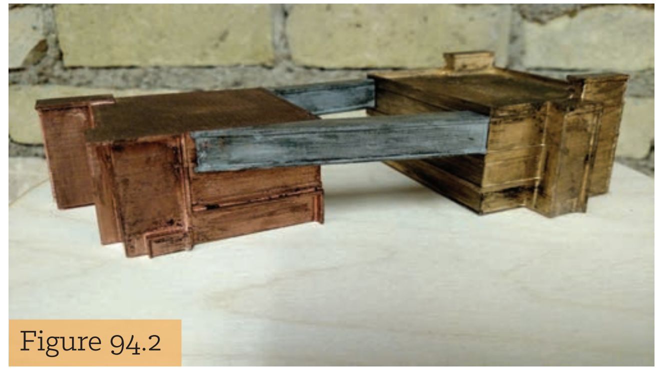


Figure 94.2

The final physical installation featured six boards spanning five feet wide by seven feet tall.

Below the boards are three stands, one with a 3d printed physical model, one holding the Oculus Rift DK2 and an xbox controller, and the third with a monitor so others can see what the user wearing the Oculus can see.


Figure 94.3


Figure 95.1

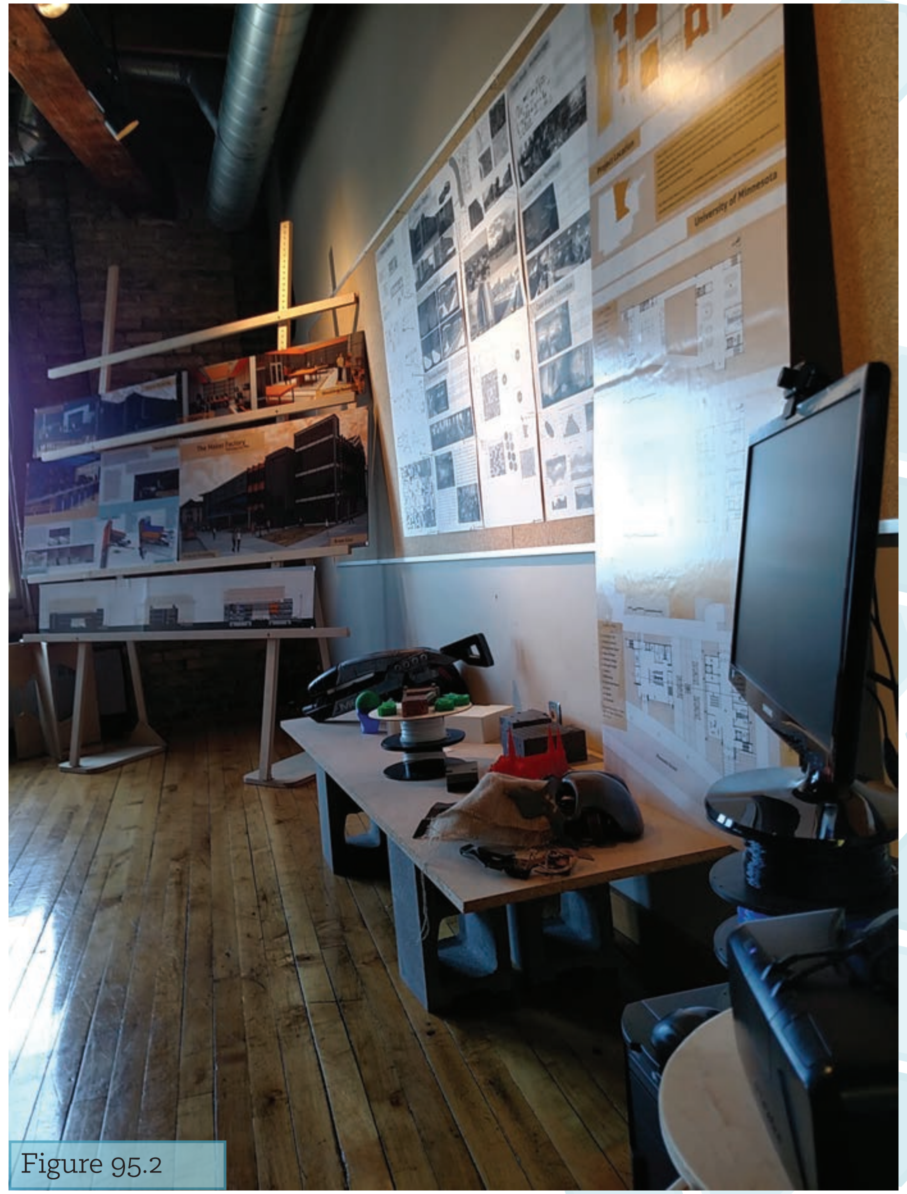


Figure 95.2

Figure 2 - Makerbot 3d Printer
http://www.mcssl.com/content/assets/29/297284/REP2_PRESS_15x10_high8.jpg
Figure 3 - Panoramic Maker Space
http://makezineblog.files.wordpress.com/2013/12/makerspace-pano2.jpg
Figure 5.1 - Workshop
https://fbcdn-sphotos-c-a.akamaihd.net/hphotos-ak-xaf1/t31.0-8/1658570_490124537754655_483296523012216947_o.jpg
Figure 5.2 - Dining Center
http://www.nasethconstruction.com/s/cc_images/cache_936711740.jpg?t=1396015098
Figure 6.1 - Thinkbox Rendering
http://cwru-daily.com/news/wp-content/uploads/2014/06/thinkbox.jpg
Figure 6.2 - Thinkbox Rendering
http://case.edu/forwardthinking/images/thinkbox2.jpg
Figure 7 - Thinkbox Walkthrough
https://www.youtube.com/watch?v=hs_4cYziaqM
Figure 8.1 - Noisebridge Workshop
https://gigaom2.files.wordpress.com/2013/08/img_1938.jpg?w=708&h=472
Figure 8.2 - Noisebridge Sketchup Model
https://noisebridge.net/images/2/23/Overview_w_invisible_wall_RR.jpg
Figure 9.1 - Noisebridge Tool Wall
https://gigaom2.files.wordpress.com/2013/08/img_1900.jpg?w=748
Figure 9.2 - Noisebridge Workshop
https://gigaom2.files.wordpress.com/2013/08/img_1931.jpg?w=708&h=472
Figure 10 - Noisebridge Floor Plan
https://noisebridge.net/images/thumb/e/e3/Noisebridge_map.png/800px-Noisebridge_map.png
Figure 11 - Noisebridge AutoCad Floor Plan
https://www.noisebridge.net/images/0/04/Noisebridge_Floorplan_36x24.jpg
Figure 12 - Techshop Map
http://techshop.ws/images/VA_LandingPage700x250_Map_061814.jpg
Figure 13.1 - Techshop SF Lounge
http://techshop.ws/sftour/ts08.php?pano=nr
FIgure 13.2 - Techshop Laser cutting
http://www.techshop.ws/images/TSSF_laserSF.jpg
Figure 13.3 - Techshop Workshop
http://techshop.ws/sftour/ts02.php?pano=nr
Figure 26 – Past Experience
Figure 29 – Personal Photo
Figure 32.1 – Makerbot Founder with Replicator 2
http://finchfactor.com/wp-content/uploads/2013/01/adafruit_4951.png
Figure 32.2 – Maker Workshop
http://blog.yukonstruct.com/wp-content/uploads/2014/04/makerspace-tables.jpg
Figure 33.1 – Electronic Workshop
https://farm9.staticflickr.com/8516/8543425196_b36888c2bc_b.jpg
Figure 33.2 – 3d Printing Gathering
http://makerbot-blog.s3.amazonaws.com/wp-content/uploads/2012/06/Milwaukee-Makerspace-1.jpg
Figure 34 – Techshop Lounge
http://techshop.ws/sftour/ts08.php?pano=nr
Figure 35 – Makerspace
http://www.situstudio.com/sites/default/files/newsite_makerspace163_0.jpg
Figure 36.1 – Makerbot Replicator 2
http://tctechcrunch2011.files.wordpress.com/2013/06/6f9a6772.jpg?w=400
Figure 36.2 – Fargo 3d Printing Founders
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