

The Activated Medium

Modern Architectural Representation and Transposition

Brad Steven Benke

Signature Page

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

By Brad Steven Benke

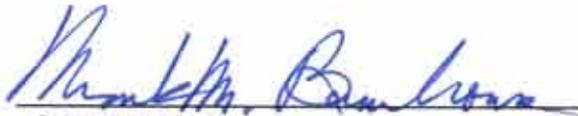
In Partial Fulfillment of
Requirements
for the Degree of
Master of Architecture



Primary Thesis Advisor

5/8/2013

Date



Committee Chair

May 9th, 2013

Date

Contents

Signature Page	2	Site Information	17	Project Goals	71
Contents	4	Project Emphasis	21	Site Analysis	73
Abstract	7	Plan for Proceeding	23	Climate Data	83
Problem Statement	9	Previous Studio Experience	24	Programmatic Requirements	87
Statement of Intent	10	Theoretical Premise Research	29	Interaction Matrix	89
Narrative	12	Research Summary	45	Data Ranking	91
User & Client Relation	14	Typological Research	49	Reference List	113
Major Project Elements	15	Historical Context	63	Personal Identification	114

Tables & Figures

F1: Scarpa Ottolenghi Sketch

F2: Zumthor Kunsthhaus Sketch

F3: Macro Site Map

F4: Regional Site Map

F5: Central Winnipeg Map

F6: Site Location Map

F7: Chrigo's *The Archaeologists*

F8: Schedule for Proceeding

F9: Plan of St. Gall

F10: Palladio's *Ceasar's Bridge*

F11: Vertov's Man with a Camera

F12: Passignano's Painting

F13: Medium is the Massage Scan

F14: Pionen Photos

F15: Pionen Drawings

F16: Sagrad Familia Photos

F17: Manhattan Transcripts

F18: Cloud Comic

F19: *Thirteenth Century*

F20: Alberti's Window

F21: Winnipeg Birds Eye

F22: Soils Map

F23: Climate Data

F24: Climate Map



F1:Carlo Scarpa's Plan Drawing for Ottolenghi House (Albertini, 1988)

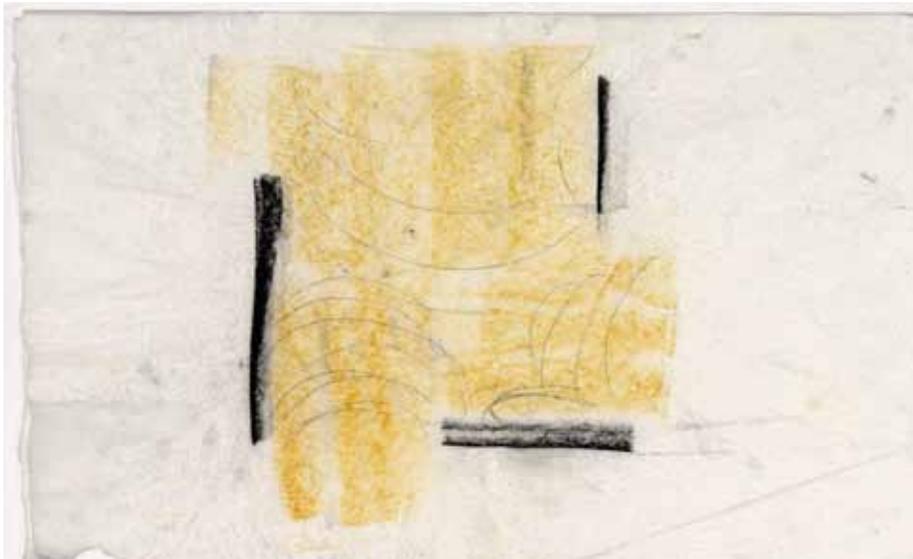
“My architecture is done with architects’ medium,
which is drawings and drawings only.”

-Carlo Scarpa, *From Dinner for Architects:
A Collection of Napkin Sketches, 2004*

Abstract

This thesis explores the role of the modern architectural representation and its changing relationship to the act of making. The investigation will seek and test outlets for architectural representations to operate under functional and technical demands while activating a generative environment for the positive transposition from representing to building. These outlets will be demonstrated through the design and documentation of a growing building typology of the 21st century: the data center.

The design is sited in Downtown Winnipeg Manitoba and is contrived to test the opportunities of an urban, city owned, public data center.



F2: Peter Zumthor's Plan Sketch for Kunsthhaus (Crosbie, 2009)

Problem Statement

What role do modern and traditional modes of architectural representation play in the act of making?

Statement of Intent

Theoretical Premise:

The modern architectural drawing has become a system of prosaic information transcription and it is having an adverse effect on our built environment.

Actors: representations

Action: transposition

Object: physically manifested buildings

The profession of architecture survives in the highly contested space between art and science. Suffering most in this uncomfortable territory is the architectural drawing, and thus its physically manifested counterpart – the building. Of course, architects don't make buildings, we make representations of them. Currently, the drawing is the architects medium. It is the device from which materiality, form, and emotion are birthed. From an historical perspective, the act of drawing and the drawing object itself were done completely by hand and were as much a work of art and craftsmanship as was the finished structure. Having a strong and well developed command of the medium, architects of the time were able to make positive transpositions through their representations.

But modern representations, heavily influenced by changes in building industry standards, are being increasingly flooded with functional demands such as hyper-realistic imagery, technical precision, and comprehensive building information to name a few. To meet these demands, architects hastily adapted computer aided design methods to streamline the production of drawings. This rapid shift in methodology has caused a disconnect between architects and their representations. No longer holding a strong command over the medium, architects struggle to make positive transpositions through their drawings. Rather, their drawings have become prosaic information transcriptions based on dying methods of practice. Which leaves the question - What is the status and future of the architectural drawing?

Typology:

These architectural explorations will be manifested through the design of a growing building typology of the 21st century: the data center.

The data center is perhaps the most meaningful architectural invention of the 21st century. Whether we are conscious of it or not, the data center is a physical manifestation of our culture's values - it is a house for computers. It represents our society's constant use of technology, the mystification of the internet, and our increasingly immaterial lifestyles. The data center's future as a building type is paramount to our modern society's understanding of self.

Justification:

Winston Churchill stated, "We shape our buildings, and then our buildings shape us." What we build is in fact who we are, or at least who we become. For architects then: we shape our drawings, and then our drawings shape our buildings. For the last half millennium drawing has been the modus operandi for architectural creation and communication. Many architects and critics now argue that drawing is dead. With emergent technologies transforming the way architects draw it is imperative to evaluate these transformations and test how they may inhibit or enhance architects' ability to reform a more meaningful practice of architecture and building in the 21st century. As participants of a social and political practice, it is the duty of architects to critically examine the medium in which they operate and its capacity to induce either positive or negative transformations of our shared natural landscape.

Narrative

“Wired people should know something about wires.”

- Neal Stephenson via Andrew Blum Ted Talk

She uploads the file, rattles off a confirmation e-mail, and proceeds upstairs to print the content – a mindless process that for her has become as effortless as breathing. Of three things she is now certain: the uploaded file will be accessible anywhere, her boss in the office down the hall will have already read her e-mail, and the two flights of stairs currently under foot seem even more tedious than normal. “Should, have taken, the elevator,” she mumbles between heavy breaths.

It’s a process we are all familiar with. Uploading data to cloud servers, e-mailing someone who is seated twenty feet from you, and feeling that the journey over to the printer is somehow the longest part of the entire transaction. What is less apparent to most of us are the physical ramifications of everything that just took place. What really happens when we upload data to clouds? When we click “send” on an e-mail, where exactly does it go? More importantly, how do these transactions happen physically? The answers cannot be found in the nebulous of ones and zeros that we often envision as “The Internet,” but in the tangible cables, disks, and warehouses – the physical matter, the material connections, the real Internet.

Ask someone where Google is. If they’re clever, they might wave their iPhone in your face responding “it’s right here, duh.” More likely, however, they will stare at you blankly for a moment and respond “what do you mean where is it?” The Internet has entirely and irrevocably altered the way humans live, yet it remains one of the most mysterious inventions man has ever created. Never before has a civilization used a tool so much and known so little about it. As much as the Internet is a part of our daily lives, it remains obscured from our understanding

- hidden underground and behind blank windowless walls of massive power-guzzling warehouses. These warehouses, more commonly referred to as data centers, are perhaps the most important architectural inventions of the 21st century. Essentially giant dwellings for servers, author Andrew Blum states that data centers are “anti-monuments” that “declare their own unimportance.” But if architecture is a political act, if it is a conscious construction of our society’s values and interests, than what does the data center say about our beliefs? As long as the green light is flickering on our modem, does it really matter where and what the internet is?

It is no surprise data centers have avoided criticism from the design community when the design community barely knows of their existence. Simply put, data centers house data. They are spider webs of cables and cooling systems; physical manifestation of the virtual. Typically devoid of any architectural influence, these creations are navigable only by the engineers who maintain them and function almost entirely without humans at all (Lozado, 2012). But when data centers cost up to a half a billion dollars each (Liebanau, 2012), and combine with telecommunication networks to rank in the top 5 users of global energy (Greenpeace, 2012), the importance of their design becomes immediately apparent. It is a typology set to expand exponentially without understanding of its cultural, social and political implications, it’s future will have dramatic effects on both the ecology of our built and natural environments, we know almost nothing about it, and we are 15 years behind on designing them. For architects, the future of the data center is as open as the internet itself. The crucial step will be engaging the public with these rapidly developing technologies and ensuring that wired people, indeed, will learn something about wires.

I have always felt inclined to draw. From childhood, to architectural education, to the beginnings of architectural practice, my interests in two dimensional representations only seem to increase with age. As with many students of architecture, I have been (and admittedly often still become) mystified by architectural images. Whether it be a section that captures light and materiality just right, a perspective that creates a certain emotion, or a collage that stimulates intense inquiry, I often come dangerously close to worshipping architectural drawings more than their built counterparts. But of course, the most beautiful drawings don't always result in the most beautiful buildings. Furthermore, in academia, there is often no room for building at all. Thus it wasn't until recently that I began to critically examine both *what* and *how* architects draw and how those processes are transformed into buildings, because more than anything else, I'm interested in making architecture - more importantly, making *quality* architecture.

It has taken conscious effort to develop my taste for what I now consider honest works of architectural drawing. These drawings, often far less detailed but perhaps no less thought out, offer insight into the moment of architectural conception - when idea becomes point, becomes line, becomes material. Drawings that act. Never tracings of known outcomes, never finished products, never pointing to themselves - always pointing to the other, always asking more questions than they answer, always *activating* a generative environment for both architectural thinking and making.

The explosion of new technologies now associated with architectural creation seems to have affected the profession in two very different ways. On the one hand they opened up a world of opportunities and possibilities that architects could

have never before imagined; and on the other hand, they threatened to contaminate architecture from the inside out, surging through arteries of the profession with uninformed and un-examined acceptance and over use. This apparent dichotomy originally created two groups: those who were in favor of new technologies and unquestionable acceptance of their use within all aspects of design, and those who attempted to deny their potential for architectural creation all together in favor of traditional methods. Today few people would argue that computer aided design has its place within architectural creation and if used properly can yield truly amazing results. The debate still continues however as to what degree software should be used and under what circumstances.

New technologies have perhaps not increased our ability to draw, but they have vastly expanded the means by which we draw - thus increasing our potential to re-frame the world and re-orient people through architecture. I see this as the most promising yet least utilized ability of digital tools. In practice, digital tools are hailed for the ability to automate repetitive processes and perform traditional tasks exponentially faster. Many firms now use the computer to design entire projects. Adored mostly for its contribution to architectural efficiency and streamlining of production, I would argue that the computer is highly over-used but highly under-utilized. This thesis will shed light on the potential of digital design methods to transpose architectural ideas, and how it may be possible to create a poetic and meaningful workflow with a mixed medium approach. Current use of technologic standards will be challenged and tested using a lens of "action" and "transposition."

User & Client

Users:

Essentially, the data center will be used by anyone with an internet connection. More specifically, the data center will be a public collocation facility for the city of Winnipeg. Business owners, start-ups, or general citizens will be able to rent data space for their private or public entities. Also, technicians and engineers will be one of the most frequent users (but smallest in numbers) as they will be the ones who directly access and maintain the equipment.

Client:

The city of Winnipeg will be the client and owner of the new facility.

There is a growing demand for data space and internet exchange points in metro areas. Traditionally these privately owned facilities have tended to have internal goals and motivations. This project will explore the opportunities created by having a city owned data center with public interest playing a role in the functioning of the architecture.

Major Project Elements

Physical Exchange:

The physical point where fiber optic cables are connected and exchanged.

Cooling system:

A sustainable way to cool the buildings servers and equipment.

Power Generation:

A sustainable way to supply the buildings massive energy demands.

Stacks:

A physical volume for archiving general data.

Vault:

A more private volume for archiving restricted access data.

Lens:

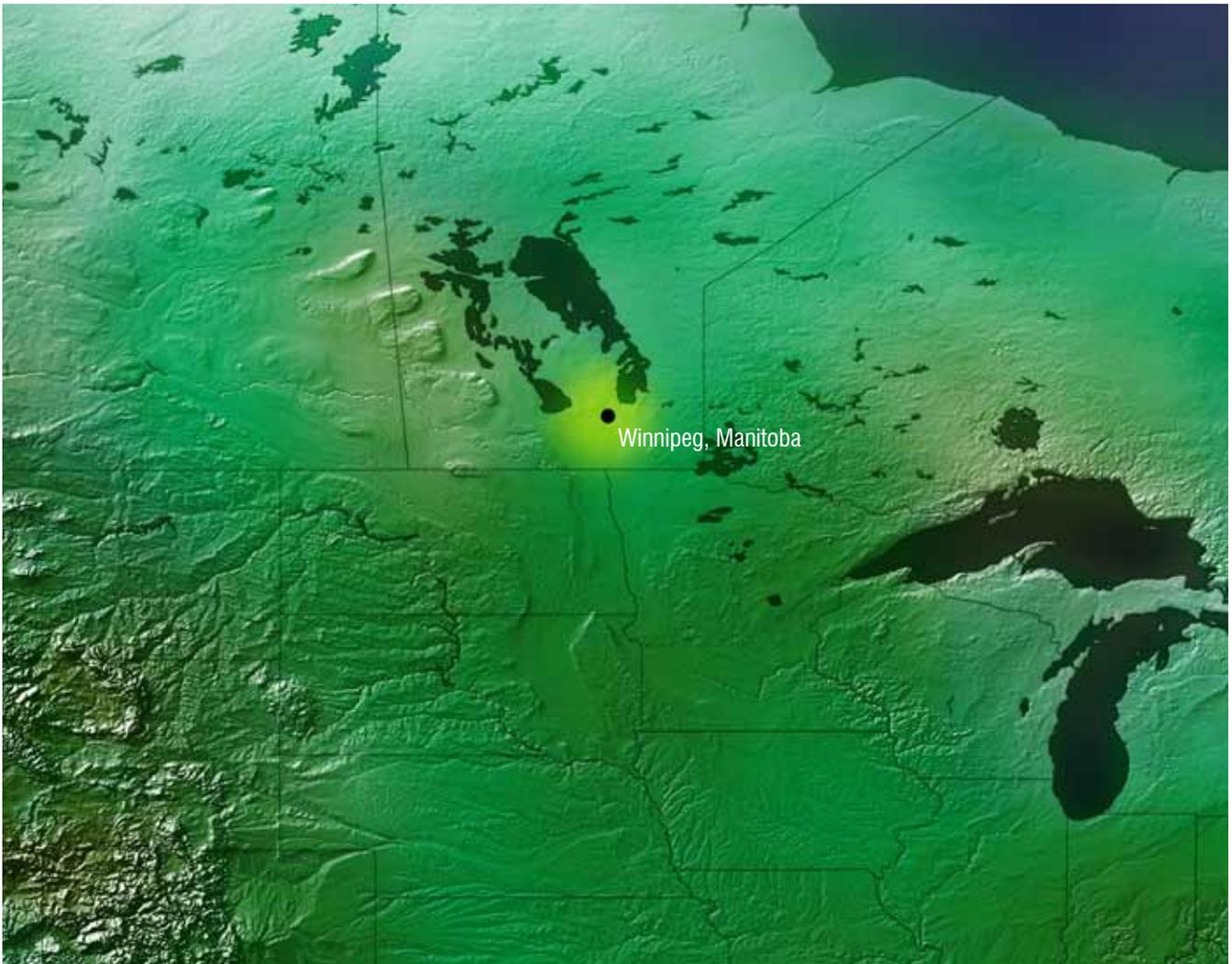
A point of focus to promote knowledge.

Data Garden:

Gathering space for the public to interact both physically and digitally with the building and each other.

Auxiliary Heat Exchange:

The nature of data centers causes them to put off a lot of heat. This resource will create a potential for seasonal alternate uses.



F3: Macro Site Map (Benke, 2012)

Site Information

Macro

Northern territories are one of the last remaining frontiers for human settlement. Although Winnipeg Manitoba has a thriving urban population, it represents one of the northern most points of large bandwidth fiber optic connectivity for the upper Midwest. In today's economy we often hear "if you're not growing your dying" and network connectivity via fiber optics is any indication of growth potential for a landscape, then the upper Midwest is on thin ice. The site was thus selected partially for its huge potential to stimulate and attract internet bandwidth and become a digital hub for the entire upper Midwest. Winnipeg also goes beyond the functional demands of data center sites and also stimulates cultural questions and possibilities about what data centers *mean* to communities - especially those that are being left behind in the rapid expansion of the internet.

The site also contains several vital factor for data center success including Winnipeg's physiographic potential for data center ecology. Data centers are often sited for four main factors: Cost and robustness of energy, disaster avoidance, inexpensive cooling, and geographic diversity. Winnipeg thus has some of the cheapest energy in all of Canada, is very stable geologically speaking, has an ideal climate for inexpensive cooling (especially water cooling from the Red River), and in terms of diversity it would be one of the first facilities of its kind for hundreds of miles - a huge benefit for businesses looking to spread out their data in diverse locations.



F4 Regional Site Map (Microsoft, 2012)

Region:

The diversity the Red River Valley in the Manitoba region are highlighted in this satellite image. The contrast between urban and agrarian developments show the growth of Winnipeg around the Red River. A less obvious diversity is illuminated at this scale - the contrast of land planning schemes. Along the Red River we see long narrow strips of land mostly perpendicular to the stream. This mode of land planning, with its thin elongated allotments is known as “the Long Lot System” and was brought to the America’s by the French. It was developed so as to give as many farmers as possible access to water for irrigation and living. Traditionally, farm houses were developed riverside where tenants would have a place to stay as they farmed the land of which typically (but not always) belonged to a different owner. Blending and branching off of the long lot system is the more common township and range delineation of land. Often referred to as the “Jeffersonian Grid,” this system is overlaid onto the majority of land in North America. The contrast gives clues as to the historical development of Winnipeg and its present cultural and physiographic diversity.

Site Information

Micro



F5: Central Winnipeg Area Map (Microsoft, 2012)

Area:

Central Winnipeg is focused around the Red River. The largest commercial district (the downtown area) lies west of the river with small commercial establishments and residential neighborhoods to the east. The site is positioned adjacent to the river and situated just east of the densest urban developments in all of Winnipeg. South of the site is one of the most thriving public spaces in all of Winnipeg - The Forks. Aply named for its proximity to the Assiniboine/Red River confluence, this district is known for its public markets, green spaces, and shops. Generating large amounts of pedestrian traffic, this district will play an important role in activating public interest in data use and distribution.



F6: Site Location Map (Microsoft, 2012)

Location:

At this scale, the current site conditions are visible. Situated between CanWest Park to the north, the river to the east, the rail tracks to the west, and a brand new cultural museum to the south, the site has very strong visible accessibility. However it is also confined and separated by the two highly trafficed routes of Provencher Boulevard and Waterfront Drive. This will present many challenges and opportunities for development. An existing parking lot and a riverside green space covered with open grass and deciduous trees make up the current site condition. The eastern portion of the site is one of the many green spaces along the river and it is hoped that the construction of a new data center will not disturb its use as a green space but enhance it.

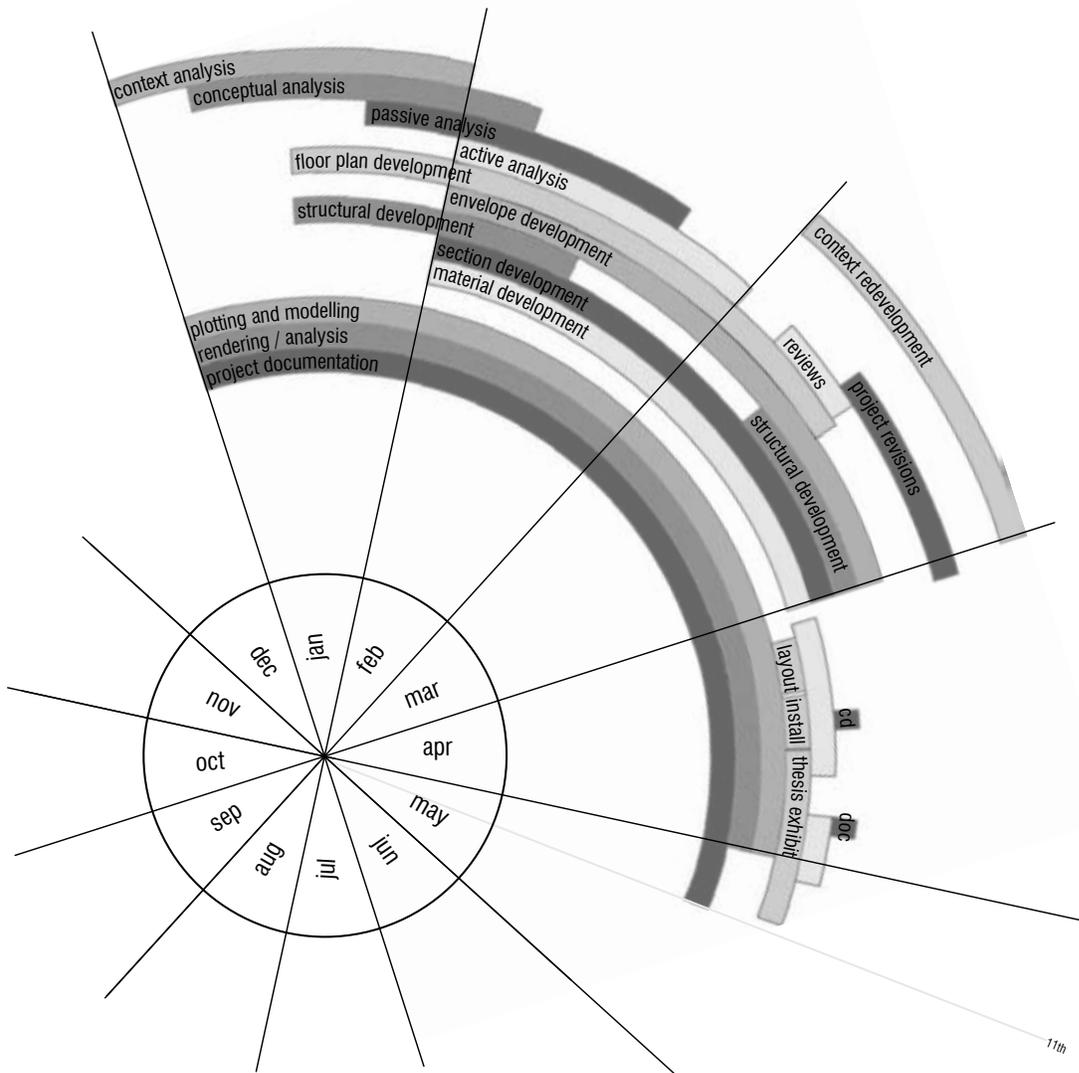


F7: "The Archeologists" Giorgio de Chirico 1968, Oil on canvas (ARS, 2007)

Project Emphasis

Humans surely have the desire to build. To what ends we should pursue these urges is a question often overlooked. Giorgio de Chirico's painting on the opposite page depicts two human figures having an intimate conversation and appearing to be made of flesh by actual building elements. The piece, titled "The Archaeologists" suggests that the figures have literally become the architecture of their past - an architecture inherently of the body and lived in the present through memory. I imagine the two discussing atmospheres of their past, cities which they love and are able to re-live through conversation. I can hear them speak of the *quality* in the architecture, the shadow of a portico, the shelter of an arch, and the firmness of a column; I see them longing for these moments of purity. I hear them critique a more modern building, their posture confident, but their embrace regretful - I don't like what I hear.

The key emphasis of this thesis will be the exploration of how different forms of representation have been catalysts for change in both architectural epistemology and culture in general. From historical perspectives to modern methodologies, the focus will be on architectural representations as agents for ethical creations, those which inspire meaningful interactions between humans and their built environment - of which our friends in the painting would be proud to call their city. We must remember that what we build (even in the smallest participation) is in fact who we are, and that these buildings will not only be judged by those who use it today but for countless generations to come. What message will we leave behind for archaeologists to discover?



F8: Schedule for Proceeding (Benke, 2012)

Plan for Proceeding

Research Methodology

Research will be conducted thoroughly on the theoretical premise/unifying idea, project typology, historical context, site, and programmatic requirements.

Design Methodology Plan

A mixed methodology will be imperative for this thesis. The research will be executed using a multi-faceted design methodology in which both quantitative and qualitative analysis and data will be critically examined in the production of knowledge. Drawing in both digital and analog forms holds the title of *modus operandi* for modern architectural creation. This fact will also be examined as whether or not (and in which form) the most appropriate mode of architectural conception is. Graphic analysis, digital analysis, and interviews will also play a role in the production of knowledge for this thesis. The resulting knowledge gained from the design process will be priority driven with a focus given to information that either supports or rejects the theoretical premise/unifying idea. This resulting information will be presented in both texts and graphics.

Documentation Plan

Recording the design process is crucial in the documentation of this thesis. To test methods, analyze results, and record findings will be a critical endeavor for the translation of personal process work into formal and communicative knowledge. I plan to record and categorize process work weekly in digital form and bake this information into hard copies as soon as possible. The body of this work will be formally presented at the end of the thesis at a location to be determined on the North Dakota State University Campus and will be subsequently uploaded to an online data base to contribute to the growing sample of design research done by students at North Dakota State University. It is hoped that this information will provide current and future scholars with a valuable insight into current and traditional modes of architectural representation and how they influence physical buildings and architectural epistemology in general.

Previous Studio Experience

2nd Year Design Studio

Fall Semester 2009

Instructor: Joan Vorderbruggen

Tea House

Boat House

Spring Semester 2010

Instructor: Phil Stahl

Montessori School

Chair

3rd Year Design Studio

Fall Semester 2010

Instructor: Cindy Urness

Fargo Food Co-op

NDSU Downtown Wellness Center

Spring Semester 2011

Instructor: Regin Schwaen

ASCA Steel Design Competition

National Geographic Cafe

4th Year Design Studio

Fall Semester 2011

Instructor: Frank Kratky

Highrise Design Studio

KKE Recycle Competition

Spring Semester 2012

Instructor: Ronald Ramsay

Agincourt Iowa Aero Facility

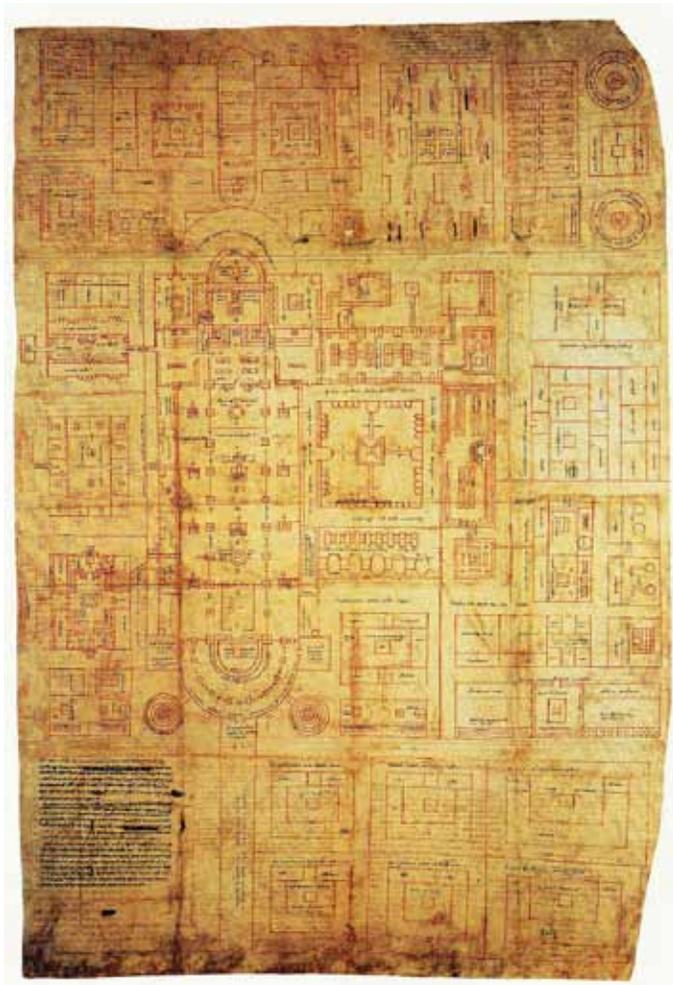
5th Year Design Studio

Fall Semester 2012

Instructor: Regin Schwaen

North Dakota Museum of Art

The Program Document



F9: Plan drawing of St. Gall Switzerland - Believed to be the only surviving architectural drawing before the 12th century. (Unknown, 2004-2012)

Theoretical Premise Research

Historical Precedents and Modern Implications

“I was soon struck by what seemed at the time the peculiar disadvantage under which architects labour, never working directly with the object of their thought, always working at it through some intervening medium, almost always the drawing, while painters and sculptors... all ended up working on the thing itself which, naturally, absorbed most of the attention and effort” (Evans, 1997, p. 156).

-Robert Evans in *Translations from Drawing to Building*

Introduction

Let us begin with a simple fact: drawing is not, and has never been the aim of architectural practice. Since the dawn of the profession, the aim of architecture has of course been the creation of public spaces, shelters, and dwellings. It wasn't until the 15th century that drawings came into use in architectural practice. From there, the role of architectural representation has had a constantly changing dialogue with physical buildings. In order to understand the modern role of architectural representation, it is necessary to examine the act of drawing from an historical perspective in order to trace where it's been, and thus where it's going. In the following attempt to time line significant acts of architectural representation, I have cross examined historic attitudes towards these representations with modern critiques and corollaries. Many people now argue that in light of digital design methods the *drawing* is dead. Rather than springing mindlessly into use of emergent technologies, or clinging hopelessly to romanticized traditional methods, let us first critically examine what it is architectural representations represent, how they have been used, and how we might use them in the future.

[Re]Presentations

What are architectural representations, and what do they represent? Lets first look make a distinction between two types of representation of which there is a great deal of overlap. The first kind that act as artifacts for design process, and the second kind that act as artifacts for the creation of other artifacts. The first may have significant artistic value in the form of a preliminary sketch, working drawing, or perhaps a rendering for a client who may be unfamiliar with the second type, which generally is the documentation of a design to guide others in its construction. It is often assumed, based on the nature of architectural representation, that the purpose of either form of representation is to depict the world as we see it - or to show us future buildings. In his essay *On Architectural Representations*, David Leatherbarrow reveals the opposite to be true stating that,

“Drawings do not depict the world around us, or the rooms or streets... the purpose of architectural drawings is to discover and disclose aspects of the world that are not immediately apparent and never will be... Drawings would be neither interesting nor productive, if they showed us what we can otherwise or normally see without them” (Leatherbarrow, 1998, p. 53).

He goes on to explain that a plan drawing is constructed not only from an impossible vantage point in space, but also through a dimension of time and space that normal experience could never provide - granting us the ability to view and inhabit two or more separate spaces simultaneously. The same could be said with section drawings, elevations, or even oblique drawings, which allow us to see elements of a building

in a way we would never otherwise be able to experience. Leatherbarrow argues that in essence, drawings don't even depict buildings, but rather they occasion the *idea* of a building through a representative language. He closes his essay with a fantastically matter-of-fact conclusion, stating that plan, section, elevation (I would also add map, diagram, and graph), “In their very poverty of representation, they contain the greatest promise of architectural embodiment; their deficiency guarantees their retreat into the margins of spatial experience” (p. 55). Honest architectural representations never exceed themselves as tools for a yet to be constructed artifact (Leatherbarrow, 1998).

We seem to have a basis for what architectural representation are, how then do they influence *making*? Or rather, how do architectural representation become buildings? The dominant process for modern architectural creation is that drawings are read and interpreted by builders, and then *transposed* into buildings. They are not however, translated. Translations assume a one-to-one correspondence and equivalent, where as transpositions are more fragmented. American architect Stan Allen describes the process of architectural transposition in his essay *Diagrams Matter*. He asserts that

“In operations of transposition, conversions from one sign system to another are performed mechanically on the basis of part-to-part relationships without regard for the whole... internal relationships are transposed moved part by part from the graphic material or the spatial, by means of operations that are always partial, arbitrary, and incomplete” (Allen, 1998, p. 23.17).

A builder only works on one element of construction at a

time. His perception of the architecture only comes together from connecting one discrete component after another. Any understanding of the building in its totality is temporarily concealed from the builder. The architect may have an overall image of the building in his/her mind. The image might even have significant cultural meaning, metaphor, or other poetic associations to it; but the builders of the project, those responsible for bringing abstract ideas into reality, will always be limited by the nature of modern representation. That is, they will always be dealing with the construction of someone else's ideas. Thus the effectiveness of representations lies in the architect's understanding of this disparate and fragmented approach to construction and how their representations will be transposed. This is why today's construction documents exist as they do. Rarely artistic or poetic, their meaning exists only after they have been transposed. If this were not the case, than they would become objects in themselves, and as Leatherbarrow states they would fail to "retreat into the margins of spatial experience" (p. 55)

The incompleteness and arbitrariness present in any work of transposition, is potentially a rich source of inspiration for architecture. With transposition, a drawings relationships are articulated and approximated rather than translated. Since the architect will not be there to describe everything with the builder, there are inevitably degrees of interpretation to a drawing and an exact one-to-one correspondence must not be assumed. This mode of operation presents an infinite number of challenges and opportunities for architects. For the foreseeable future, architects will be limited to representing their ideas. One goal of this thesis will be the exploration of a methodology that situates architecture more closely with the actual making of their buildings. In a search for the future of architectural representation, we should

remember, that the current mode of operation has not always existed. In fact, representations themselves are a relatively new invention. One with a long and clouded history. Let us go back in time and examine the evolution of making buildings.



F19: Thirteenth Century, Reproduced from L.F. Salman. (Shelby, 1961)

The Middle Ages

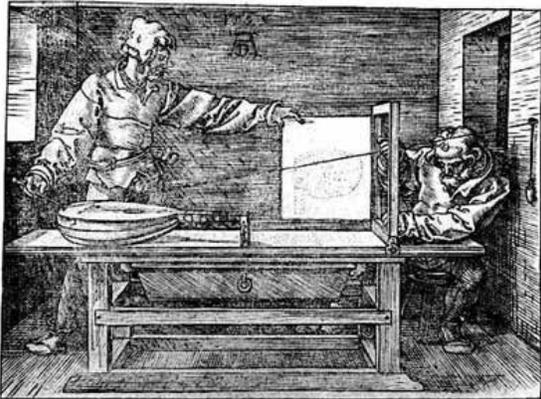
Architectural drawings in the middle ages were rare. During this era buildings were constructed much differently than we are familiar with today. The architect was a role not fully developed and instead the profession was situated much more intimately with the physical construction of buildings. Master builders, or usually master masons, held the closest role to modern architects. These professionals led entire guilds of craftsmen in building construction and were constantly on site overseeing and participating in construction (Gimpel, 1983). It is important to note that much of the construction during this period, especially cathedrals, were based on geometrical calculations that were known and understood by the builders (H. Powell & D. Leatherbarrow (Eds.), 1982), thus the prescriptive and demanding construction documents that we are familiar with today were unnecessary. In *The Craftsman* Richard Sennet attributes a great deal of quality craftsmanship of the time to a tactile material understanding. He states,

“First, all skills, even the most abstract, begin as a bodily process. Second.. technical understanding develops through the powers of imagination: The first argument focuses on knowledge gained in the hand through touch and movement. The argument about imagination begins by exploring language that attempts to direct and guide bodily skills” (Sennet, 2009, p. 44).

Sennet is positing that material knowledge is gained only through bodily interaction and that transposing this knowledge requires the understanding of a language (or *representation method*) to direct others. In the middle ages this two step process was unnecessary - in essence, thinking architecture and making architecture were happening simultaneously. Material knowledge was a language itself understood by the entire guild of workers and was bound to the creative process of building. The few drawings that were used were most often constructed on site or during (or even after) the building process at 1 to 1 scale and were often only used for the refinement of details and ornamentation. It wasn't until the late medieval period when builders attempted to codify some of their personal styles and principles, and two-dimensional drawings (often ink on paper or parchment) began to play an active role in the spreading of building knowledge (H. Powell & D. Leatherbarrow (Eds.), 1982). They may not have known it at the time, but this decision to adopt a new medium completely and irrevocable altered the future of architecture. Architecture is once again changing mediums and it is imperative that we step *cautiously* and *concisely* into these new territories. We must remember that the decisions we make now, will ripple throughout the future of architectural practice and epistemology.

Renaissance & Perspective Development

Bridging the gap between medieval and renaissance architecture was a period of artistic works experimenting with the use of perspective. This led to one of the most drastic changes in the history of architectural representation which occurred during the Renaissance period with the development and use of perspective theory and drawing. Often cited for his contribution to perspective theory, architect Leone Batista Alberti (1404-72) is believed to be the first to compile a written treatise on one point perspective. Not to exclude the efforts of Da Vinci, Brunelleschi or even Vitruvius who all performed many visual and perspectival experiments, but it was Alberti who wrote about perspective and its relation to buildings.



F20: Alberti's Window, Woodcut from the treatise *Underweysung der Messung* (On Measurement), by Albrecht Dürer, 1527 (Dürer, 1527)

Alberti, although fully committed to the development of perspective within the arts, was less enthusiastic about its use in the creation of buildings and instead preferred the use of plan above all others. Alberto Perez Gomez evaluates the work of Alberti in *Architectural Representations and the Perspective Hinge* stating that Alberti even warned against the use of perspective in *De Re Aedicatoria II.1*. Alberti is quoted saying that the architects work is valued “not by deceptive appearances” but “exactly on the basis of controllable measures.” (Gomez, 2009, p. 27) Although many other architects warned against the use of perspective in the creation of buildings, it came to be used side by side with other orthogonal projections as a form of communication. Donato Bramante (contributing architect of St. Peter's Basilica) was noted for his use of perspective and illusionistic drawings of early Renaissance. Among many architects of his time, Bramante was also a practicing painter and artist (H. Powell & D. Leatherbarrow (Eds.), 1982). This surely contributed to his architectural 'depictions,' or photo-like drawings which became commonplace in design thinking. The problem with perspective drawings, as Alberti had originally conveyed, was their inadequate level of building information for the construction of projects.

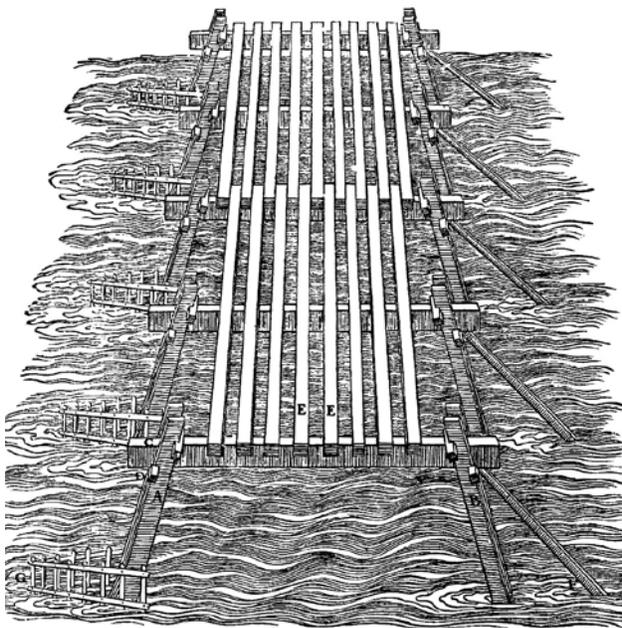
With the edifice of perspective theory came drawing as a geometric quantification of space, and various architects sought for the elevation of architecture from that of a labor to that of a science-art (Tierny, 2007). Most importantly, it marked the shift in profession from architectural thinking being done prior to its making. First noted in Renaissance practice, were the making of decisions prior to construction via drawing and verbal exchange between architect-builders and client who were seeking to be a part of the design process (H. Powell

& D. Leatherbarrow (Eds.), 1982). This change in thinking about constructed space was synonymous with a cultural change in thinking about space in general. Beginning with the work of perspective artists and theorists such as Alberti, the idea of a *Cartesian rationality* of measurement with the use of perspective was practiced and expanded throughout the 15th century. Although highly controversial at the time, the science of geometric space was later codified by Kepler and Galileo's re-writing of cosmic order in the early 16th century. This further distanced the science of optics (and thus architectural representation) from its medieval theological background. Quentin Fiore describes the changes in *The Medium is the Massage*. He proclaims,

"The Renaissance Legacy. The Vanishing Point = Self-Effacement, The Detached Observer. No involvement! The viewer of Renaissance art is systematically placed outside the frame of experience. A piazza for everything and everything in its piazza" (Fiore, 1967).

It was thus drawing and vision that created the destabilization in traditional modes of thinking about space with a divine world view, and again drawing and vision that calmed the anxiety of this destabilization through its use of quantifiable and homogenous geometry as a new truth (Tierny, 2007; Gomez, 2007). In developing a modern understanding of architectural representation, this was a critical step. It acted as a catalyst for society to view (and desire to view) architecture and space in a quantifiable way. The change in both architectural and cultural thinking led to the profession of architecture becoming one of measurement, geometry, and drafting, as separate from physical building (Tierny, 2007; Gomez, 2007; Quek, 2007). Although it took several hundred years to occur in

practice, this is perhaps the most crucial change in the history of architectural creation – it marked a complete change in medium, the separation between drawing and building, and the separation between builder and architect. The drawing became the representation of choice for the architect, mostly in plan, elevation, and section, and it's reign as the medium of choice remained mostly unchallenged for the next half century.



F10: Andrea Palladio's Caesar's bridge over the Rhine - Mix of perspective and elevation oblique (Scolari, 2012, p. 246)

Post-Perspective Developments

By the 17th century perspective drawing had become a legitimate architectural idea. It represented both the ability of the architect to conceive future space and represent the world as a geometric portion of infinite space (Gomez, 2007) Most architects of the 16th and 17th centuries employed perspective drawings, including birds-eye depictions as part of the design process along with plans, sections, and elevations. Drawing as an architectural science-art and its

tools for execution continued to spread and develop following the Italian Renaissance but remained consistently the medium of choice for most architects (and still remains today). More notable during the 16th century was the apparent desire for architects to develop orders, styles, and techniques for architectural production as well as a shift from ink drawings to wood cuts and various forms of printmaking (H. Powell & D. Leatherbarrow (Eds.), 1982).

The early 1600's also saw a revival of oblique and axonometric representations. Massimo Scolari outlines the development and historic use of axonometric projections over the use of perspective in his book *Oblique Drawing: A History of Anti-Perspective*. Even during the height of perspective use in the Renaissance, oblique projections were being used by artists such as Kyser, Taccola, and even Da Vinci, and also thoroughly in military fortification design and mechanical inventions. Scolari states that the authors of these representations commonly sought the use of parallel projection "to represent the actual space of an object rather than an object in space" (Scolari, 2012). Axonometric drawings in particular are often detailed with dimensions for the construction of an object. These representations give designers a unique tool - the ability to provide a formal three dimensional outline of an object, as well as its technical information. Less pictorial than their perspective counterparts, oblique drawings are sited exhaustively throughout history by Scolari as being used to describe rather than depict - drawings as tools rather than objects. American architect Stan Allen reminds us "The drawing as artifact is unimportant, it is rather a set of instructions for realizing another artifact" (Allen, 2000, p. 32). From antiquity to modernity, this has held true of architectural representations in all forms.

Shifting Mediums

“All media work us over completely. They are so pervasive in their personal, political, economic consequences that they leave no part of us untouched, unaffected, unaltered. The medium is the message. Any understanding of social and cultural change is impossible without a knowledge of the way media work as environments. All media are extensions of some human faculty - psychic or physical.”

-Quentin Fiore in *The Medium is the Massage* (1967)

Perhaps not surprising throughout the history of drawing was the continued use of paper as the surface of representation for architects. This simple fact often goes overlooked as a critical difference between historic and modern architectural creation. Although paper and its various forms present an infinite number of resistances to certain drawing tools, it is often assumed to be a *passive* medium. Marco Frascari argues the opposite in his essay in *From Models to Drawings*. He claims that “Because of the interaction of their material qualities with the conceiving of future buildings, the various kinds of drafting paper... should be taken into account as inspiring the more meditative aspects of architectural factures” (Frascari, 2007, p. 23). If we assume his stance to be correct, then it might appear that our modern shift to digital design methods removes a significant means of material knowledge from the design process. Whether or not this is true, Frascari’s recognizes paper as an *active* medium rather than a frictionless *tabula rosa* for design. Fifty years before Frascari made this distinction, Quentin Fiore predicted the same. He writes,

“media, by altering the environment, evoke in us unique ratios of sense perceptions. The extension of any one

sense alters the way we think and act—the way we perceive the world. When these ratios change, men change” (Fiore, 1967).

The medium we use structures every aspect of our lives. Architecture does the same - it is a medium for living. Frascari goes on to describe the invention of paper a vital step in the separation between building and designing. He claims that paper “has allowed architects to alter the temporality of the process of invention and move away from the site during the making of their architectural factures” (Frascari, 2007). Paper not only distanced architects from their craft, it became the entirety of their craft. Beginning in late antiquity and being solidified throughout renaissance was the greatest transition in the profession of architecture. It wasn’t until the 18th century that another significant change in imagery occurred. Aided by an even more sophisticated understanding of the science of light and optics, the camera was invented. Becoming accessible to the masses in the early 1900’s, photography played an fundamental role in our modern understanding of representation and imagery.



F11: Still from Dziga Vertov's *Man With a Movie Camera* (Vertov, 1929)

The Camera & Imagery

“I’m an eye. A mechanical eye. I, the machine, show you a world the way only I can see it. I free myself for today and forever from human immobility. I’m in constant movement. I approach and pull away from objects. I creep under them. I move alongside a running horse’s mouth. I fall and rise with the falling and rising bodies. This is I, the machine, maneuvering in the chaotic movements, recording one movement after another in the most complex combinations. Freed from the boundaries of time and space, I coordinate any and all points of the universe, wherever I want them to be. My way leads towards the creation of a fresh perception of the world. Thus I explain in a new way the world unknown to you” (Berger, 1977).

-Dziga Vertov, 1923 excerpt from *Kino Eye Manifesto*

The camera was perhaps not intended to be used as a form of architectural representation. It came to be adopted by architects much later on. The same could be said for the computer, or even paper itself. However, photography has still changed the way we think about imagery more than any drawing ever has. It mobilized our perception of the world. Vertov’s quote to the left comes from an article in 1923 describing his stance on film and cinema - a manifesto of sorts. He describes himself as “in constant movement” and “freed from the boundaries of time and space.” In Vertov’s mind, photography destabilized the world of static imagery. Similar to the destabilization created by perspective drawing in the Renaissance, the invention and use of photography as a means of communication opened up an entirely new world of time and space. In *Ways of Seeing* John Berger discusses the destabilization photography created claiming that photography “destroyed the idea that images were timeless” (p. 18) and instead what was being depicted depended on your location, your personal tastes, the things around you, even your own way of perceiving, and that the traditional mode of perceiving imagery - where it is assumed that everything converges on the human eye - was no longer a sufficient understanding of time, space, and atmosphere. (Berger, 1977, p. 17-19) Berger goes on, analyzing the role photography has played in our understanding of imagery. He states,

“When the camera reproduces a painting, it destroys the uniqueness of its image. As a result its meaning changes. Or, more exactly, its meaning multiplies and fragments into many meanings” (Berger, 1977, p. 17).

Berger is discussing an effect of photography that is not immediately apparent to its users. However, it is exactly

this multiplication and fragmentation that makes the camera useful to architects. The ability to frame specific moments, analyze spaces, draw attention to materials, and expand the meaning of an otherwise under-developed element can be very beneficial for architects. The camera originally presented challenges similar to the invention of perspective. Architects need to understand that photography, as with any medium, presents certain opportunities and limitations for representing. The camera will always have frictions - it will always favor certain ways of viewing, framing, and thinking about space. If misunderstood, one might argue that the camera lacks any objective use for the creation of architectural form since it lacks the ability to be accurately transposed into other artifacts. But what it lacks is not a downfall of the medium, far from it. Instead, as with the drawing, the effective and meaningful use of the medium is often discovered not only through what it allows us to see, but also what it removes from our consciousness. A still photo tends to present the world as a replica, as a complete and total capture of its source (an error Vertov would make haste to point out). Perspective drawings hint at the same falsity if we assume them to be actual replicas of their portrayal. We must remember, that no representation ever acts as more than itself - a representation. As American photographer Stephen Shore argues,

“Still photography’s meaning and poetry come from its incompleteness. A photograph can imply a narrative but it never really is narrative. It can describe but it explains very little... A photographer combines a perception, with an understanding of its transformations” (Shore, 2010).

Earlier, I highlighted Sennet’s argument that craftsmanship

must be learned through perception, and translated through a “language that attempts to guide bodily skills” (Sennet, 2009). We now see Shore echoing a similar attitude - that for him, the aim of photography starts with a perception, and ends with an understanding of its transformation. Architects should operate with a similar understanding - that buildings may imply a narrative, but they never really are narrative - they will always take on their own meanings, interpretations and life.

As with every new change in medium, it took time for photography to find its place within culture. Architects soon began to see its potential and today most architects have adopted it as a tool for design. The problem remains however, that the majority of architects using photography as a design medium, are unconscious of its implicit limitations. Rather than using these limitations as a source of inspiration and insight (as Shore does), many architects (along with the majority of our entire culture), continue to use photography without an understanding of the way it structures our seeing. Of the challenges that photography presents to architects, the most difficult for many to look past is its inverse relationship to architectural creation. Architecture usually starts with a representation, and ends with that representation being transposed into a building, park, plaza, etc. Or stated differently, architects depict a desired condition, and present the condition to be re-constructed in the world. The inverse of this relationship between image and object would be the photograph. Photography starts with an already constructed world, and creates a representation of it. This dilemma goes beyond photography and architecture. Italian author Italo Calvino describes a similar situation for writers in his compilation of thoughts and critiques on literature titled *Six Memo’s For the Next Millennium*. In describing imaginative process he states there are two types,

“the one that starts with the word and arrives at the visual image, and the one that starts with the visual image and arrives at its verbal expression” (Calvino, 1988, p. 83). We can extrapolate a similar outline for architectural making. The first process starts with an image (usually in the client’s or architect’s mind) and is transposed into representations. Calvino describes the first process which I feel are some of the best words to describe architectural representations themselves. He writes,

“we read a scene in a novel or the report of some event in a newspaper and, according to the greater or lesser effectiveness of the text, we are brought to witness the scene as if it were taking place before our eyes, or at least witness certain fragments or details of the scene that are singled out” (Calvino, 1988, p. 83).

Later Calvino discusses his personal writing process which is the second form of imagination. Beginning always with mental images, Calvino sets out to allow the images in his mind to “develop their own implicit potentialities” and later to “leave a certain margin of possible alternatives” and finally he transposes the images onto paper saying that “writing guides the story toward the most felicitous verbal expression, and the visual imagination has no choice but to tag along” (Calvino, 1988). The typical spectrum of architectural creation today requires both forms of imagination. The first stage is performed by the architects, where the image of intention is represented. Those representation then go through the second stage, where the representations are transposed by builders back into the world as a physical construction. Words are the writers representations, and fortunately for them, they are the final product of work. Construction documents are the architects representations but they are not the final product of work.

Representations are then taken a step further and transposed into buildings where the *greater or lesser effectiveness* of their communication, will determine yet another work of art. I would like to propose an alternative way of thinking for architectural creation, one that although impractical in current standards might be found to be more effective for making meaningful buildings. The alternative is to eliminate the idea that architecture is a two step process, and is instead, like photography, a one step process. In theory the two would be the same, taking a desired condition of the physical world, and representing it. The poetic, artistic, metaphoric (or similar) *meaning* of the representation would then be open to interpretation, and within that interpretation would be the space of translation. Architects could benefit from this mode of thinking with the understanding that modern construction is also a medium that needs to be understood, and not a frictionless translation of ideas. As with every medium, there are inherent limitations and forces at work in construction industry that are potentially a rich source of architectural inspiration.

Models

“Because architecture is concerned with the physical articulation of space; the amount and shape of the void contained and generated by buildings being as material a part of its existence as the substance of its fabric” (Dunn, 2012, p. 7)

-Tom Porter, *The Architects Eye*

The architectural model is argued to be the best form of representation for its future artifact. Used today, as well as throughout history, models have the ability to convey an infinite amount of information upon immediate interaction. Their physical three dimensionality is able to do what no two-dimensional representation ever can - achieve depth. I refer to depth here not as geometric idea, but as an experiential property of the physical world. The depth of a physical model can immediately give its audience a sense of material, light, shadow, and space - aspects of architectural experience that in other forms of representation need to be *represented* one step further. Although drawing conventions have established ways to portray these experiential aspects in two-dimensions, for example variations in line weight, hatching, or color, they will always be just that - *portrayals*, rather than the actual experience. Let us not assume however, that architectural models ever become more than representations. In all their material reality, they still remain only fragments of the intended reality beyond. Massimo Scolari addresses this common error in the perceiving of physical models. He explains,

“in its role as a miniature isomorph of the building, the model has on occasion simulated stability where in fact there was none, and it has also concealed many a compositional and distributional uncertainty.” (Scolari, 2012, p. 137)

Scolari goes on to cite Alberti having this understanding even during the renaissance period. He states that Alberti’s models were constructed so as not to “trick” their viewers with an “unworthy” representation of a detailed and ornamented object, but rather a conception of a future to come. Seeing the design process and profession of architecture as a mental labour rather than a physical one, Alberti went as far as to separate himself from the building of models. He believed that even the model, as a representation of the future architecture, should be constructed by others, from another location, with precise and accurate drawings (Scolari, 2012). Alberti understood that never were his representations more important than that which they represent, and he believed so strongly in this fact, that he wanted nothing to do with their construction.



F12: Domenico Cresti di Passignano's Painting *Michelangelo Shows Pope Paul IV the Model of the Dome of St Peter's*, 1620 (Dunn, 2010)

Jumping to more modern attitudes we see similar ideas for two dimensional drawings. Swiss Architect and 2009 Pritzker Prize winner Peter Zumthor's office is known for producing some of the most engaging models in modern architecture. A self proclaimed phenomenologist, Zumthor strikes at the heart of what representations are in his book *Thinking Architecture*. Applying to both models and drawings, his words are worth quoting at length. He writes,

"If the naturalism and graphic virtuosity of architectural portrayals are too great, if they lack "open patches" where our imagination and curiosity about the reality of the drawing can penetrate the image, the portrayal itself becomes the object of our desire, and our longing for its reality wanes because there is little or nothing in the representation that points to the intended reality beyond it. The portrayal no longer holds a promise. It refers only to itself. Design drawings that refer to a reality which still lies in the future are important in my work. I continue working on my drawings until they reach the delicate point of representation when the prevailing mood I seek emerges, and I stop before inessentials start detracting from its impact. ... These sort of drawings enable us to step back, to look, and to learn to understand that which has not yet come into being and which has just started to emerge." (Zumthor, 2010, p. 13)

In defining what modern architectural representation are, perhaps we can agree that they are never objects to be desired in themselves. Leatherbarrow purposes the same for architectural detail drawings, stating that "perhaps construction details are rarely seen as *works* [of art], because

they are designed *to work*" (Leatherbarrow, 1998, p. 51). Representations should never be final, never all encompassing, never complete - truths that can be easy to forget in light of the newest medium architects have turned to, the computer.

The Computer

"All media work us over completely. They are so pervasive in their personal, political, economic consequences that they leave no part of us untouched, unaffected, unaltered. The medium is the message. Any understanding of social and cultural change is impossible without a knowledge of the way media work as environments. All media are extensions of some human faculty- psychic or physical"

-Quentin Fiore in *The Medium is the Message* (1967)

Give a child a tape measure, turn away for a minute, and you might return to find a broken tape measure. Give a child a hammer, turn away for a minute, and you will return to find a smashed tape measure, a hole in your wall, and a child crying with a bruised foot. Every tool on the planet, if used improperly, will yield unfavorable results. But the degree of damage a tool can cause varies dramatically upon the tool and even more dramatically on the user's ability to operate it. The computer is no different. It structures the way we think (and thus design) more than any other design tool in history. However, the computer demands a very specific way of thinking, and is perhaps more of a medium than a tool. It is the medium that architects are now faced with adopting.

It is difficult to give credit to any one person for the invention of the computer but they generally became commercially

available throughout the 1950's. However it wasn't until the mid 80's that "computer-aided design" (CAD) methods began to play a role in architectural creation. In the beginning, CAD technologies took on the role of already established representation conventions. Autodesk's release of AutoCAD was one of the first and most successful software programs for designers (still often used today). It's original functions were quite simple, automating manual drafting techniques with digital ones. As computers became more graphically accessible and user friendly, digital drafting methods began to creep into the workplace. AutoCAD made the transition relatively easy for architects and draftsman. The same lines they once constructed on paper could be graphically constructed on the computer screen with digital graphic input. From its very inception, CAD mimicked existing methods of practice. Traditional straight edges and templates were unnecessary with simple parametric coding, and it wasn't long before digital drawing with CAD became an industry standard. Many firms were quick to adopt CAD technologies, which streamlined drafting, printing, and construction documentation. But few firms, if any, understood the implications it meant for architecture.

Today the computer has not only replaced manual drafting but begun to play a significant role throughout all phases of design. The creation of digital 3D models with comprehensive building information are now standard practice for many firms along with hyper-realistic imagery and exports for full construction documents. Emerging research in digital fabrication, CAD/CAM operations, 3D printing and other material aspects of architecture are also now being explored through the use of the computer. It is a medium that is exploding into the workplace in rapidly multiplying forms. If John Berger was right in

accusing the camera for multiplying the meaning of its subject, then the computer has done ten-fold what the camera did. The computer and the internet have given architects (and culture at large) an infinite multiplication of meanings and images that we now must learn to work with. With more and more of the design process being moved to the digital world, many critics now blame digital technologies for disrupting age-old architectural traditions. Outlined below are issues of modern digital methodologies:

Digital Challenges

- Architectural software is often developed by those without an architectural background.
- Architectural software is often developed to correspond with existing modes of construction and representation which may or may not be the most appropriate mode of architectural conception.
- Software is often developed to enhance the efficiency of architectural conception rather than the quality of the architectural product. “Jevons Paradox”
- Digital modelling gives the illusion of *depth* where there in fact is only simulated dimension. Scale becomes an abstract idea.
- Digital modelling presents the model as a one-to-one replica of the building, rather than a mediating digital artifact.
- The digital medium is based on software programs which are typically only manipulated by those with a knowledge in computer programming, which few architects possess.
- Design process in the digital world gets updated rather than overlaid. There is no trace of process.
- Crossing media platforms usually occurs with resistance, but not understanding.
- And perhaps the most critical issue will be the ability to achieve material knowledge through a non-material medium.



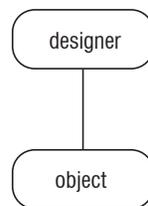
F13: A spread I scanned from Fiore's *The Medium is the Massage*. (Fiore, 1967)

Summary

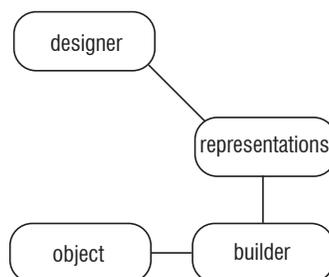
Historical Precedents and Modern Implications

The Act of Making

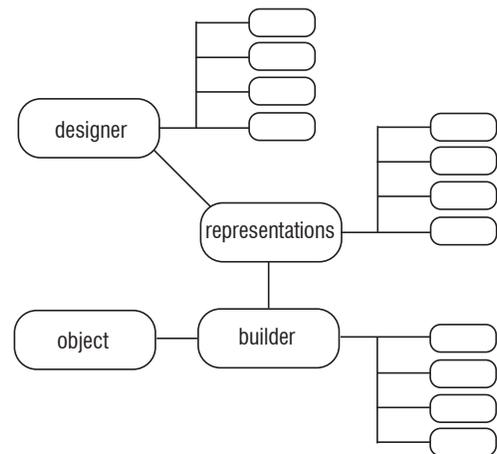
In the Middle Ages design and making were one act performed by the same workers. Ideas were *presented* as the thing themselves. The process of making was direct between those who designed, and those who built.



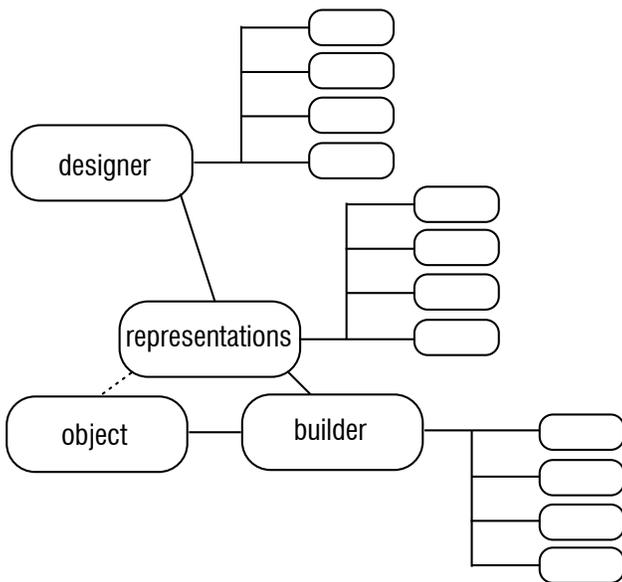
During the Renaissance period architectural drawings were thrust into practice and for the first time designing and building became different activities. This diversified the process of making.



Since the invention of representations, architects have been working towards the object through mediating artifacts. Today the process has been diversified even further with multiple designers creating multiple forms of representation and multiple parties in the building process but the designers relationship to the act of making has remained constant since the first use of representations.



Whether in the form of a plan drawings done by hand on parchment, perspective renderings fully water colored, or digital models representing multiple elements of a building, the process of making has remained consistent. Even CAD/CAM design methods which some argue to be a revival of the master builder process of building, still rely on representations to be carried out physically - almost always by someone else or a robotic machine.



We can assume that with any architectural endeavour there is a limited amount of time for the architect to conceive the design. Either in the micro scale of a budget and time line, or on the macro scale of the hours, days, or years the designer has remaining in their career. These understandings should come as no surprise to anyone, yet they often go overlooked and have drastic implications on the education, practice, and epistemology of architecture. Architects need to ask themselves, how best should we be spending our time? Is the current system of representation and building the most effective and meaningful for architectural practice as both an art and science?

Architects must be aware that we are no longer working with the objects we desire to create. We are not *presenting* our ideas directly, we are *[re]-presenting* them through various means. As we have learned this was not always the case but it has remained the *modus operandi*.

The scale and speed at which we now represent, view, think, analyze, map, draw, and design has increased ten-fold in the past 20 years. However, the scale at which we experience space is still very small, and has arguably never had the ability to change. Our spatial existence is still centrally locked in our own sensory perception of the world. The *thing* matters. Architecture inevitably takes on its own life after construction despite the intentions of its creators. Throughout history architects have found various ways to work under the circumstances of the times. Some were successful, and others were not. Some used the latest technologies, while others opted for different methods. So what makes successful architects? Everyone seems to think that the solutions are just around the corner, that soon everything will come together

with the aid of an emerging technology. We've become numb to the concept of new technology. If its not emerging its already dated. We spend so much time looking to the future that we forget and even fear to live in present. Fiore states of this evolution saying,

"From the fifteenth century to the twentieth century, there is steady progress of fragmentation of the stages of work that constitute 'mechanization' and 'specialism'... We look at the present through a rear view mirror. We march backwards into the future... Formerly, the problem was to invent new forms of labor-saving. Today, the reverse is the problem. Now we have to adjust, not to invent. We have to find the environments in which it will be possible to live with our new inventions" (Fiore, 1967)

Architecture needs makers. At a time when more and more of our lives are being digitized and moved to the web, the physical objects and environments that we choose to surround ourselves with are becoming even more important. But paper architecture has replaced material architecture and digital architecture has replaced paper architecture. Increases in the technological offer us little if we lack the understanding of their use. The problem has become less an issue of what to do, than of how to do anything at all. Only with a clearer and more conscious understanding of the present can we design for the future. Martin Heidegger claims,

"Thus we shall never experience our relationship to the essence of technology so long as we merely conceive and push forward the technological, put up with it, or evade it. Everywhere we remain unfree and chained to

technology, whether we passionately affirm or deny it. But we are delivered over to it in the worst possible way when we regard it as something neutral" (Heidegger, 1977, p. 4)

But technology never really changed the object of architectural representation, rather *how* architects go about making their representations. Why then do we see so much confliction with new mediums of digital design? New mediums will always create tension. When new technologies threaten the way things have been done in the past there will always be anxiety. Just as the inventions of perspective drawing and the camera destabilized traditional modes of thinking, so has the computer destabilized traditional modes of architectural practice. Pritzker Prize winning architect Thom Mayne explains the situation stating that,

"Each new generation of artists claims it is ruined by new technology. I remember discussing this with my photographer friends. They suggested that electronic cameras would ruin the profession, but this has proved to be total nonsense! We use similar sensitivities with relevant, current media. The students who can draw with a pencil are the same ones that produce beautiful drawings on the computer. It has nothing to do with the tool; it has to do with the ability to discriminate and understand" (Mayne, 2012, p. 69),

In time, the challenges posed by digital design technologies might be met. But of course by the time that happens, we will have new challenges to meet. The issue instead will be making meaningful creations in a time of conflict and anxiety. The problem is not with the medium, but our understanding

of it and willingness to make meaningful use of it. “The whole matter rests on the ways materials are shaped and transformed, the ways they become what they had not been before, the ways they exceed themselves” (Leatherbarrow, 2009, p. 91).

The Challenge

This investigation began by questioning the role of modern and traditional modes of representation in the act of making. As we have seen, representations have played a very consistent role in this regard. The aim of this research will now be to explore effective representation techniques through the lens of modern practice. Are we allowing our representations to help us reveal significant architectural attributes? Time and efficiency driven processes are making this more and more difficult which has led software developers to create programs aimed at quantitative description rather than qualitative discovering. Architectural representation are successful when they act as a form of revealing. They either reveal to the designer that which has not yet fully come to present itself, or reveal to the builder that which is essential for quality construction. Moving forward, this thesis will attempt to make visible representation methods that both reveal design knowledge, and transpose it into built works. If this design process is to yield favorable results, the challenge will be to integrate similar methods into real world practice.

Theoretical Goals

- 1) Use representations to enhance the “making” or “crafting” of architecture.
- 2) Use representation and representation technology to reveal and study qualitative spatial design attributes.
- 3) Propose ways to integrate goals 1 and 2 into modern practice.

Typological Research

Case Study 1

Pionen Data Center

Case Study 2

Sagrada Familia

Case Study 3

Manhattan Transcripts

Case Study 1

Pionen Data Center

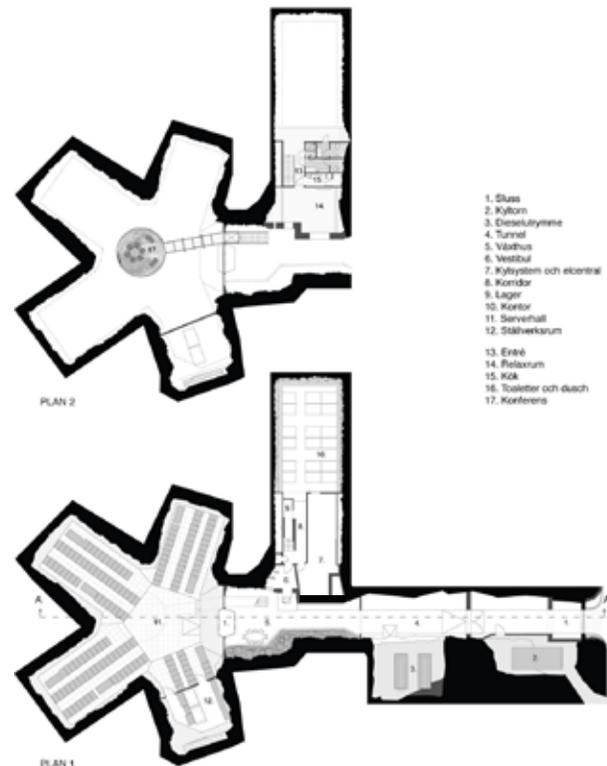
Architect: Albert France Lanord Architects

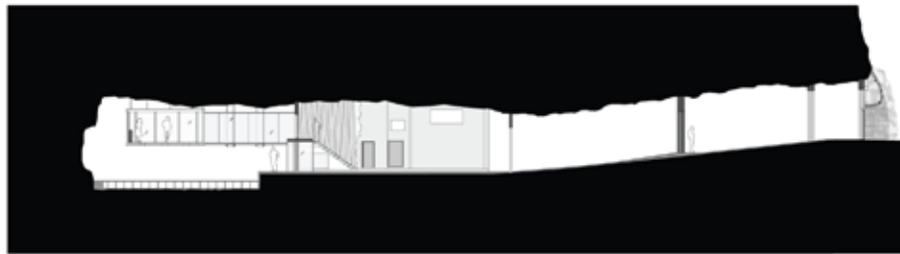
Use: The building Shows one of the most physically secure data centers on the planet - an issue that will need to be handled delicately for the Winipeg Data Center. Demonstration of typology.



F14: Photos of Pionen. Courtesy of Ake Eson Lindman (Lindman, 2008)

Pionen is a great case study for my project. It not only shows typical sizing of spaces and relations, but innovation in the rapidly evolving building type. It is an underground data center. Constructed in an old nuclear fallout shelter in Sweden, and tucked into 30 meters of solid granite. The building is accessible through only an entrance tunnel. It is both data center and colocation center - with maximum security as its most important element. How would security issues be different on a dense urban site?



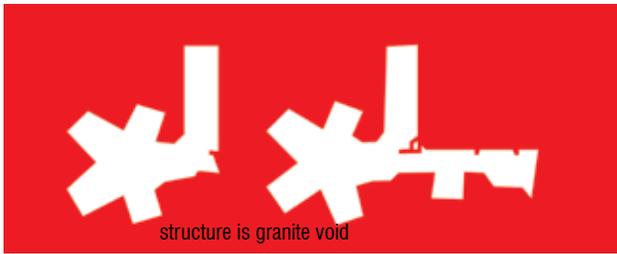


SEKTION A-A



F15: Drawings of Pionen. Courtesy of Albert France-Lanord Architects (AFL Architects, 2008)

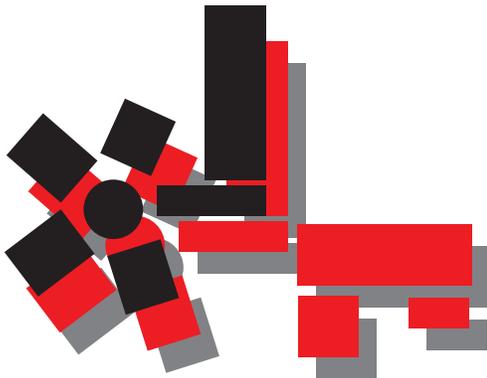
Structure



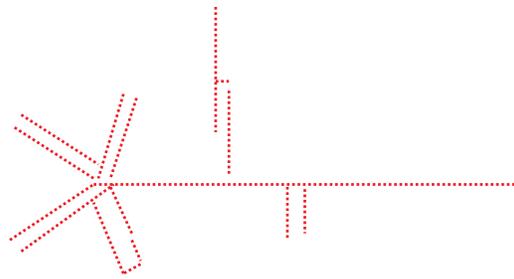
Natural Light



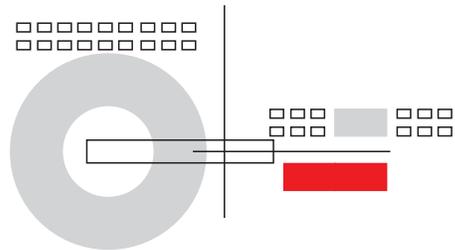
Massing



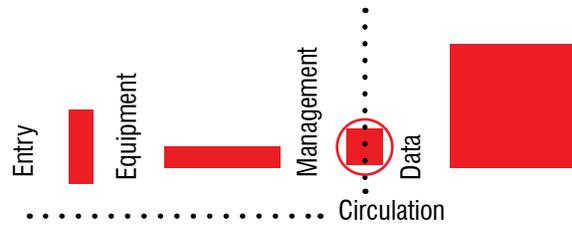
Circulation



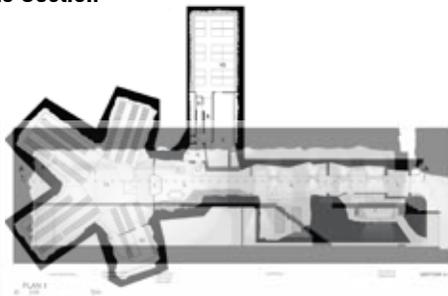
Geometry



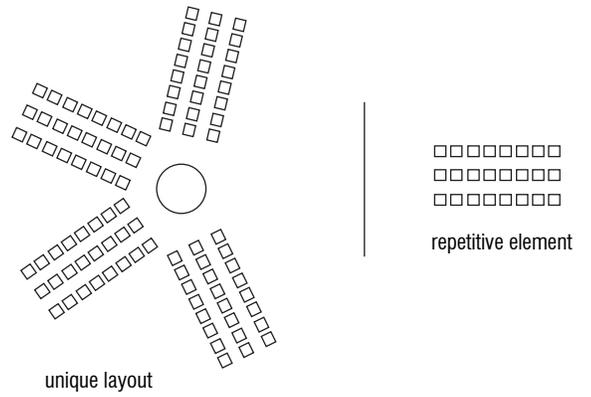
Hierarchy



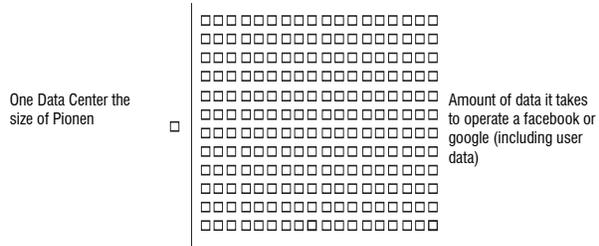
Plan to Section



Repetitive to Unique



Unit to Whole

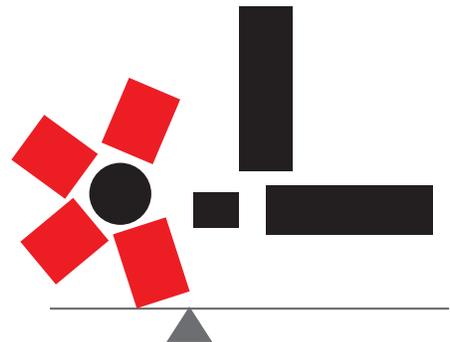


Additive and Subtractive



building is complete void

Symmetry to Balance



Case Study 2

Sagrada Familia

Architect: Antoni Gaudi

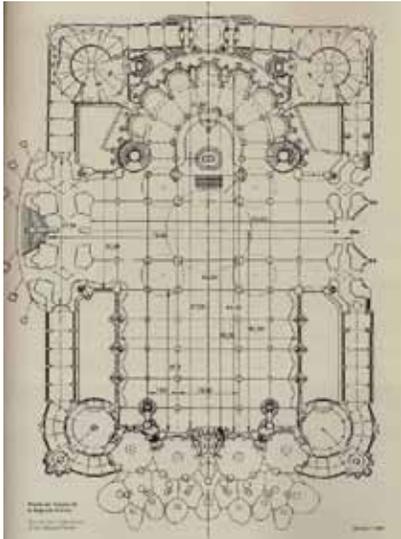
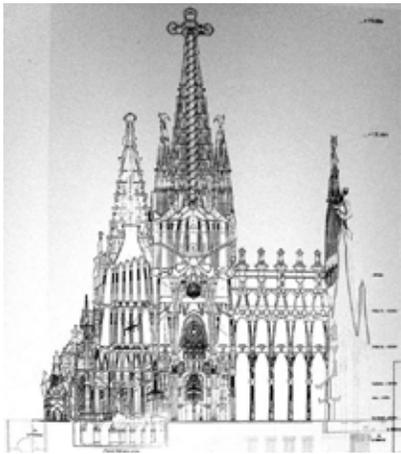
Use: The case study provides a building that has transitioned through multiple changes of architectural representation. From traditional hand drawings to computer aided modelling and 3D printing. It acts as a demonstration of changing mediums.



Few projects today last long enough to say a change in medium occur during their construction. Sagrada Familia is one of those select few. Originally designed by Francisco de Paula del Villar, work began 1882 and was soon taken over by Antoni Gaudi in 1883. Gaudi changed the design drastically and is often mistakenly given credit for being the sole designer. Gaudi died in 1926 but construction of the building is still ongoing today. The project has seen over a century of changes in media and process of architectural creation. Today it is projected to be completed sometime around the year 2026 - the centennial of Gaudi's death.

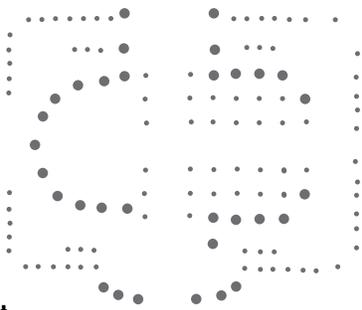
The church started with typical drawings of section, plan, and elevation from mechanical drafting. Today however, CAD technologies have been used to both streamline the construction of the project and test its parameters. CNC milling of stone from 3D models is being performed in hours, a process that would have perhaps taken traditional stone masons entire years to complete. The buildings multiple spires, arches, and buttresses are all being tested and analyzed with computer design methods. Essentially, modern architects are using the latest and most advanced technology to perform tasks that would have originally been done completely by hand.

The project is both old and new. It is both then and now. What does this mean for representation? One might argue that its current status of construction is as logical as driving a 727 airliner down an interstate highway. Should we be using new technologies to interpret a new meaning for Sagrada Familia? What are we saying by replicating traditional methods with new technology?

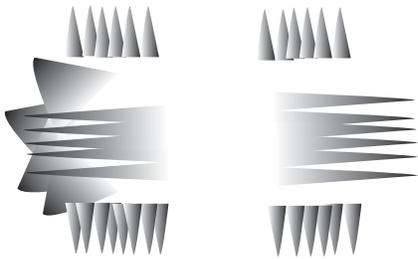


F16: Images of original drawings for Sagrada, as well as new processes, 3D models, and construction photos. Courtesy of the Sagrada Familia Foundation (Sagrada Familia Foundation, 2000)

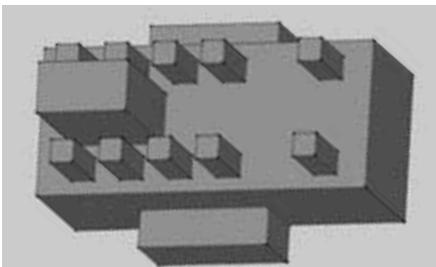
Structure



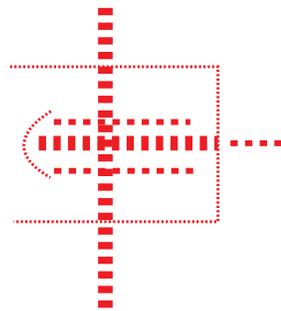
Natural Light



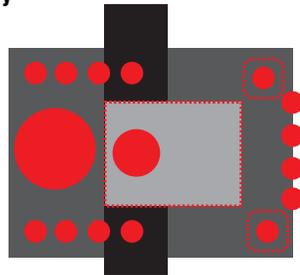
Massing



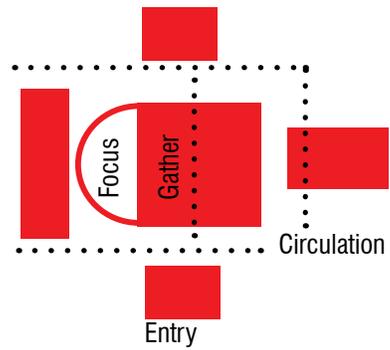
Circulation



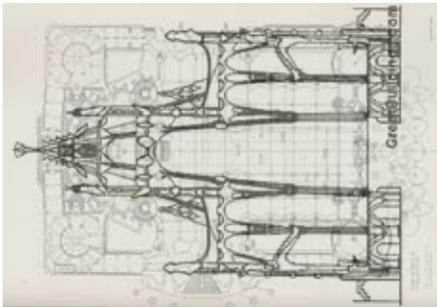
Geometry



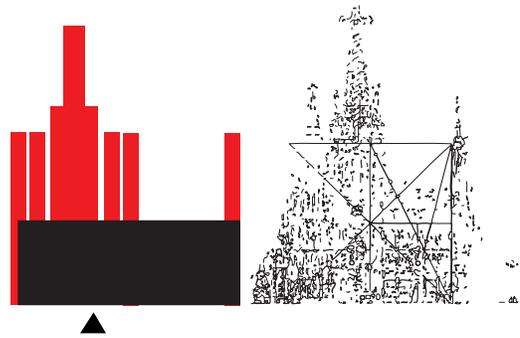
Hierarchy



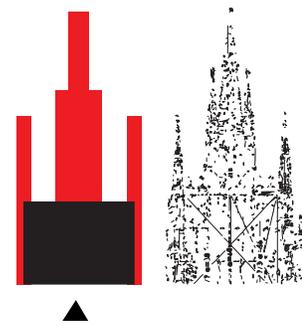
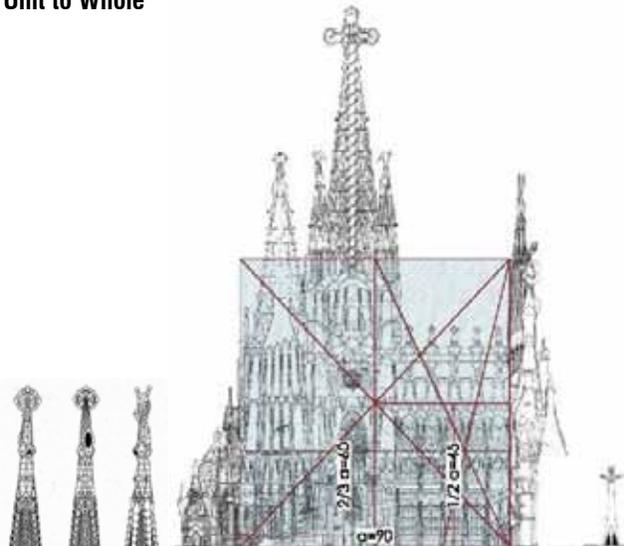
Plan to Section



Symmetry to Balance



Unit to Whole



Case Study 3

Manhattan Transcripts

Architect: Bernard Tschumi

Use: A study on the act of architectural representation when a building is not intended. What is the role of drawing when it is not intended to create a building. Is there and should there be such a role?

Architect and theoretician Bernard Tschumi is well known for drawings and writings about space, movement, and event. In the *Manhattan Transcripts*, Tschumi (1976) claimed that

“only the striking relationship between three levels of event, space and movement makes for the architectural experience. Yet they never attempt to transcend the contradictions between object, man and event in order to bring them to a new synthesis: on the contrary, they aim to maintain these contradictions in a dynamic manner, in a new relation of indifference, reciprocity or conflict...” (p. 277).

In the *Manhattan Transcripts*, Tschumi set out to document these interactions and contradictions through photography and diagrams. His aim was to transpose the typically invisible relationships between spaces and their structuring and producing of events. His drawings served as documentation of the occurrence of landscape and architecture as a framework of time and space. Within the drawings he outlines ‘actors’ and ‘stages’ - environments that stimulate and structure our lives without our consciousness of it. Moreover, his goal was to provide a critique and examination on the city of the 20th century.

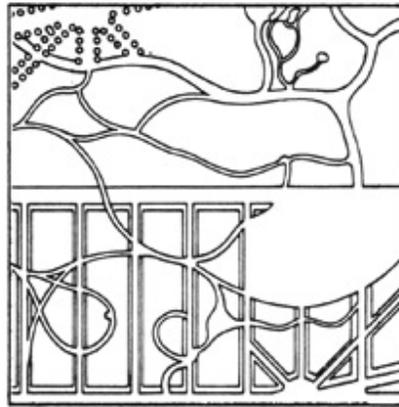
I thoroughly believe architects need to be concerned with making. Tschumi has a few built projects but the majority of his work has been theoretical in nature, contributing more to an epistemology of architecture than a construction of one. I still feel however, that his understanding of representation and effective use of it stimulates questions that building perhaps never would be able to. The *Manhattan Transcripts*, although not concerned with architectural making, were still successful in their execution. The fact is that today there are more architects than there is a demand for architecture, which leaves room for exploration within the profession.

Is there a role for representation without building? Absolutely. Its role is to test ideas and expand the understanding of architecture. It is not only a accepted role, but one that is crucial to the questioning of current methods and practices. There are groups of architects who are ultimately concerned with making buildings and there are groups of architects who are ultimately concerned with making ideas. The breadth of the profession has expanded the means by which architects operate. Some who have skills in crafting, others in planning, while others may have different skill sets all together. The important thing is for students of architecture to find what it is they are good at and move forward with those skills. As Thom Mayne comments,

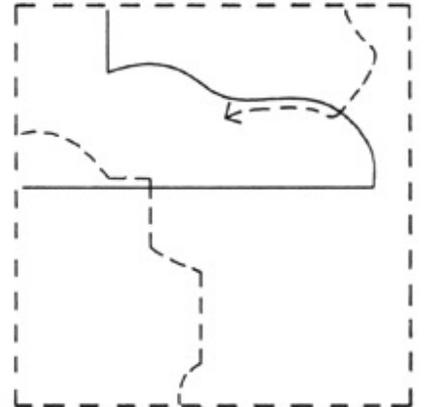
“...we must each match our abilities, talents and sensitivity to the world with our work. There is no single way of being talented. As E.E. Cummings noted, Toms can't be Harrys and Harrys can't be Toms. We each have to find our own nature as architects.” (Mayne, 2012, p. 69)



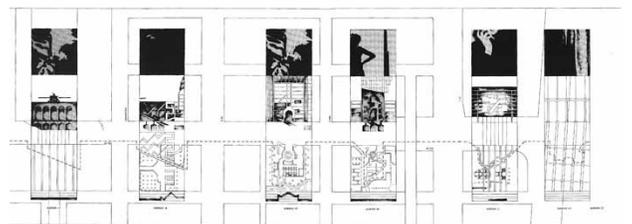
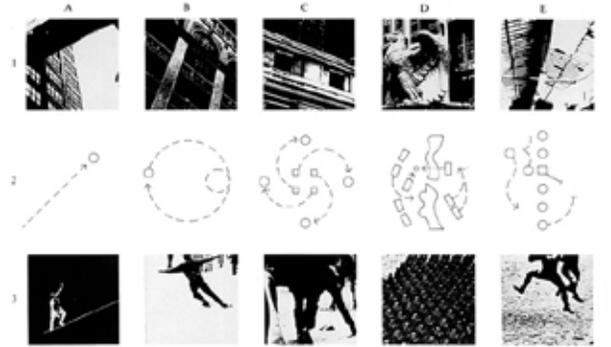
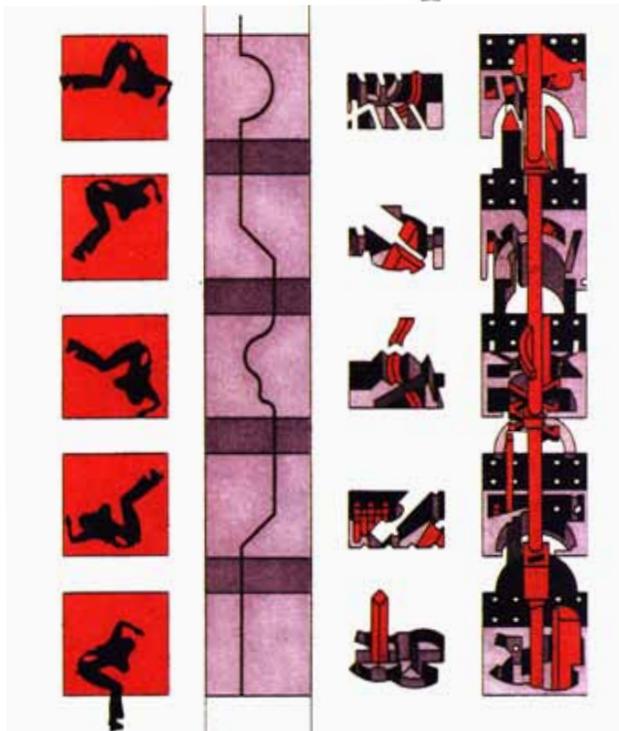
1



2

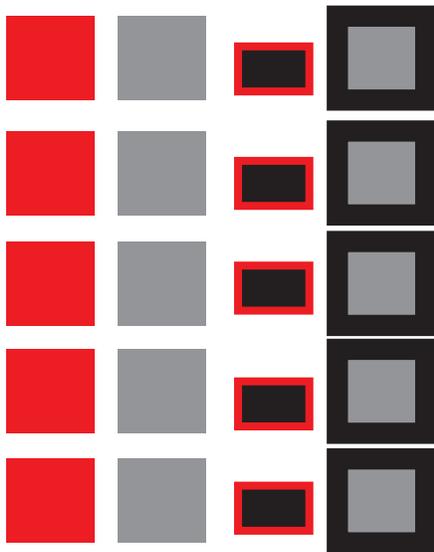


3

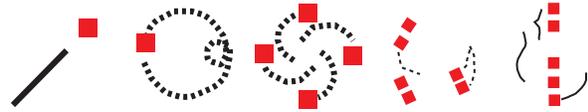


F17: Drawings from *The Manhattan Transcripts* (Tschumi, 1976)

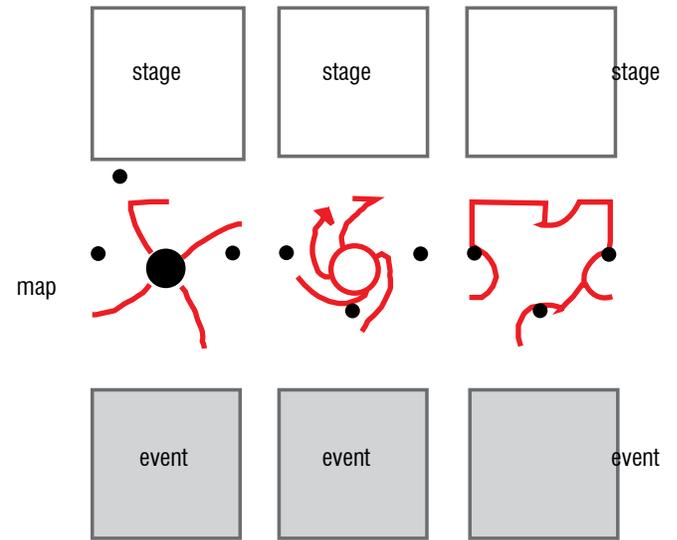
Structure



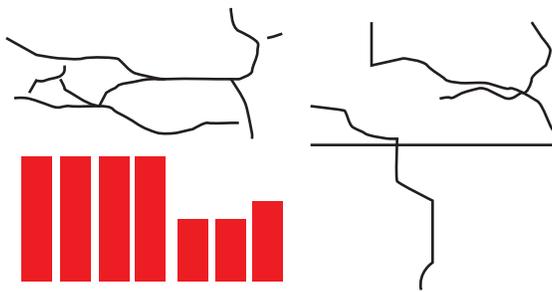
Circulation



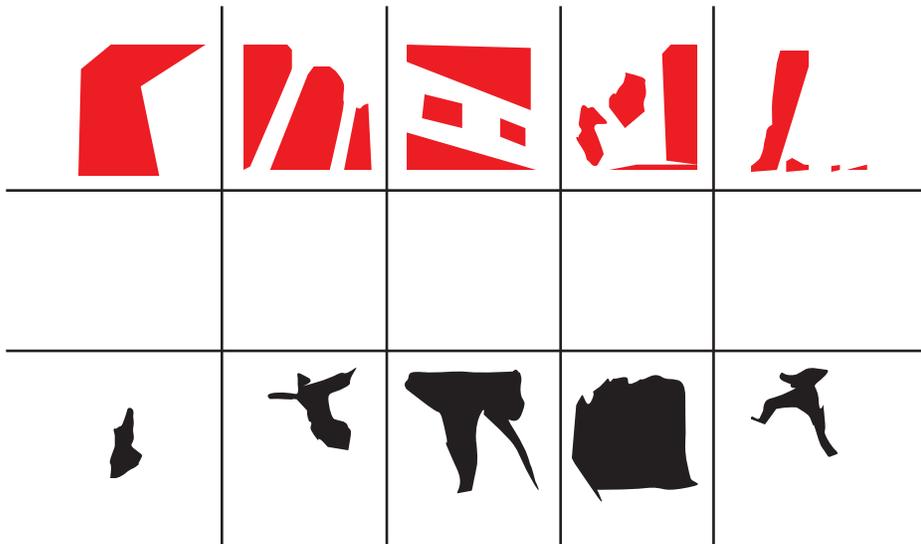
Hierarchy



Massing



Symmetry to Balance



Unit to Whole



Typological Summaries

The case studies selected represent a diverse range of architectural inspiration. The first case study - Pionen Data Center - represents one of the biggest issues that data center's must deal with, security. The second deals with changes in medium, and in this unique project, remains consistent to one project over time. The third, deals with the latent attributes of architectural practice often seen more as studies in themselves rather than architecture. Each case study presents unique variables as part of the equation for my thesis.

The theoretical premise was most affected by the third case study - The Manhattan Transcripts. My original direction for my thesis began questioning how architectural representations affect making. I was looking for connections between the mind and the hand, the built world and the imagined, but I had ignored a large part of architectural thinking. In The Manhattan Transcripts Bernard Tschumi shows exactly what the role of architectural representation is - the discovery and revealing of knowledge. Drawings are usually done to present and idea to someone. They might be used to tell a client what a design will look or feel like; they might be used to tell a builder how a masonry wall will connect with a curtain wall; or they might show the owner how to operate their equipment so as to maximize energy efficiency and save money. But we need to remember (as Tschumi vividly portrays) that architectural drawings are also communicating to the designer who creates them. They act as a two way street. They both communicate ideas, and create ideas through their immediate feedback to the designer. When we juxtapose this idea to the act of making architectural representation then becomes a form of making. Drawing becomes a form of *making* ideas, not merely transposing them. Moving forward with the thesis project, I will keep this in mind and attempt to activate representation as

not only a form of communicating design ideas, but as a form of creating design ideas.

Case Studies 1 and 2 were also very helpful, but did not directly change any of my assumptions about architectural representation. The 1st case study however, did bring to light a serious issue that I plan to address with my thesis design. In searching for appropriate case studies of existing data centers I found it nearly impossible to track down full scale floor plans, sections, elevation, etc. The issue is that these drawings and layout are considered highly valuable bits of information. Designers and data center owner have the horribly anti-productive understanding that if they share their plans and layouts they will be losing valuable intellectual property of their company. Rather than attempting to forward the advancement of data center technology, companies are holding it in a gridlock of secrecy. For data centers to fully develop as an architectural typology it is imperative that the community of those with specific knowledge for sustainable and functional use make that knowledge present. In the creation of an urban data center geared towards the promotion and sharing of knowledge the fact that most data center owners have completely opposite viewpoints will make this project highly conflicted. As an academic study however, it will provide huge opportunities to shed light on the potential for a new type of data center.

The 2nd case study on Sagrada Família was of specific interest to the theoretical premise. It represents both historic and modern attitudes towards architectural representation and making. Once manual design techniques have been replaced by computer aided digital modelling, fabrication, and construction. I would find the project to be more meaningful

however, if instead of using the new tools at our disposal to make construction of Sagrada Familia more efficient and streamlined but to make it more sustainable, more beautiful and more culturally relevant. Not that there is anything wrong with carrying out the designs of the past, but when we ignore the process for making them happen as a vital part of their future meaning we are ignoring the essence of medium. The project remains promising due to its potentially revived relationship between the thinking of architecture and its making. Computer aided design in this case acts as a link between an ancient form of architectural creation and a modern form of representation. But Alberto Gomez makes an important distinction here, he states,

“Architectural conception and realization assume a one-to-one correspondence between the represented idea and the final building. The fact that digital media also make this literal transcription more feasible through automation and robotics has resulted in an unwillingness to question this premise” (Gomez, 2007, p. 11).

Even though CAD/CAM technologies are beginning to change the way we craft and make architecture, the use of technology needs to be grounded on ethical premises.



F18 (Fletcher, 2012)

Historical Context

Typology

The data center has a completely obfuscated historical context. The vast majority of its users are entirely unaware of its existence. For as present, intelligent, and ubiquitous as the internet is, its history is daftly underwritten. Like with many utilities of modern culture, we care neither how, nor where this resource comes from. “The internet is like oxygen. People don’t ask where oxygen comes from” (Blum, 2012, p. 47). We tend to be more concerned with what is on the internet, than what the internet is. But as Fiore reminds us, “Societies have always been shaped more by the nature of the media by which men communicate than by the content of the communication” (Fiore, 1967). Today, the new media that we live with (or perhaps live *in*) shapes our experience and understanding of the world more dramatically than ever before. Yet our understanding of this new media is almost completely non-existent. A data center created on an ethical basis would then be one that not only strives to be more energy efficient and sustainable, but one that educates and engages modern society as a mirror of culture.

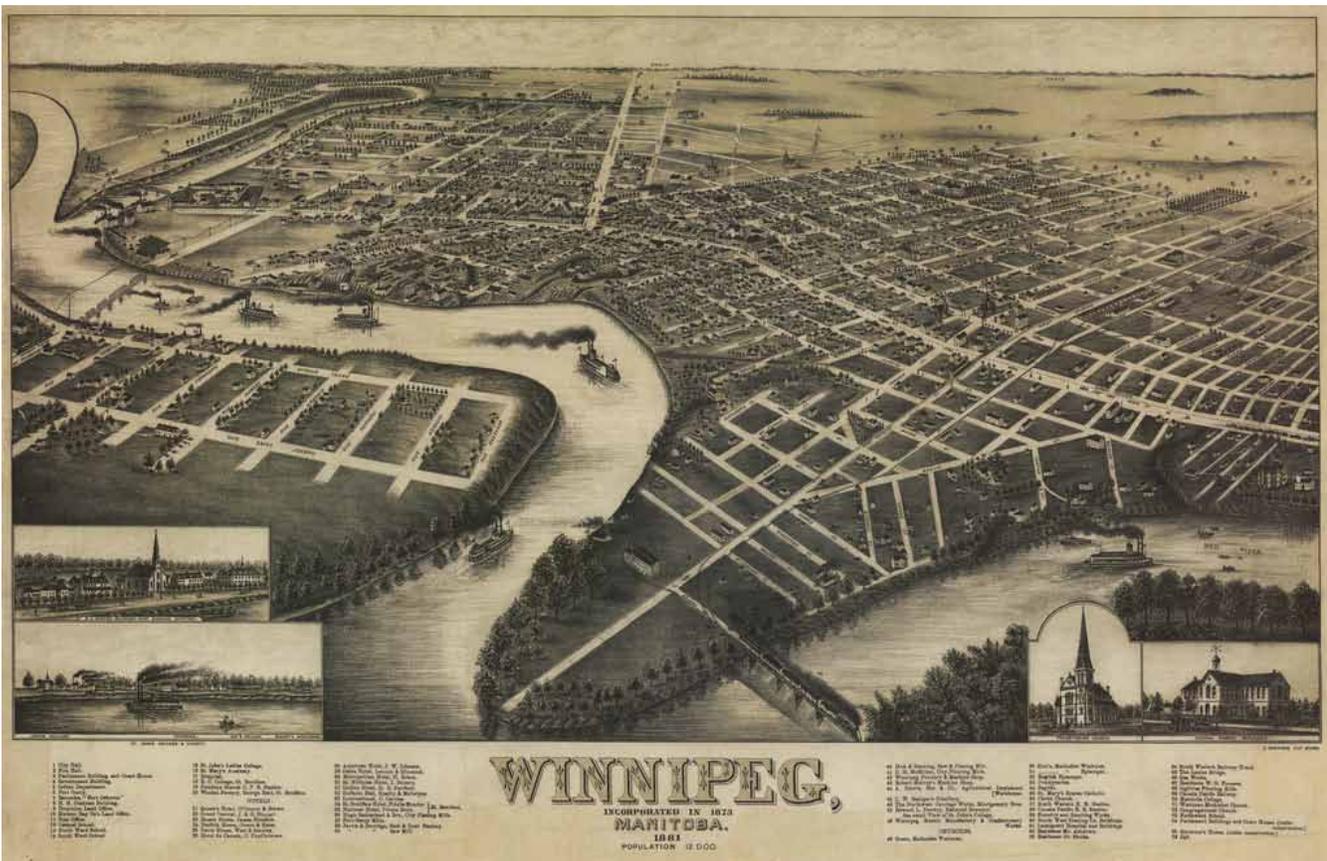
If a data center could educate, what would it teach?

It might explain how the Department of Defense’s *Advanced Research Projects Agency* was the agency responsible for much of the original research of the internet; it might teach of electricity, currents, and physics; it might tell the story of Leonard Kleinrock and the first interface message processor at the University of California in 1969; it might teach how networks began to creep out from university to university during the 70’s; it might tell of how big computer companies and government agencies like IBM, XEROX, NASA, and the Department of Energy were some of the first companies to

establish their own networks; it might narrate the story of the TCP/IP switch over on new years day in 1983; it might even talk about the political systems in place during the early years of the internet; if taken out of context, it might tell you Al Gore invented the internet (he didn’t by the way); it could describe the invention of fiber optic cables; it might speak of exchange points, or of one of the earliest ones - MAE-East in Hendon Virginia; it might speak of network theory; it might even teach you about the physical extent of the internet, a massive network of cables and fibre optics spanning continents and crossing oceans; or if it were so inclined, it could teach you about its own history - the development of servers and hubs, giant, buzzing, power-guzzling, oversized factories of computers that never sleep. But out of all the history it might teach you - all of the information it might present - it would never get at the true essence of a building.

The aim of the data center should not be the same as the internet itself which presents information. The data center must present knowledge. The internet provides infinite breadth of data, but almost zero depth of wisdom. If the data center should teach anything, it should be an ethical relationship to technology. On the urgency of this relationship, Martin Heidegger writes,

“That is why the instrumental conception of technology conditions every attempt to bring man into the right relation to technology. Everything depends on our manipulating technology in the proper manner as a means. We will, as we say, ‘get’ technology ‘spiritually in hand.’ We will master it. The will to mastery becomes all the more urgent the more technology threatens to slip from human control” (Heidegger, 1977, p. 5).



F21: Birds Eye View of Winnipeg 1881 (Manitoba Historical Maps, 2010)

Regional History

Winnipeg marks a historic settlement at the junction of the Red and Assiniboine Rivers. The name Winnipeg was derived from the Cree Indian name given to lake Winnipeg 40 miles north. Its original context was “win” (muddy) and “nipee” (water), essentially translating to “muddy water” - appropriate still today in light of the high sediment load of the Red River. A fur trading post since 1738, Winnipeg’s first permanent settlement was in 1812 by Scottish crofters and it has grown steadily since then. (City of Winnipeg, 1996)

The city was incorporated in 1873 and just 5 years later saw its first rail connection. Today Winnipeg has a thriving economy and the area has a population of over 500,000. Winnipeg is a city that was formed by connections. Created through networking and trade. The city’s infrastructure has evolved from canoe and foot travel to steam boat and rail, and now to vehicular and air traffic. The future infrastructures of the city will be one of data.

Academic

I hope my research will provide significant insight for future educational reform. There is a large misunderstanding of media throughout architectural schools in America. This dilemma has nothing to do with a generation gap, but rather the lack of a model for ethical use of technology. I would like to show how an understanding of medium is essential to architectural education. Within the academic environment I will be able to test ideas on a scale manageable yet effective for the theoretical premise and unifying idea.

My aim is to display a workflow that reveals the latent attributes of media that we work with. There is always a space between any medium and the true goal of the designer. This is the same for all of the arts. The better we understand this space, the better we will be able to make meaningful choices. To share this type of knowledge - this type of working with technology and not against it - is essential to the future of architecture and I feel that it is imperative that it starts in the academic realm. From there it can advance into the professional realm.

Project Goals

Professional

I hope to create a way of producing architectural knowledge - one that can be shared with the profession at large. If this thesis can offer anything to the professional community then it will hopefully be a critique on current use of various use of design mediums. I don't believe that many architects today understand the choices they make as they are designing. I feel that people (sometimes rightfully) blame technology for producing poor architecture. But I know this is not the case. If an architect uses a tool for design that yields an unfavorable result, then it is not the problem with the tool but the architects lack of understanding or misuse of it. Rather than continuing to use computer aided design technology as a means of efficiency, I hope that my thesis project will yield tangible results of a more meaningful design process that both meets demands of modern architectural practice and questions them. The design decision made during this thesis will always be conscious of industry standards and modes of practice. It is critical that the project is relatable to modern design practice. The changes this thesis will be able to make to the way people think depends on its ability to be read and understood by the professional community

Personal

It is part of my personal agenda to dispel rumors and myths about technology and show how it could be used more meaningfully to engage materiality and making. Since the medium will always be changing, I plan on using this project as a test to develop a methodology of the present that will also apply to the future. It is my personal goal to discover a process of fulfillment and enjoyment for the practice of architecture.

The project will of course be more useful to myself than to any others. As much as I feel the knowledge created should be shared and spread throughout the design community, no one will ever know it better than myself. With this realization in mind, I will move forward with a very personal workflow that I understand will not be applicable to everyone. But hopefully the messages I create, the ideas behind them, will be the part of my project that I can effectively share with anyone - architect or non.



Site Analysis

Winnipeg Manitoba



Site Narrative

“No ideas but in things”

-William Carlos Williams in *Paterson* (p. 163)



Site Photo (Benke, 2012)

It is often understood that landscapes, whether in the heart of a city or farthest reaches of wilderness, create events. But let us not forget that landscapes are also themselves events. The ground beneath our feet is constantly *occurring* in the sense that its material properties, those that are ultimately effected by geologic or physical processes; and its cultural properties, those that we impose on the land as an abstract idea, are in constant motion. Some move fast, others slow, but they are never static. Landscapes act. They both inspire events, and are created by them. Any architectural *site* is a constantly changing equation with its variables in perpetual turmoil. This dynamic nature to landscape is what gives architecture its meaning. It should act as both its inspiration and articulation. Architecture is an extension of this landscape - formed by it, and becoming part of it.

Critics might argue this to be a theoretical framework for architecture. I would argue the opposite. That in fact, it is the only possible outcome for any act of making. Let's test this idea. Imagine a building, any building at all. Without asking, I know two things about it. The first: it is located *somewhere*, that is, it exists on earth. The second: it is made of *something*, that is, something that came from the earth. It surprises me how long it took to come to this profoundly basic realization. A universal truth of all things made that is so simple we forget about it. Everyone has an idea - architecture is this, architecture is that. Nonsense! Architecture *is*. How beautifully simple it makes it! I design with the understanding that everything that

is, everything that exists, will be located somewhere and made of something. For me, design inspiration is not applied (as an idea), it is discovered (as a thing).

But alas, the constantly changing equation - the site. What are the events that have shaped Winnipeg? We could just as well start with the events that created the planet we live on. Instead we should ask ourselves, what are the events that are unique to the creation and existence of this specific area of Winnipeg. The difficult part with any act of making is to distinguish which events (out of the infinite number that have created its condition) must be responded to and which must be set aside. So how do we determine the relative importance of landscape events? There is no one answer. The greater or lesser success of our architecture is dependent on how they are interpreted and transposed. "The whole matter rests on the ways materials are shaped and transformed, the ways they become what they had not been before, the ways they exceed themselves" (Leatherbarrow, 2009, p. 91).

The aim of site analysis is similar to that of architectural representation. To illuminate what is not immediately visible. To show what we would not be able to see under different circumstances. Since no two places on this planet are identical the study of a site can be a complex undertaking. Still, the crux of site analysis lies in the future. The vital component to a site study is always the making of knowledge from information and the presentation of this to the public.



Site Photo (Benke, 2012)

Corridors & Human Environments

This specific area of Winnipeg is very diverse and rapidly developing. The Forks has proven to be a success in terms of planning and urban design and now the surrounding areas are being taxed with heavy increases in pedestrian and vehicular traffic. The site has both natural and man-made systems interacting. There is a walkway along the river that provides a great corridor for pedestrian and recreational traffic, as well as infrastructure crossings and junctions. The natural corridor of the river provides scenic views of the dense vegetation and even wildlife and creates an acoustic buffer to the noise of the city and is generally well connected throughout the downtown area. Some parts of the corridor have been designed and developed, while other remain less refined.



View from less developed segment of river walk (Benke, 2012)



View from the river walk looking south (Benke, 2012)



View from the river walk looking north (Benke, 2012)



View on the site looking northeast (Benke, 2012)



View across the site (Benke, 2012)

Traffic & Accessibility

Stepping away from the natural corridor, the urban vehicular conflicts of the site present many opportunities and challenges. Parking will be a major issue, as the site will be covering existing parking lots that are already in high demand. Also, accessibility both for pedestrians and vehicles will demand thorough consideration and planning. In 2009 Provencher Boulevard near the site saw an average of over 35,000 cars a week compared to the Water Front Drive that saw less than 10,000. Furthermore, crossing Provencher Bridge marks the entry into Downtown Winnipeg and is rich with inspiration for the design. Also, the sites proximity to the river corridor is an opportunity to provide much needed links and gateways for pedestrians.

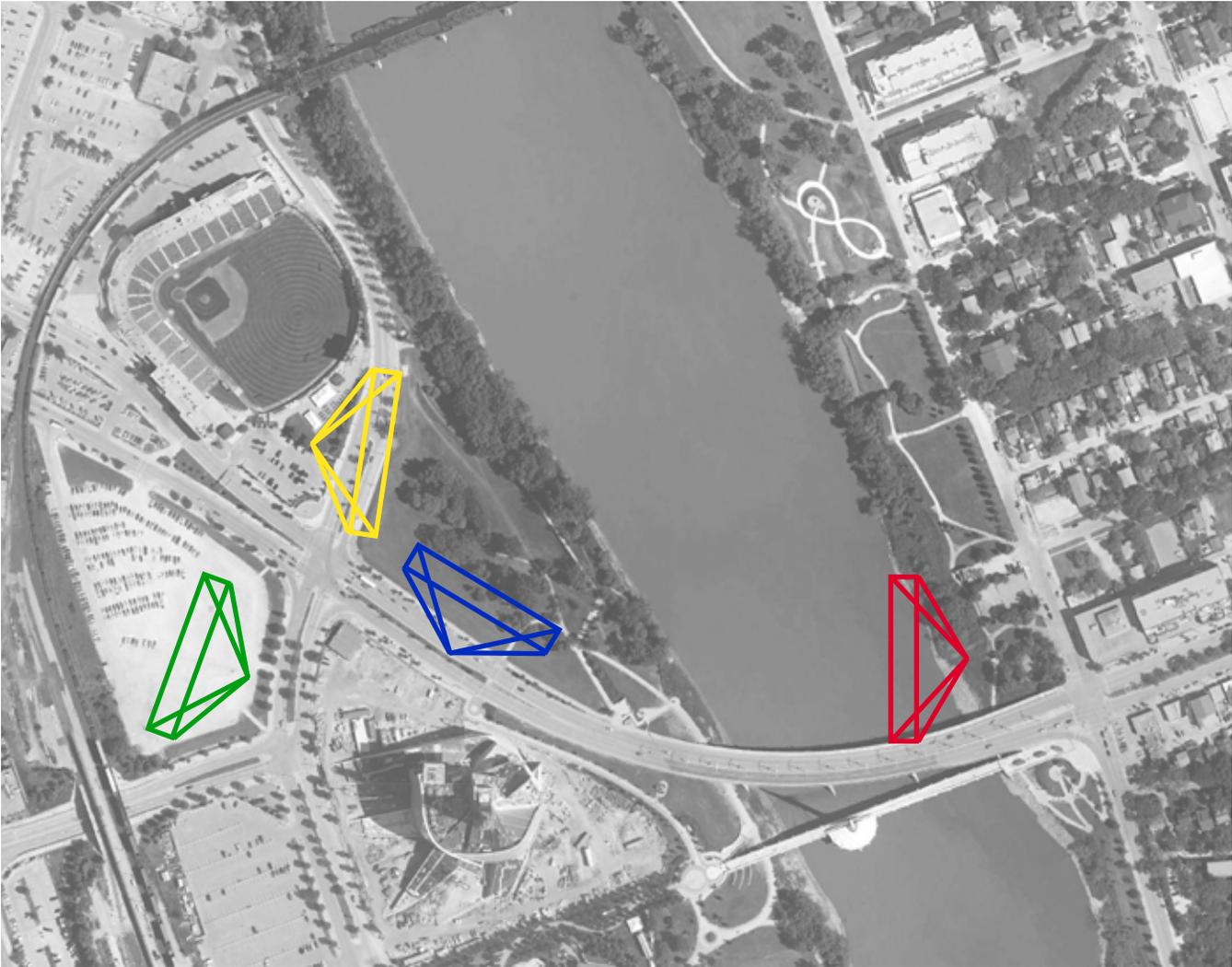


View looking at both portions of the site, parking lot in the left and open green space on the right (Benke, 2012)

Panoramas



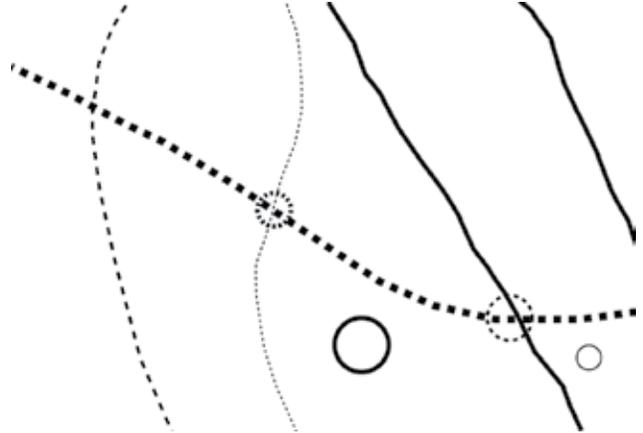
Photo Map



Imagery



Edges & Nodes



Landcover & Structures



Water



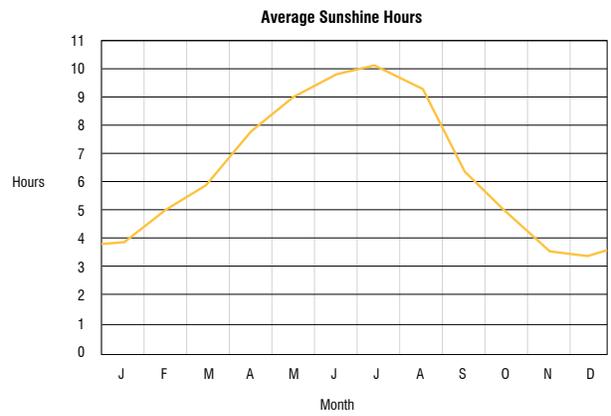
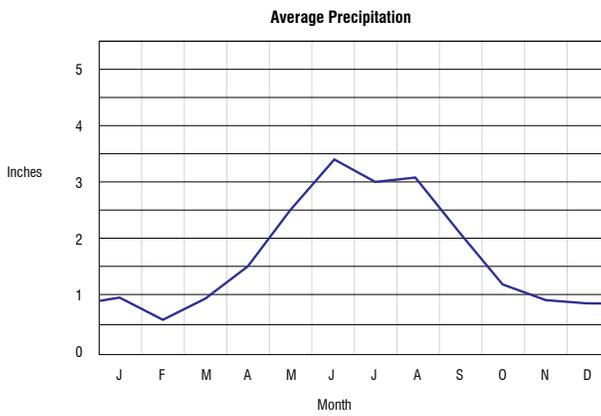
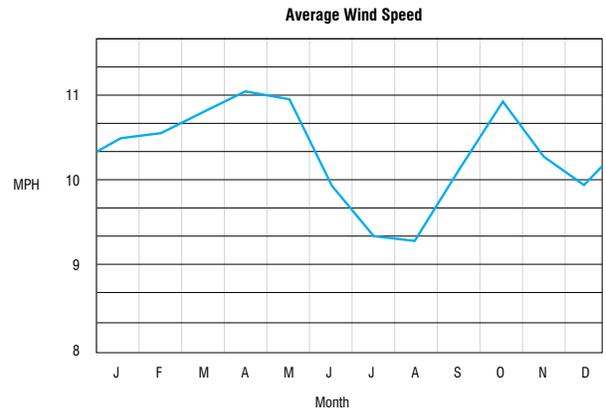
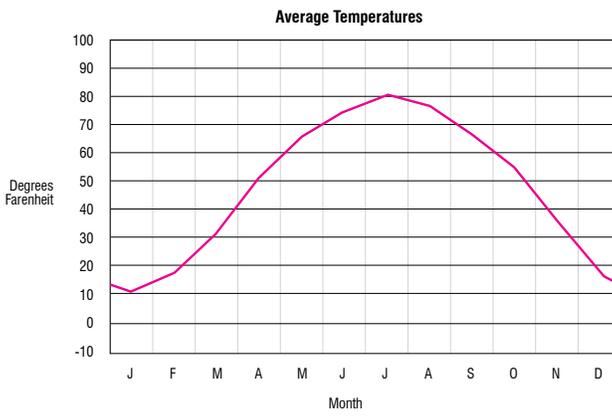
Site diagrams (Benke, 2012)

Soils



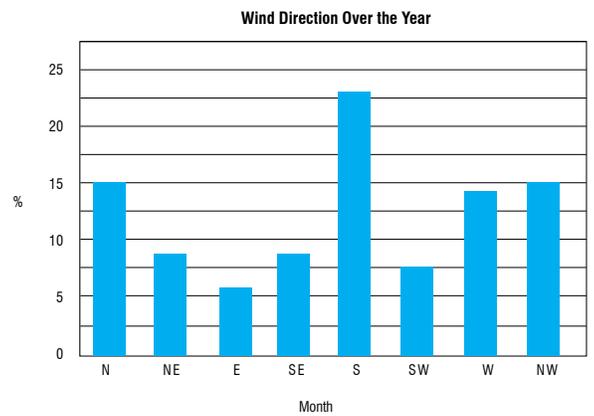
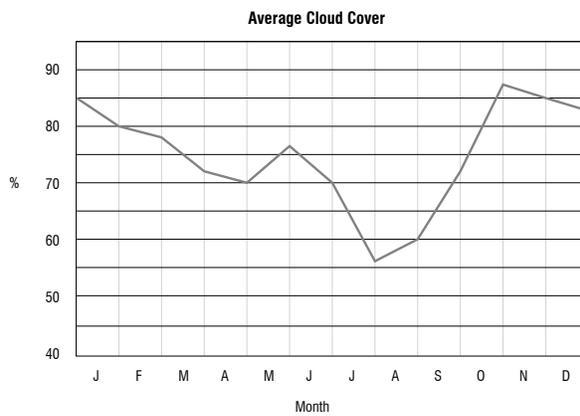
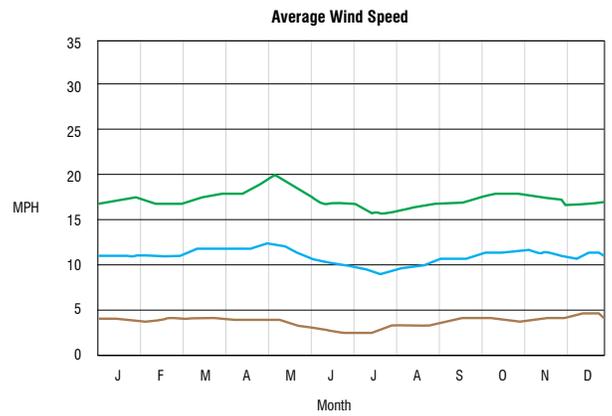
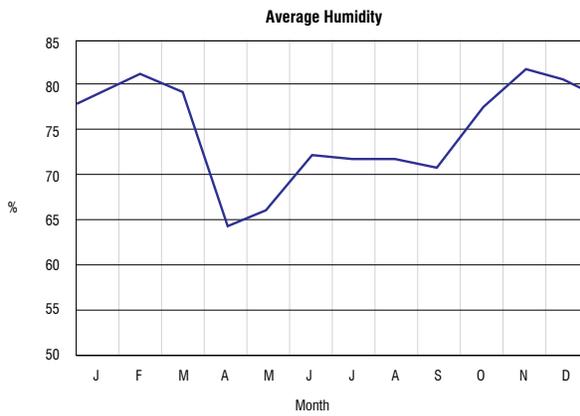
-  **Riverdale Silty Clay:** Soil With Feebly Developed Profile On River Terrace Deposits
-  **Fort Garry Clay:** Clay Over Light Grey To Pale yellow Sandy Clay Calcerous Subsoil
-  **Pine Ridge Loamy Sand:** Sandy Textured Outwash Deposits

F22: Soils Map (Agriculture and Agri-Food Canada, 2011)



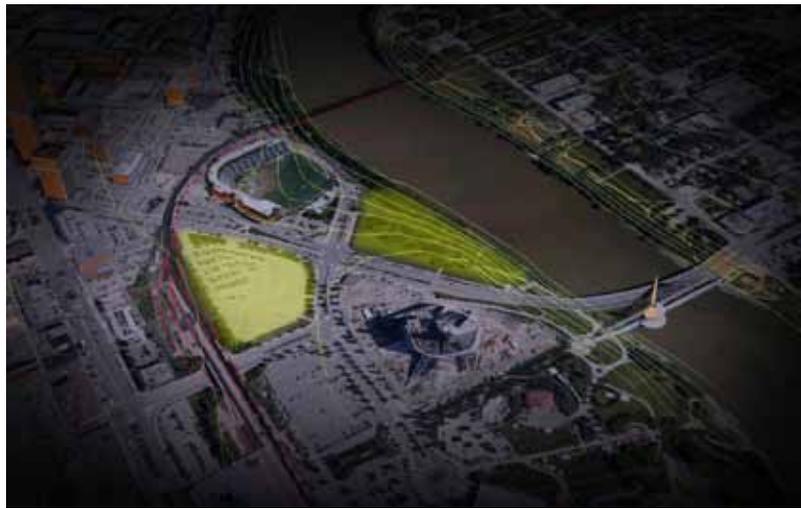
F23: Climate Data Charts

Climate Data



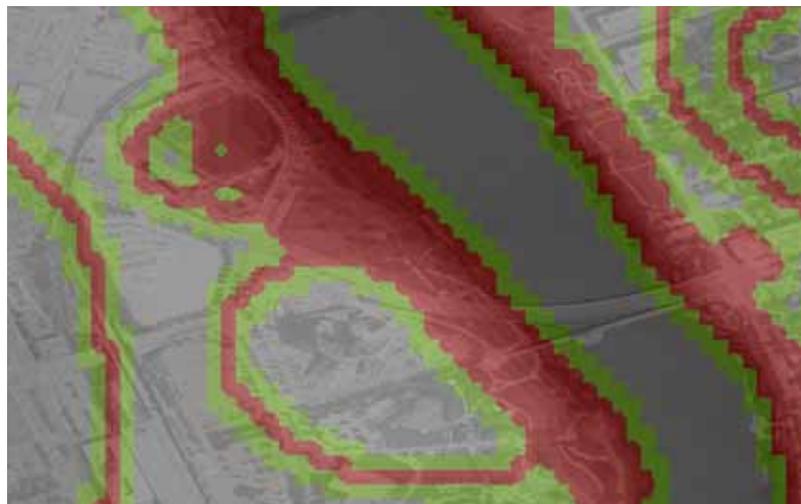
Topography

2 foot contour site view

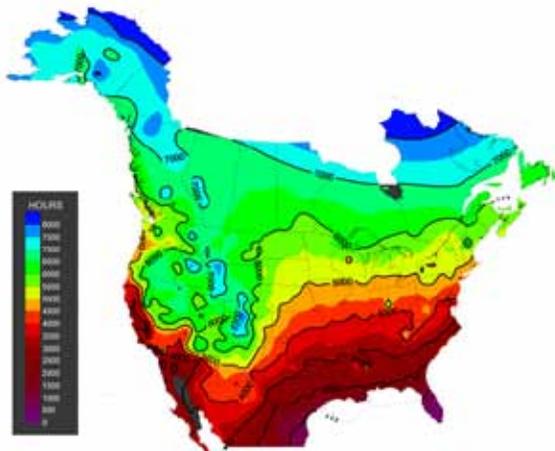


(Benke, 2012)

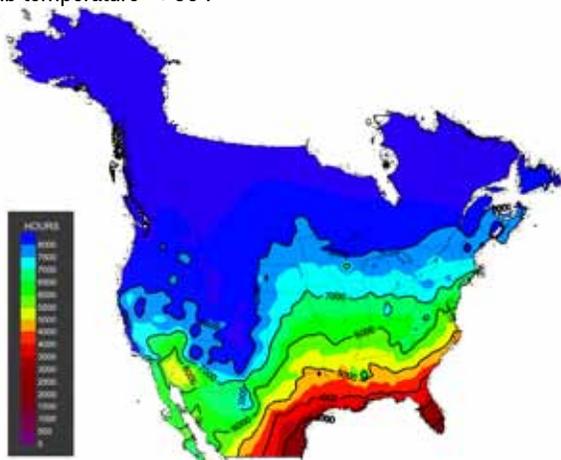
Slope Analysis



(Benke, 2012)



Free cooling hours for water-side economizers where wet bulb temperature < 50°F



Free cooling hours for air side economizers where dry bulb temperature < 81°F and dewpoint < 59°F

F24: Data Center Climate Benefits (GreenGrid, 2009)

Climate Mapping

These maps show the potential free cooling hours for both water-side and air-side economizers. A river water cooling system, combined with the positive climate conditions for air and water-side cooling would make Winnipeg an ideal site to eliminate the high costs of operating data center equipment.



(Benke, 2012)

Programmatic requirements

Available Space

The main portion of the site (current parking lot) has a developable footprint of approximately 200,000 square feet with an additional 3,000 square feet option in the east of Provencher Boulevard. The western portion of the site is suitable for a data center requirements and layouts with the eastern portion acting as a river corridor and link. Program requirements were developed from the Pionen data center case study.

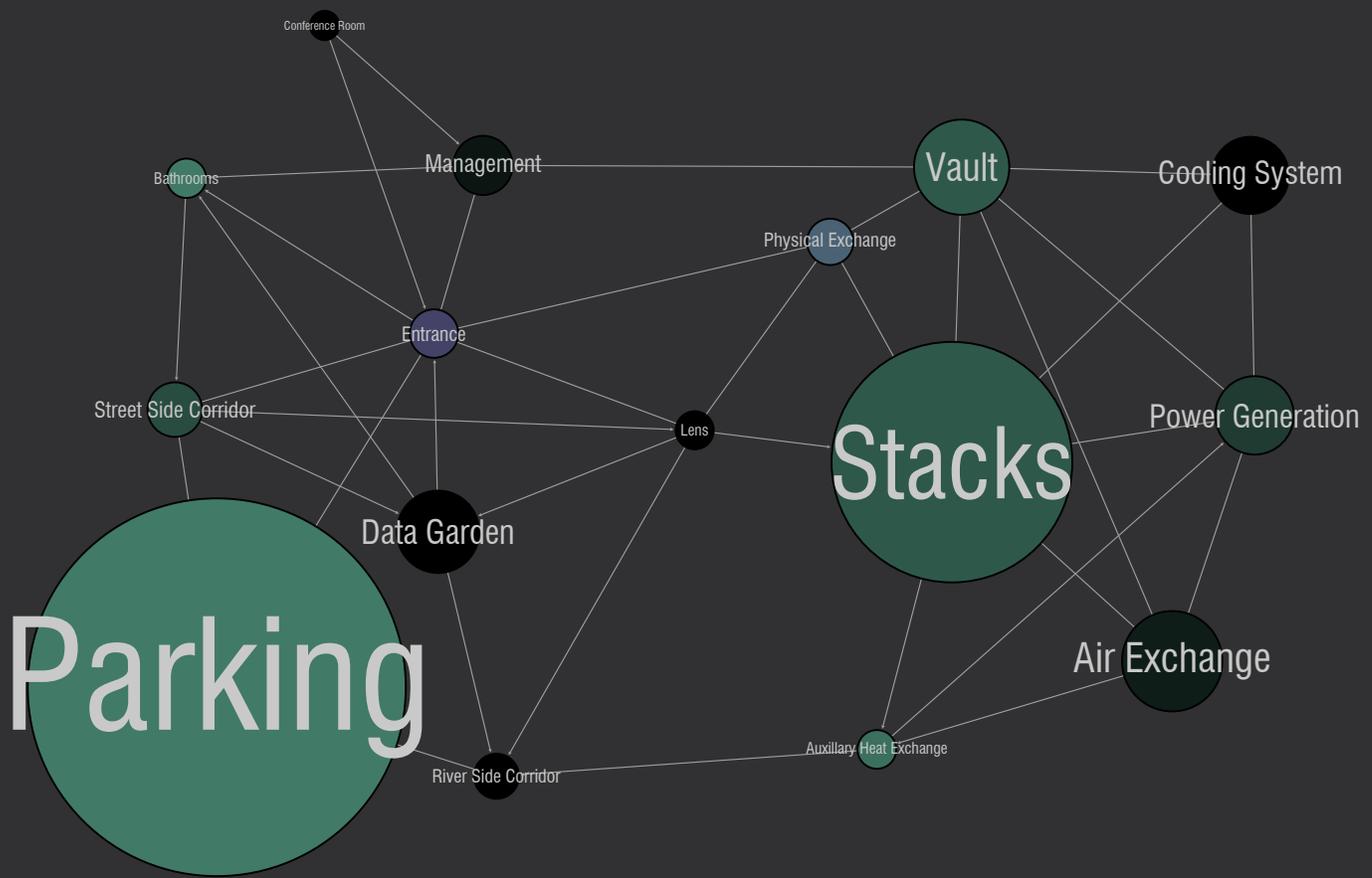
Parking requirements for data centers are typically minimal since the facilities are not commonly public buildings. However, Winnipeg's data center will be city owned and publicly accessible. Along with its new public domain, the site has an existing high demand for parking from its surrounding context. Thus parking will be increased rather than downsized to meet both the existing demands and future needs of the rapidly developing area. The base square footage of the site will be doubled to accommodate for the new structure as well as the existing functions.

Major Elements and Weight

Parking	43%	174,580
Stacks	27%	109,620
Data Garden	7%	28,420
Vaults	5%	20,300
Power Equipment	3%	12,180
Cooling Equipment	3%	12,180
Air Handling Equipment	2%	8,120
Management	2%	8,120
Auxiliary Heat Exchange	1%	4,060
Infrastructure Data Exchange	1%	4,060
Loading	1%	4,060
Entrance	0.5%	2,030
Lens	0.5%	2,030
Conference and Staff	0.5%	2,030
Bathrooms	0.5%	2,030
Street Side Corridor	TBI	TBI
River Side Corridor	TBI	TBI
Power Generation	TBI	TBI

100% := 406,000 sqft.

* TBI - to be integrated (no size requirement)



Interaction Matrix

Data Visualization and Relationships

To highlight and explore the various spatial relationships for the data center, visualization software was used to model and test the parameters of the program. The layout on the opposite page depicts the various program elements as nodes ranked with approximate sizes. The data program data was graphed using a multi-level force directed method. The connections between the nodes are referred to as edges and represent physical connections.

Degree

The degree of a node is the number of edges that are adjacent to it.

Stacks	4
Physical Exchange	4
Lens	1
Vault	1
Cooling System	1
Air Exchange	1
Power Generation	1
Parking	0
Conference Room	0
Bathrooms	0
Street Side Corridor	0
Data Garden	0
Auxillary Heat Exchange	0
River Side Corridor	0
Management	0
Entrance	0

Eccentricity

The distance from a given starting node to the farthest node from it in the network.

River Side Corridor	5
Cooling System	5
Air Exchange	5
Power Generation	5
Parking	4
Street Side Corridor	4
Lens	4
Stacks	4
Vault	4
Auxillary Heat Exchange	4
Management	4
Bathrooms	3
Physical Exchange	3
Entrance	3
Conference Room	0
Data Garden	0

Modularity Class

Networks with high modularity have dense connections between the nodes within modules but sparse connections between nodes in different module.

Parking	2
Street Side Corridor	2
Lens	2
Physical Exchange	2
River Side Corridor	2
Entrance	2
Stacks	1
Vault	1
Cooling System	1
Air Exchange	1
Power Generation	1
Conference Room	0
Bathrooms	0
Data Garden	0
Auxillary Heat Exchange	0
Management	0

Data Matrix Ranking

Closeness Centrality

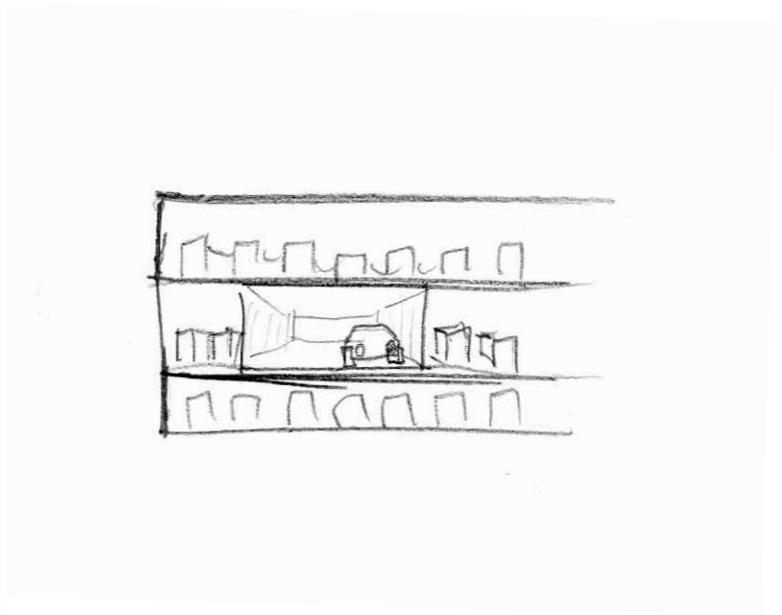
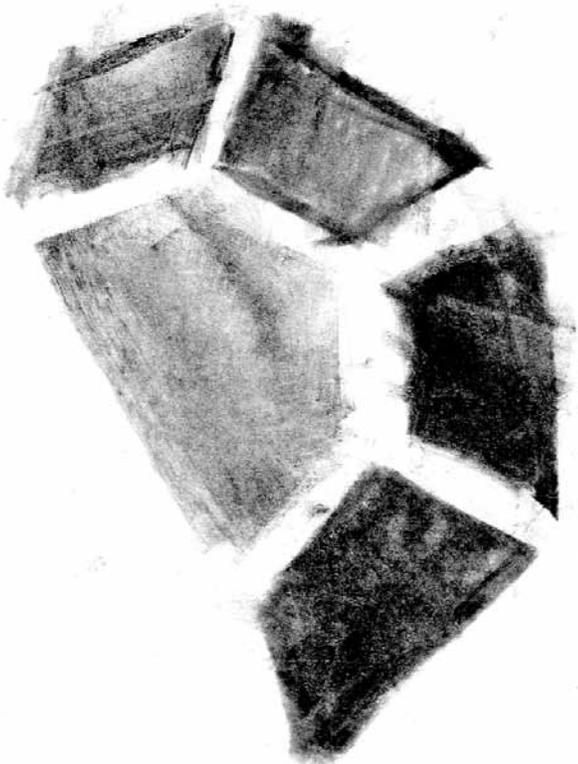
The average distance from a given starting node to all other nodes in the network.

River Side Corridor	3.384615385
Cooling System	2.692307692
Parking	2.461538462
Lens	2.384615385
Management	2.384615385
Air Exchange	2.384615385
Auxillary Heat Exchange	2.307692308
Power Generation	2.307692308
Bathrooms	2.230769231
Street Side Corridor	2.230769231
Stacks	2.076923077
Vault	2.076923077
Physical Exchange	1.923076923
Entrance	1.923076923
Conference Room	0
Data Garden	0

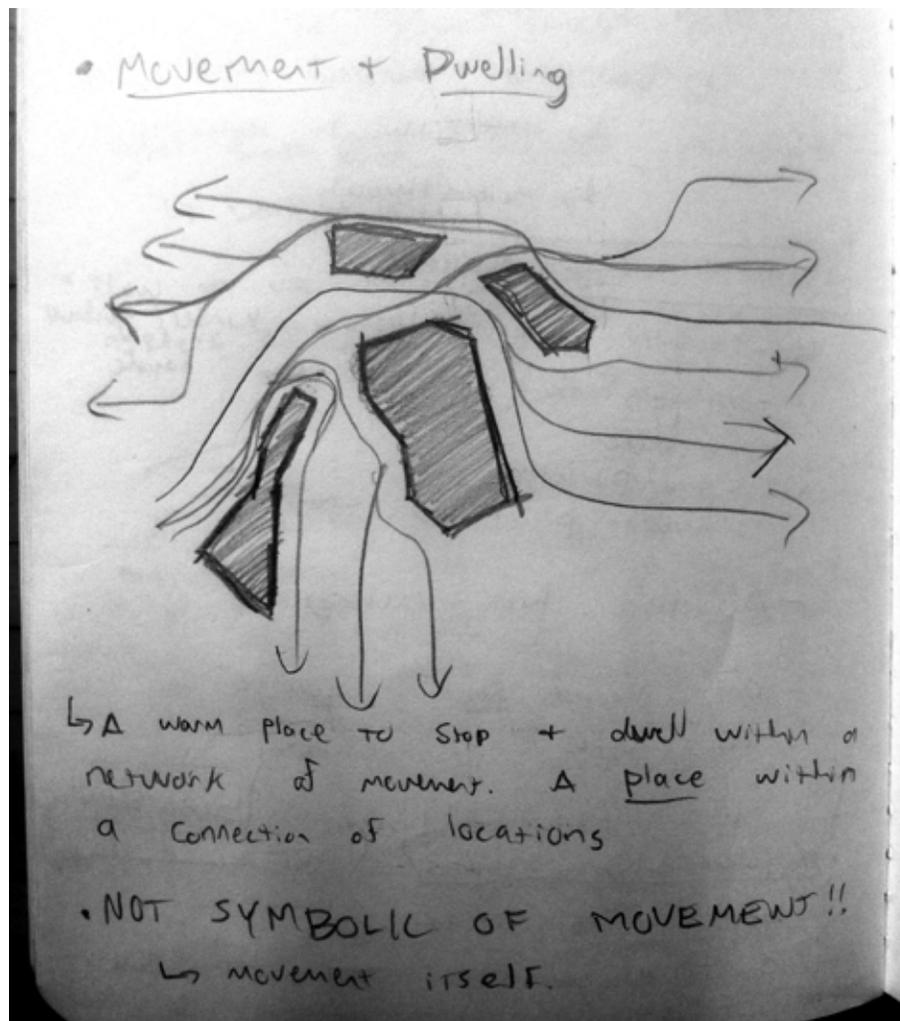
Betweenness Centrality

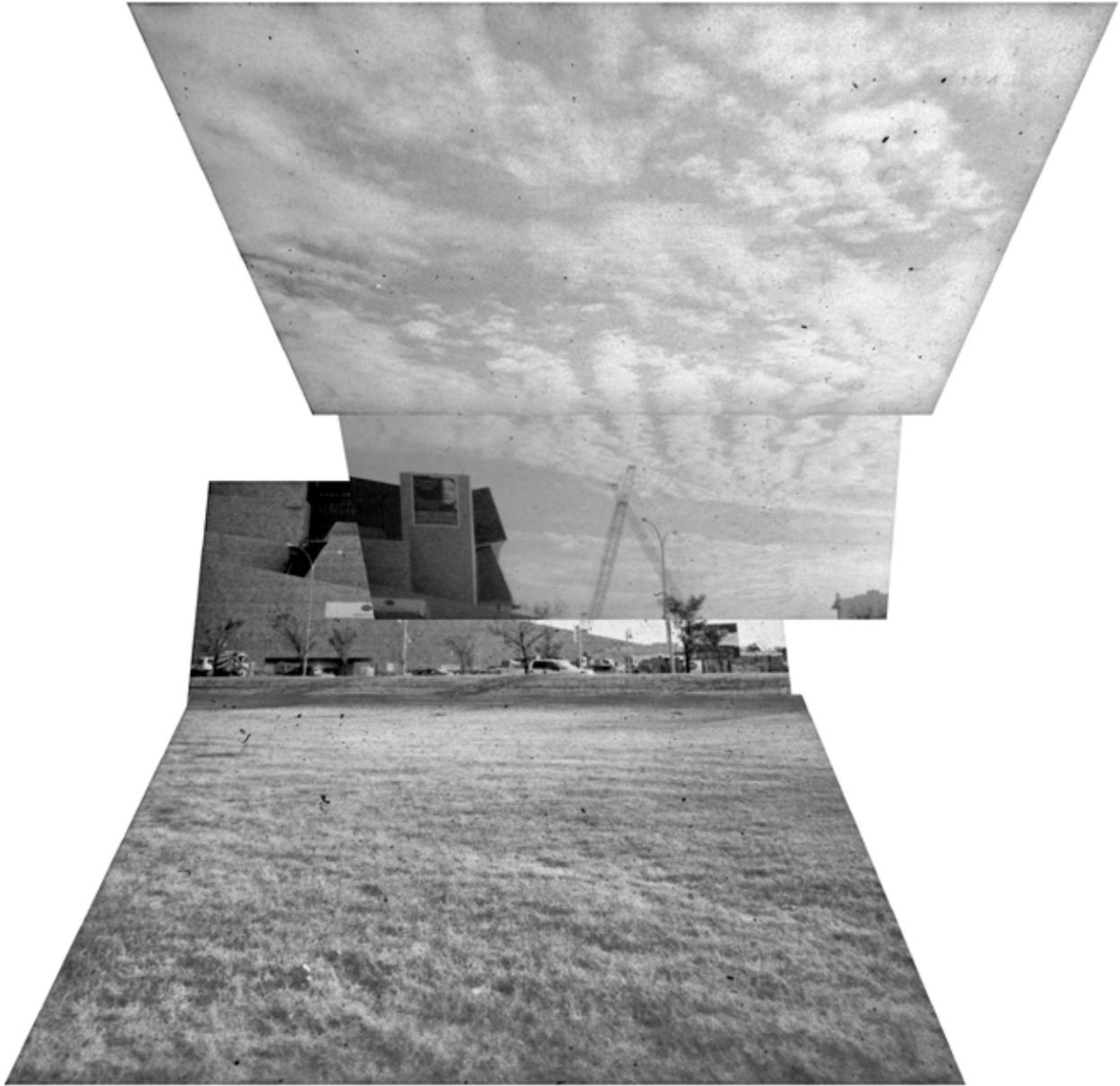
Measures how often a node appears on shortest paths between nodes in the network.

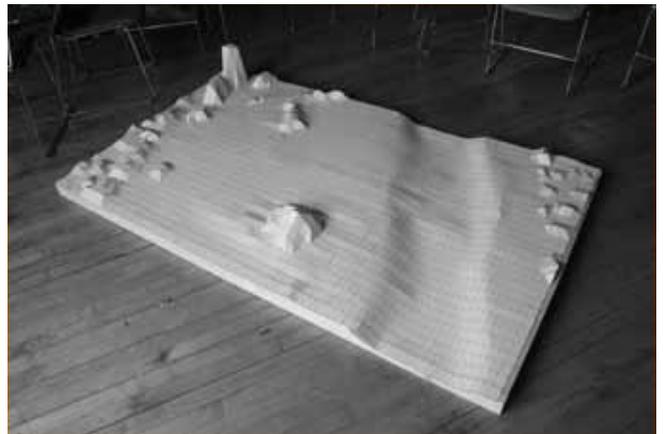
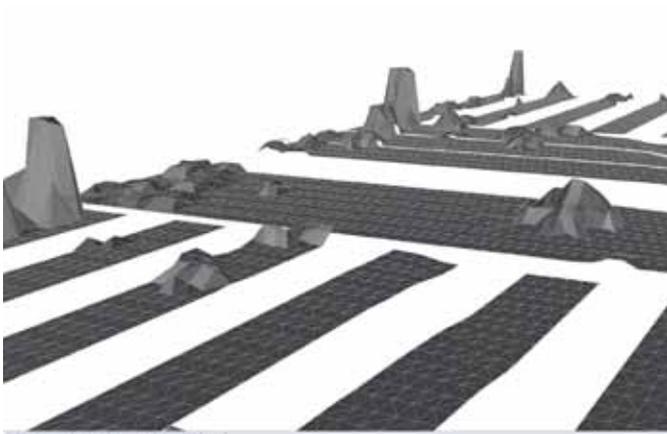
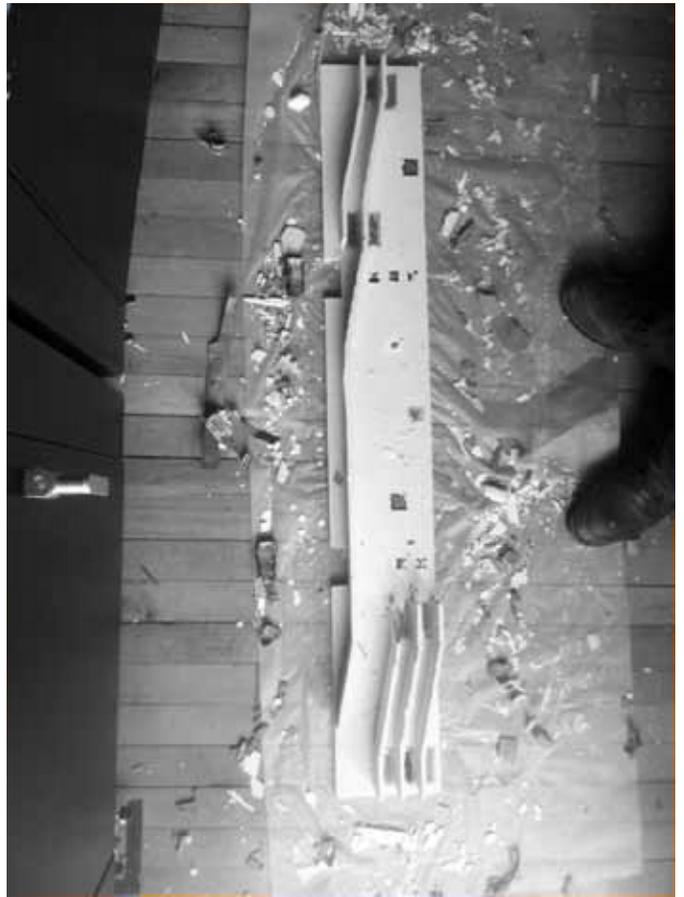
Entrance	26.83333333
Physical Exchange	24.66666667
Parking	12
Bathrooms	11.83333333
Auxillary Heat Exchange	11
Stacks	8.666666667
Vault	8.666666667
Street Side Corridor	7.5
Power Generation	5.833333333
Air Exchange	2.833333333
Management	2.166666667
Conference Room	0
Lens	0
Data Garden	0
River Side Corridor	0
Cooling System	0

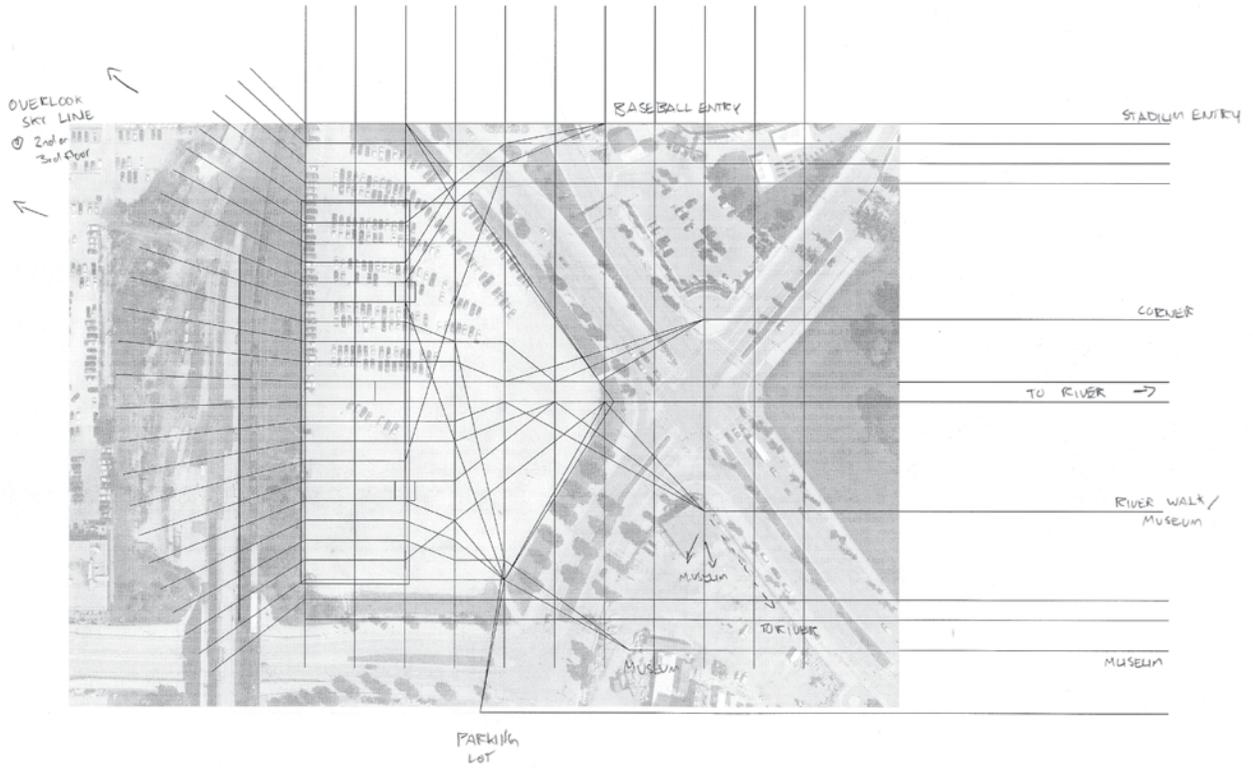
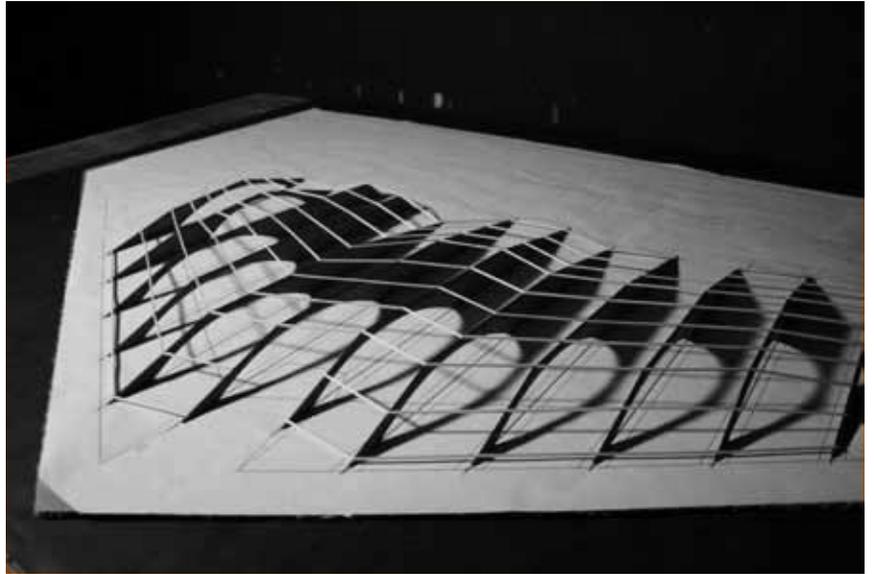


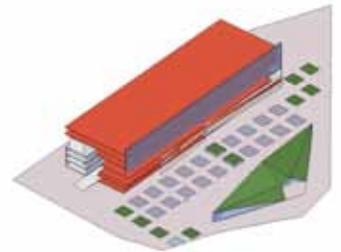
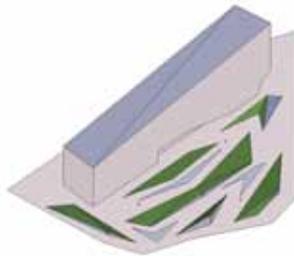
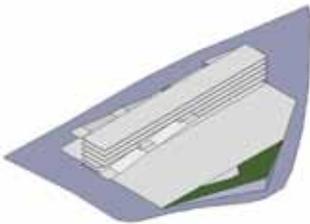
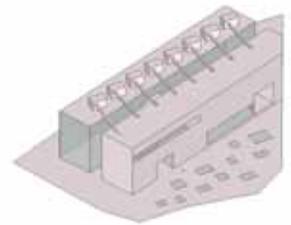
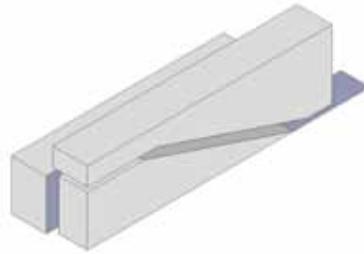
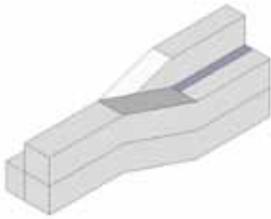
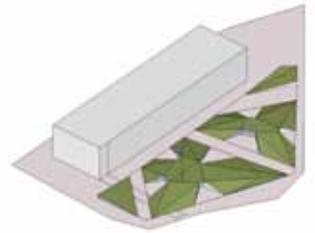
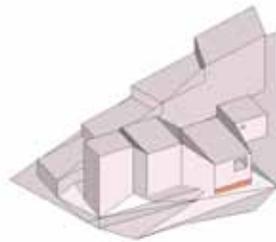
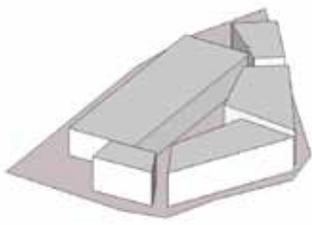
Process Documentation



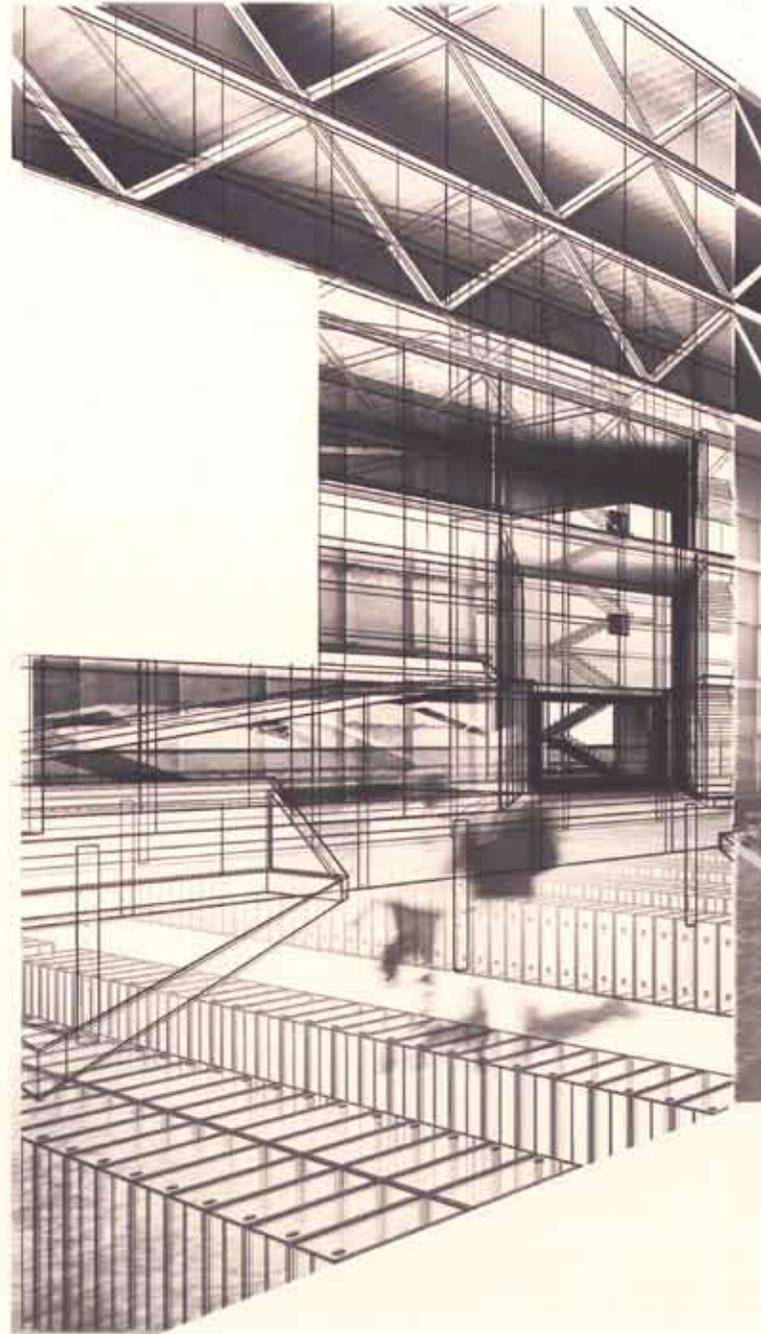








Project Solution



the activated medium

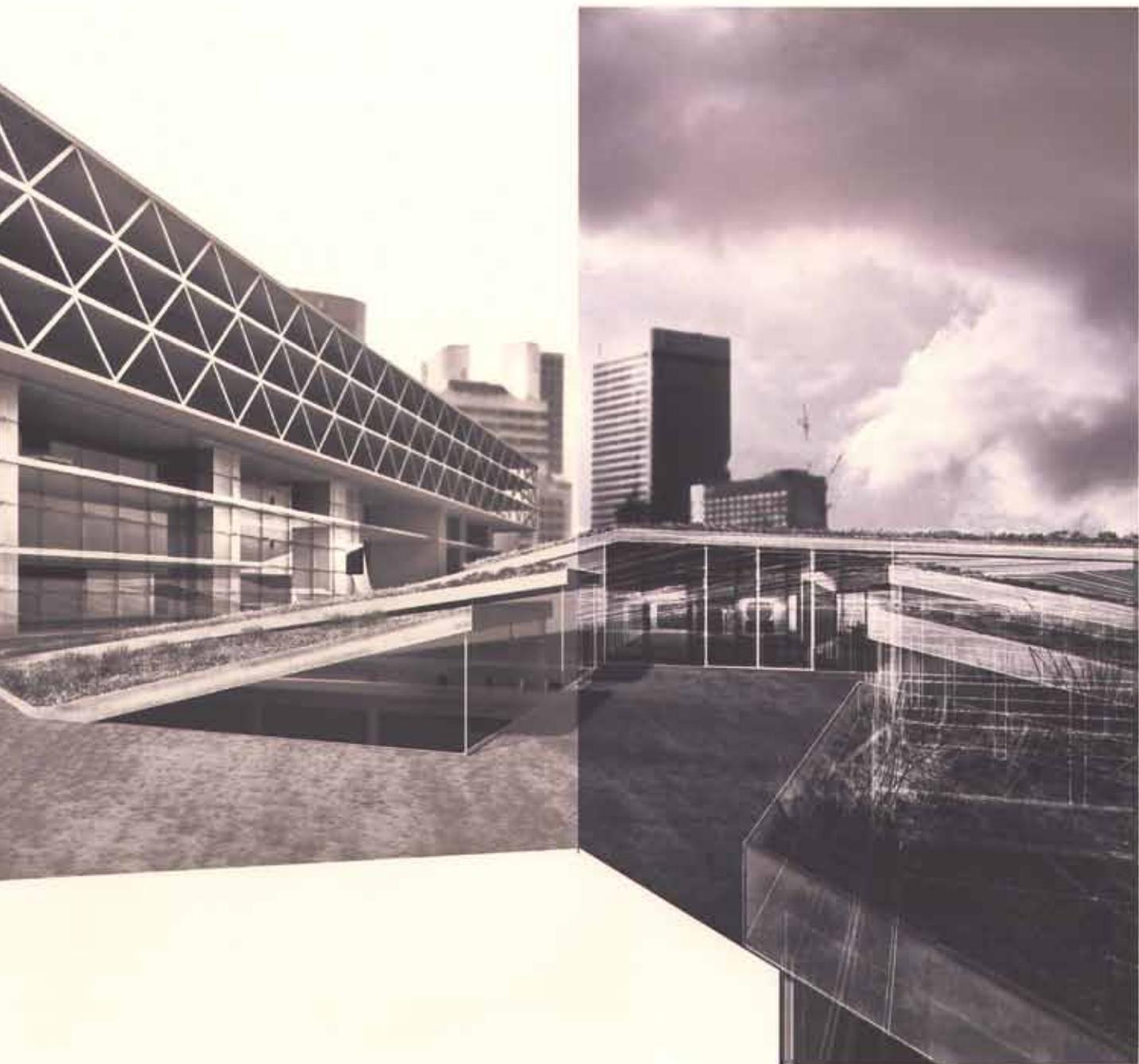
"Wired people should know something structures"
-April September via Architecture Today

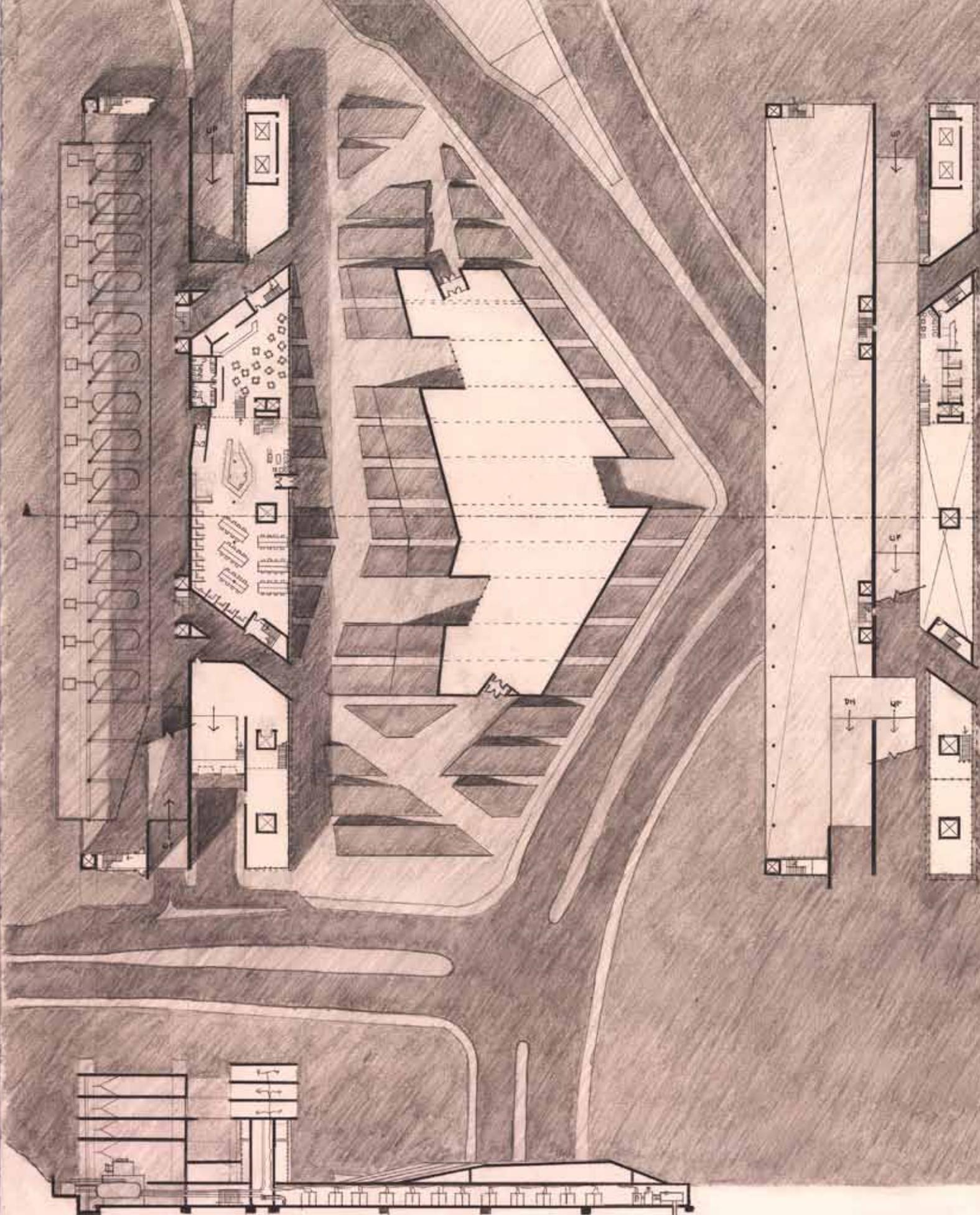
This thesis explores the role of the modern architectural representation and its changing relationship to the act of making. The investigation will seek and test outlets for alternative representations to operate under functional and technical demands while activating a generative environment for the positive introduction from representing to building. These outlets will be demonstrated through the design and documentation of a growing building typology of the 21st century, the data center.

The design is sited in Downtown Winnipeg, Manitoba and is conceived to take the opportunity of an urban, city center, public data center.

Using a multi-medium and multi-layered representation method, this design collage affirms essential and qualitative contextual moments from various 2D and 3D representations. The design strategy enables modern tools and methodologies to be utilized beyond their intended usage and explore new design solutions. Typically, architectural tools or representations are good at quantifying and measuring "the thing" but less effective in retaining qualitative design aspects. This design shows the potential for representation methods that begin to integrate architectural moments through a combination of collage, model making and chemical analysis. It is hoped that through these exercises a more flexible and honest architectural atmosphere will arise.

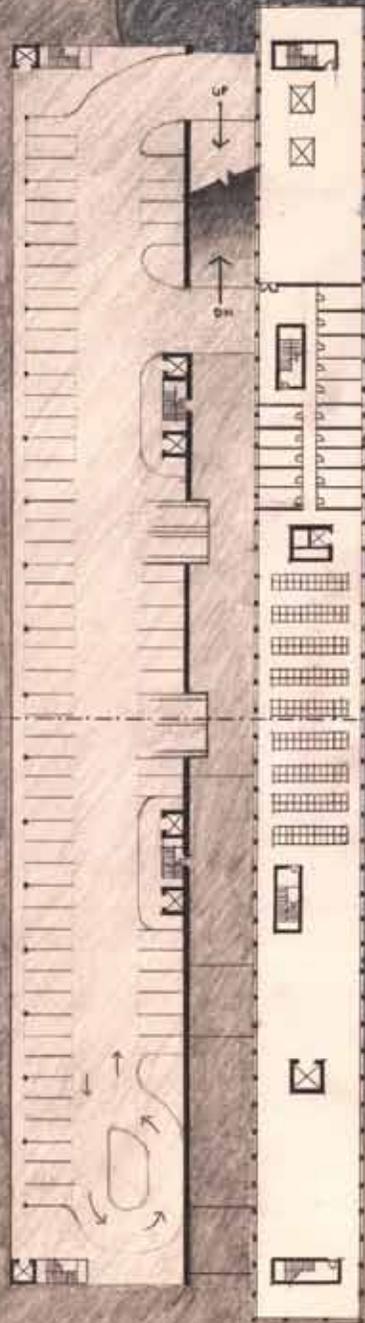
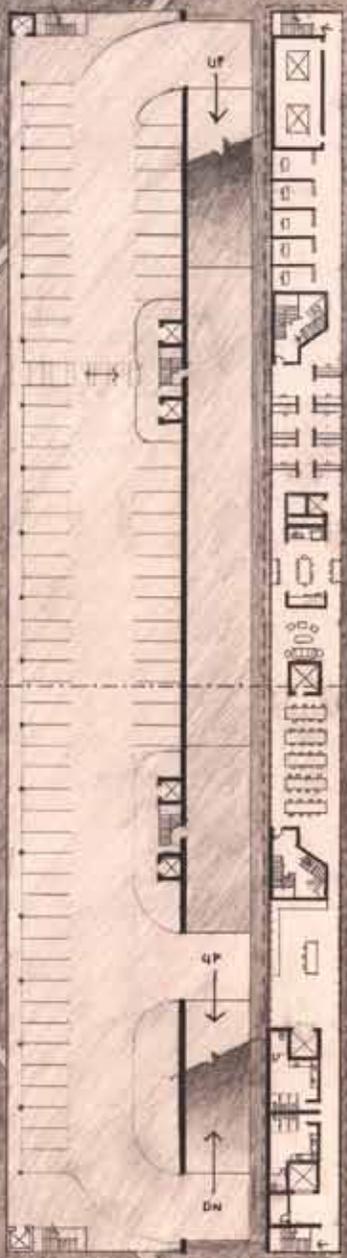
① Parking	400	174,584
② Data	275	108,625
③ Data Center	75	29,450
④ Wall	50	20,300
⑤ Tower Equipment	30	12,180
⑥ Cooling Equipment	20	7,920
⑦ Air Handling Equipment	20	7,920
⑧ Management	25	9,900
⑨ Auxiliary Heat Exchange	15	5,925
⑩ Architectural Data Exchange	15	5,925
⑪ Cooling	15	5,925
⑫ Heating	15	5,925
⑬ Structural	15	5,925
⑭ Other	15	5,925
Total	1,000	396,000

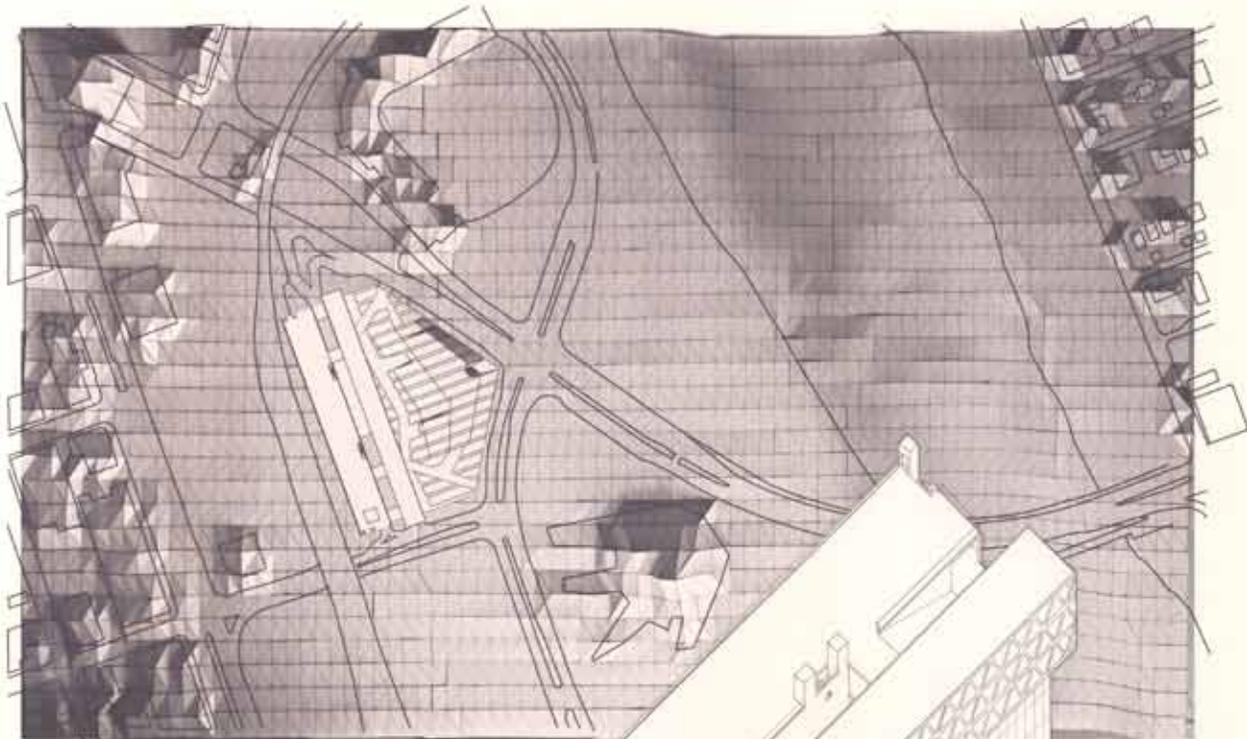




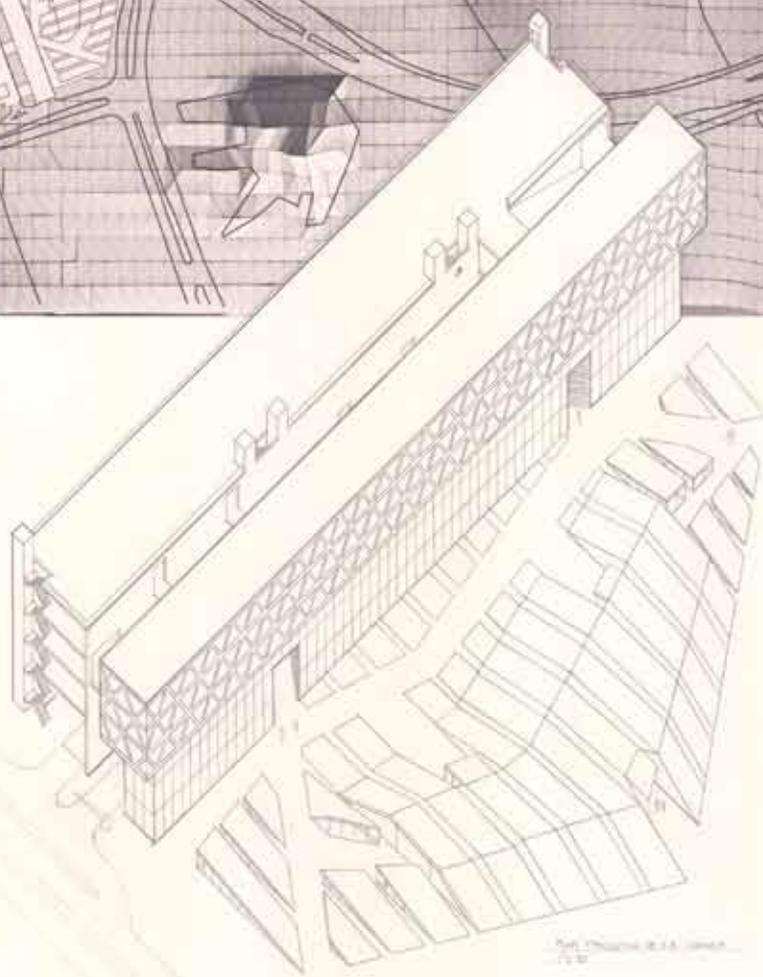
PLANS & SECTION
1" = 30'



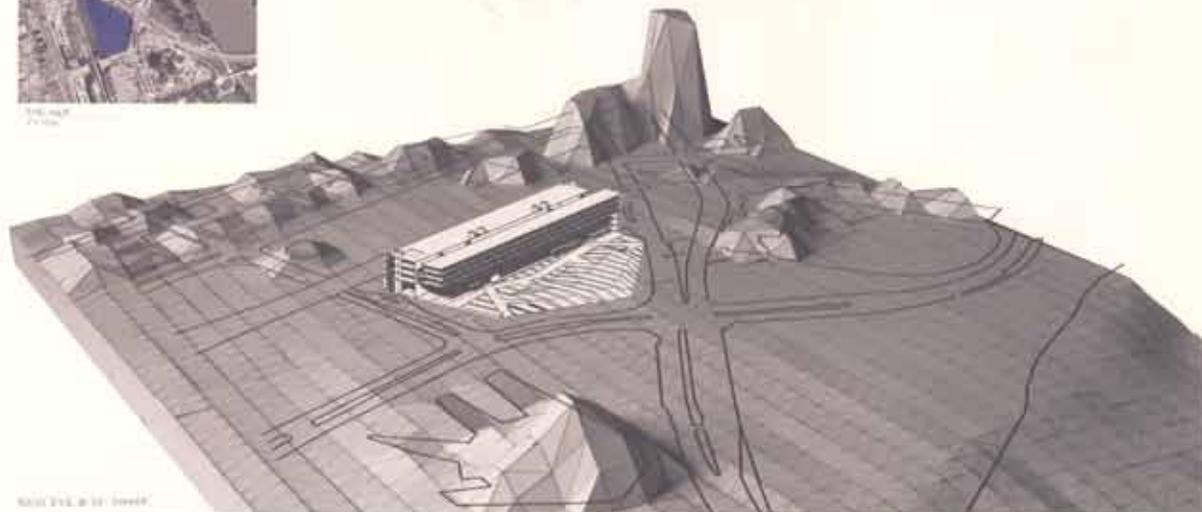




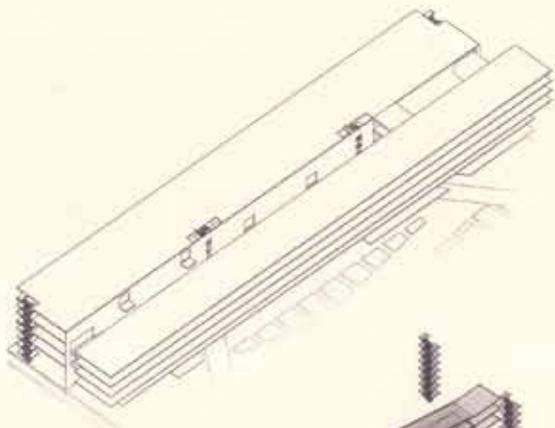
THE STADIUM



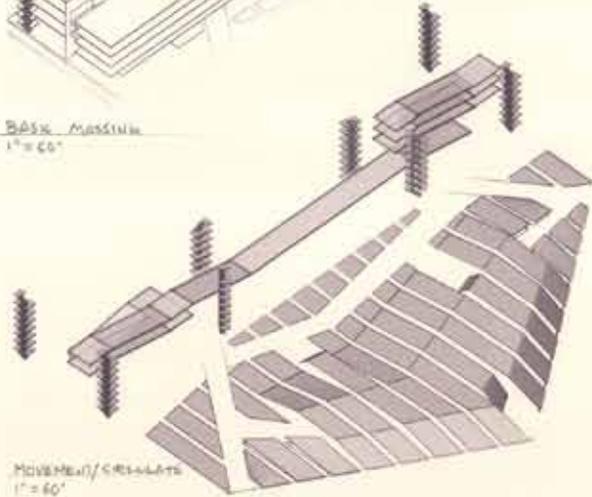
Arch. Elevation of the building



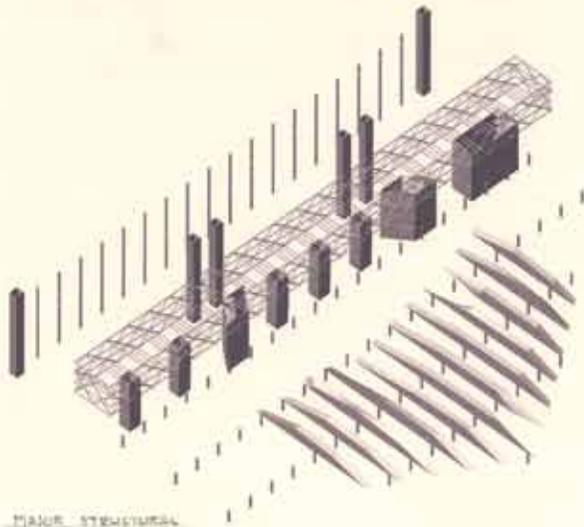
Model of the city



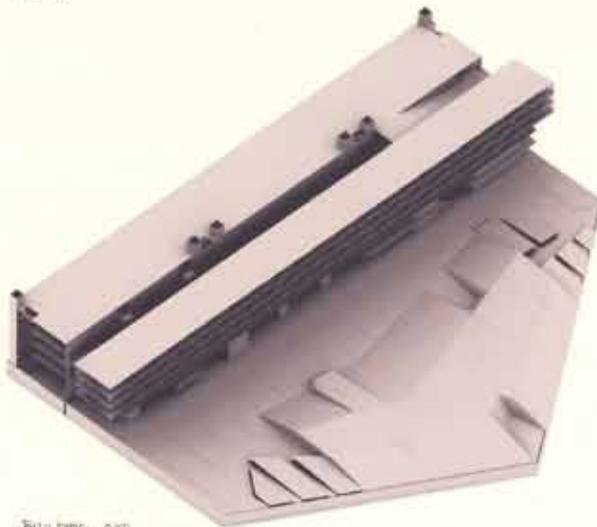
BASIC MASSING
1" = 60'



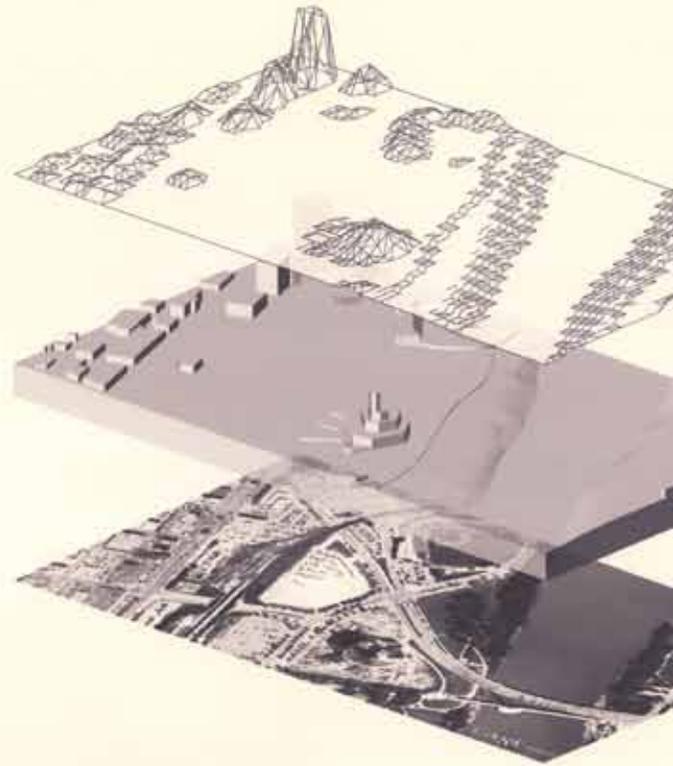
MOVEMENT/FORMALITY
1" = 60'



MAJOR STRUCTURAL
1" = 60'



BUILDING AXON
1" = 60'



SITE MODEL LAYERS
1" = 500'



PEDESTRIAN CORRIDOR
SITE PHOTO



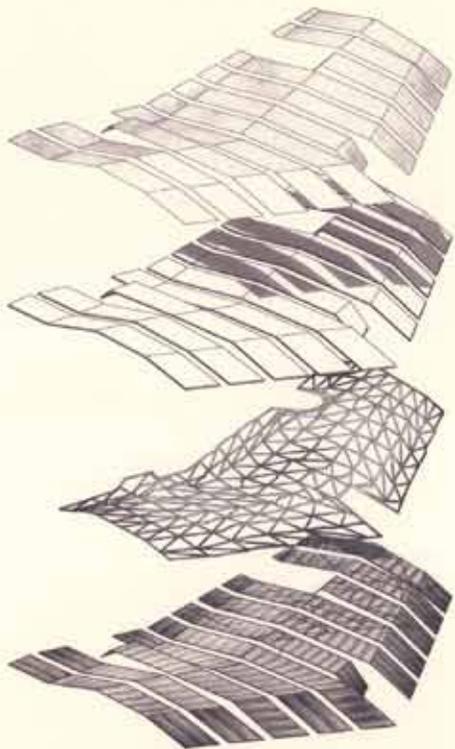
HEAVY RAIL
SITE PHOTO



PEDESTRIAN CORRIDOR
BUILDING PLAZA



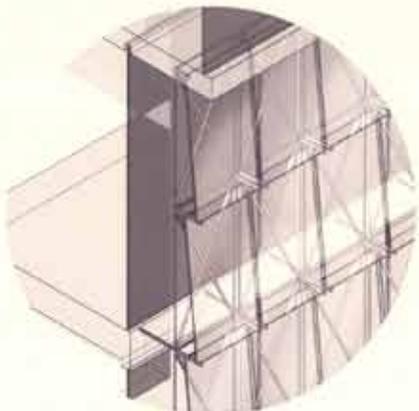
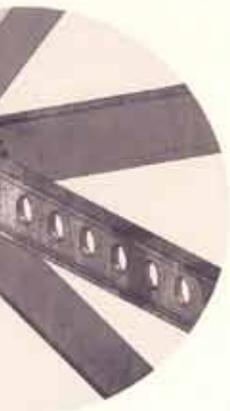
SPACE FRAME



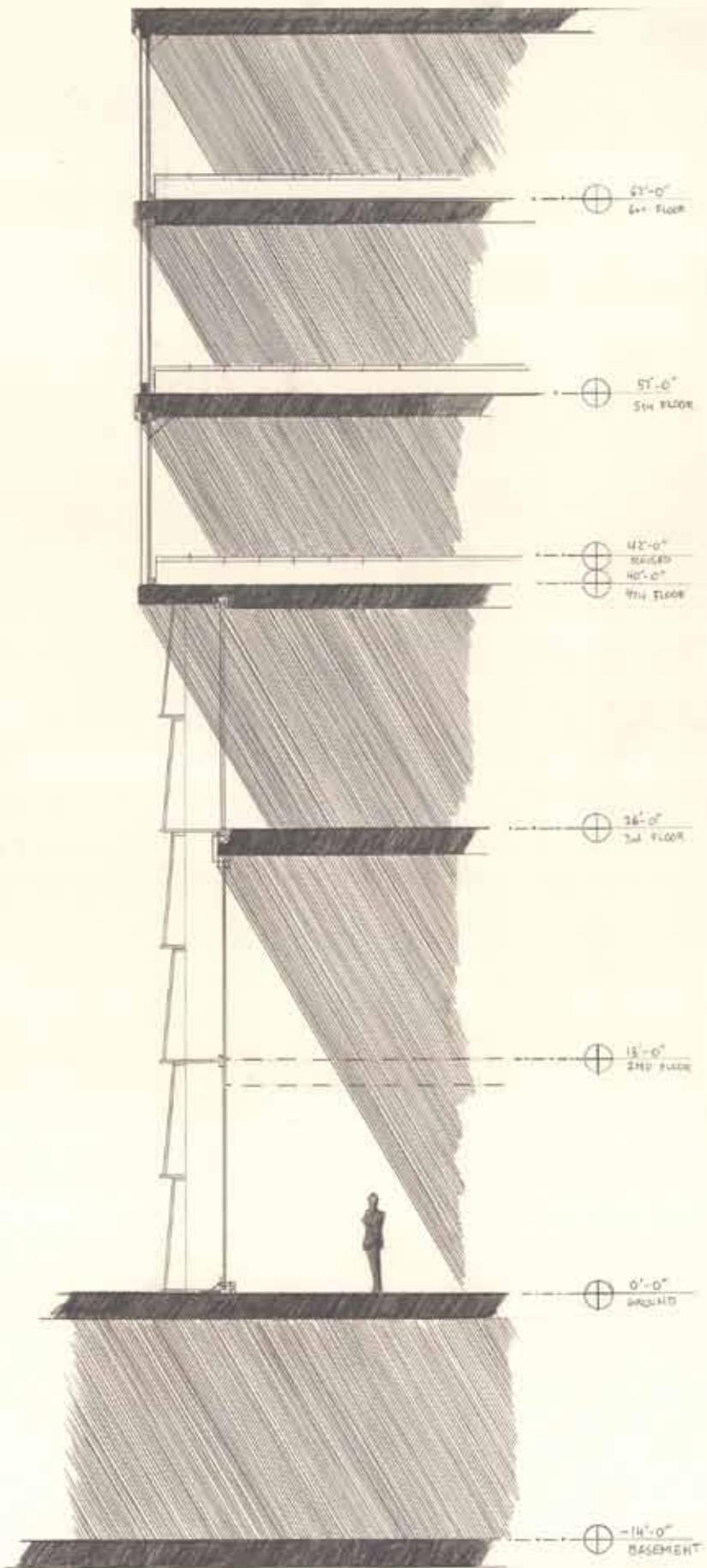
GALLERY SHELL EXPLODED
1" = 50'



ABORIGINAL DWELLING

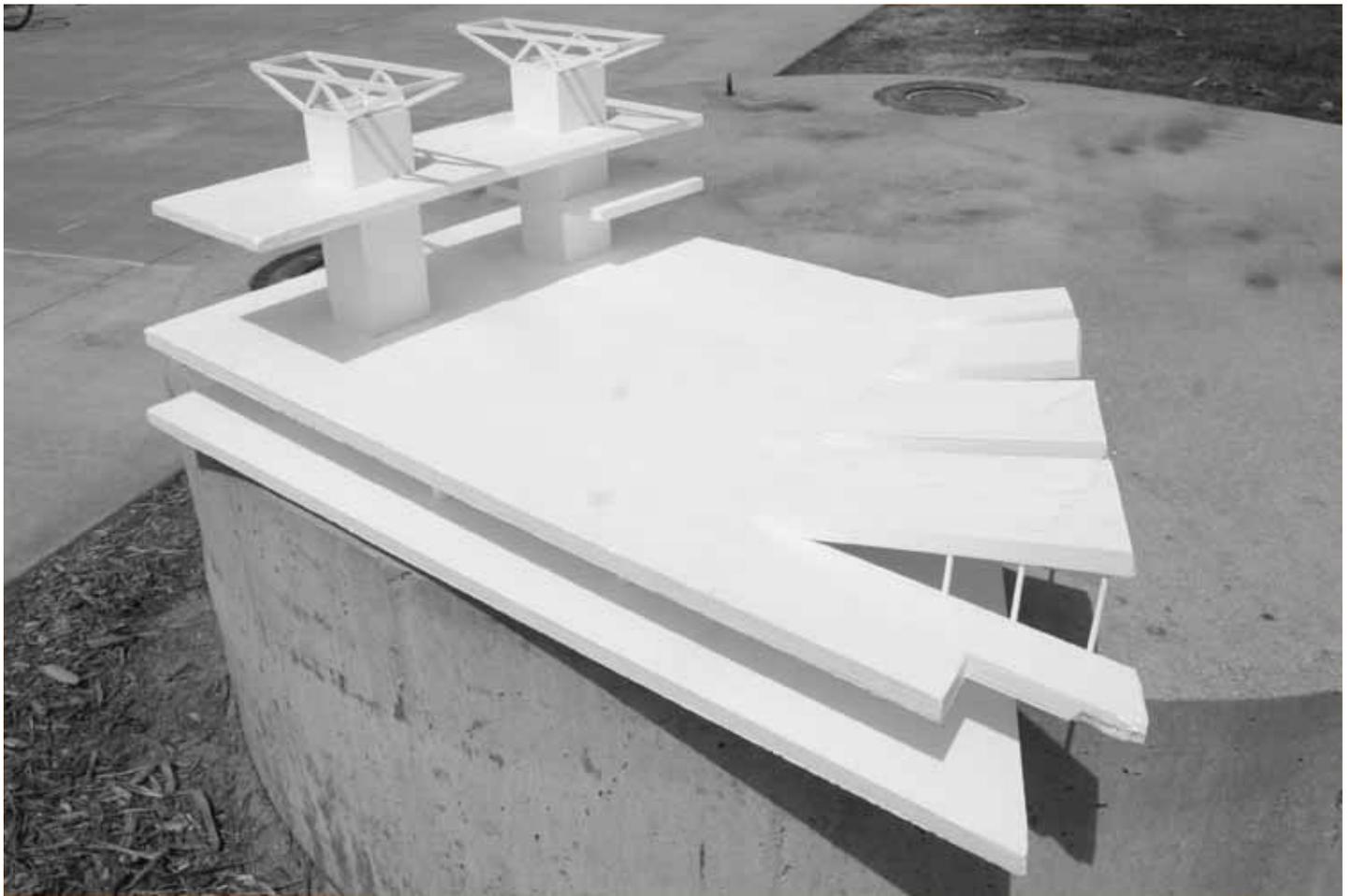


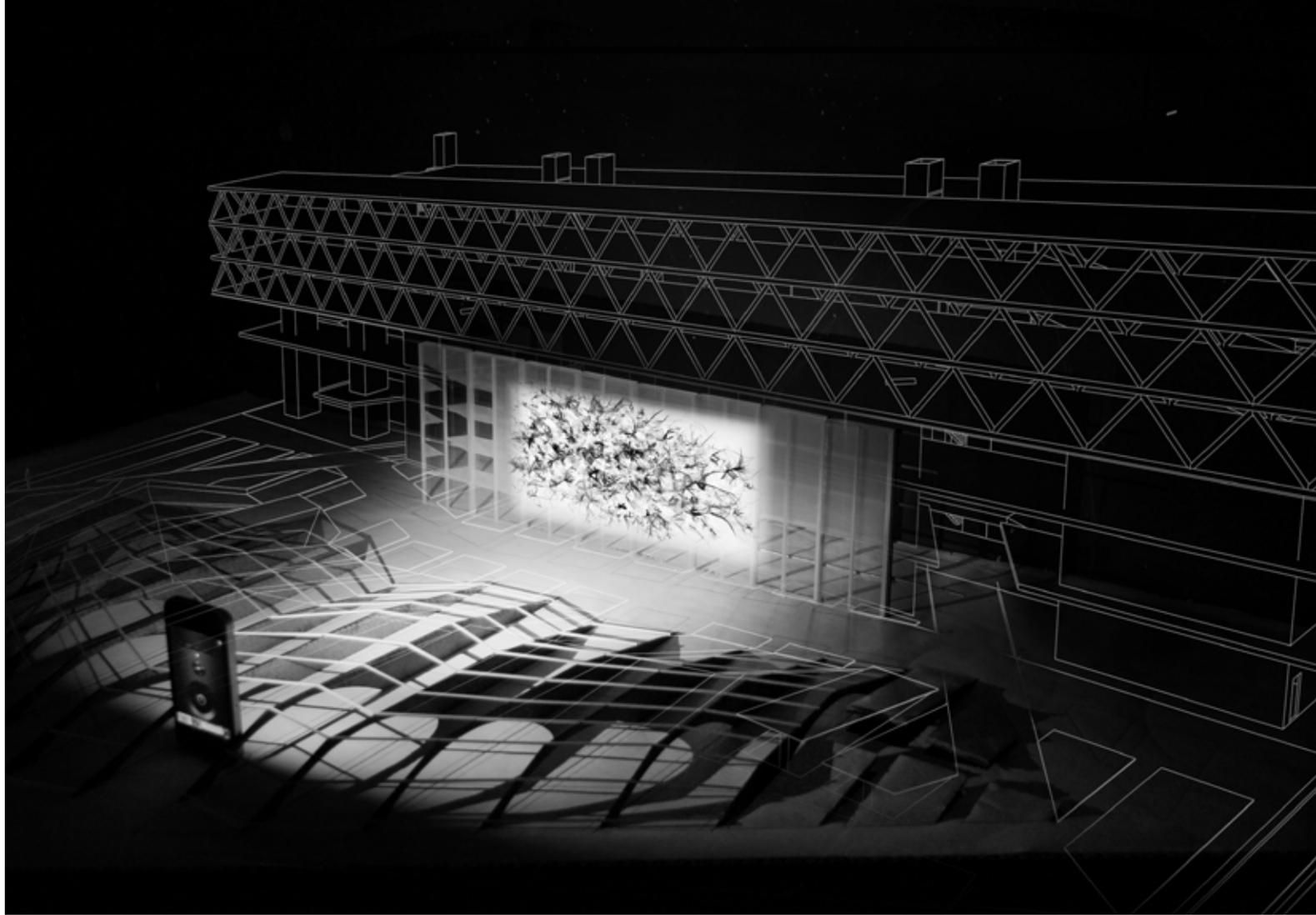
DOUBLE GLAZING SYSTEM



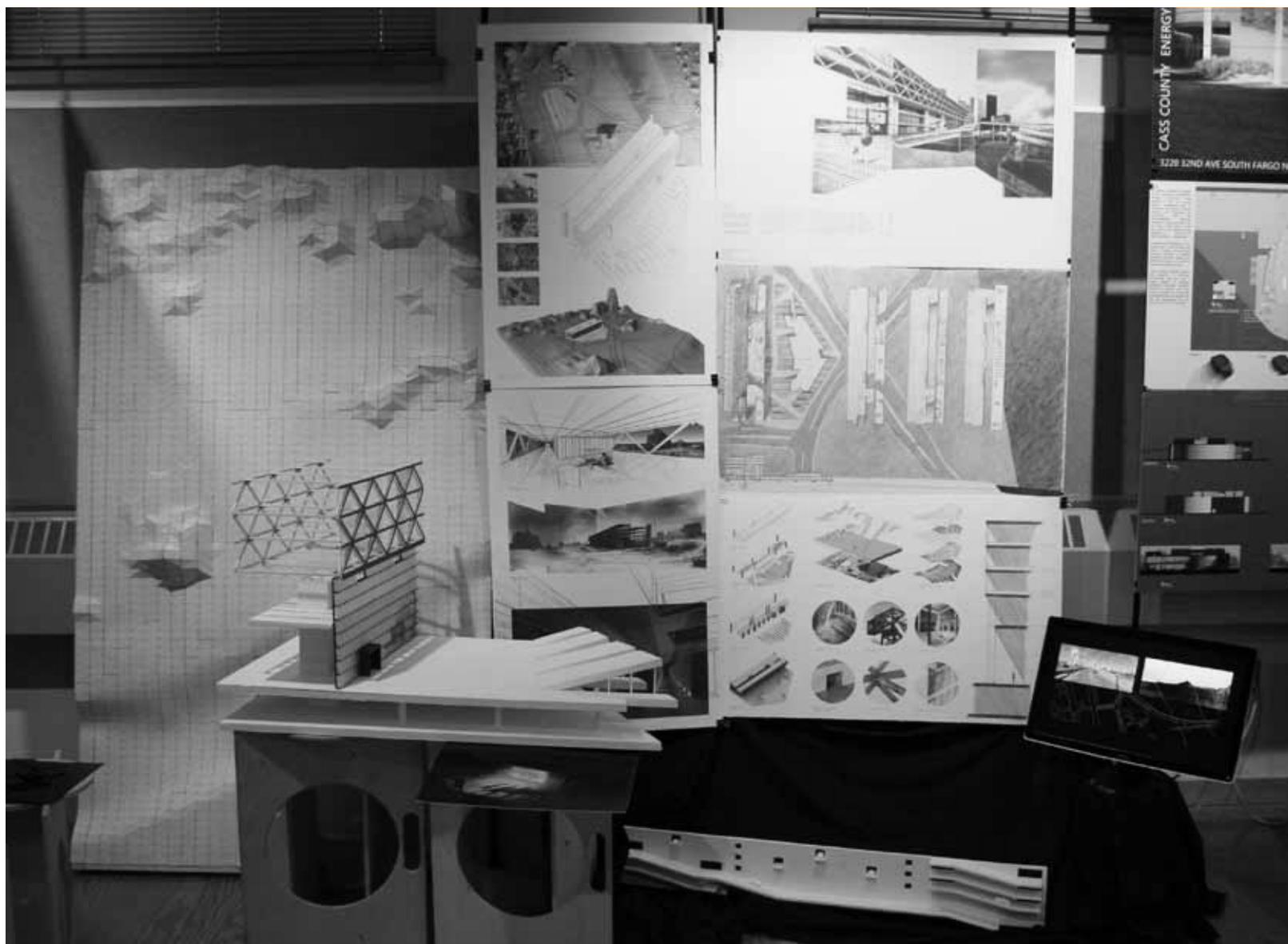








Final Presentation



Reference List

- Agriculture and Agri-Food Canada. (Designer). (2011). Map winnipeg. [Web Map]. Retrieved from <http://sis.agr.gc.ca/cansis/publications/surveys/mb/mb5/index.html>
- AFL Architects. (Artist). (2008). Pionen white mountain. [Web Photo]. Retrieved from <http://www.archdaily.com/9257/pionen---white-mountain-albert-france-lanord-architects/>
- Albertini, B. (1988). Carlo scarpa: Architecture in details. Milan: Jaca Book spa.
- Allen, S. (2000). Mapping the unmappable on notation. Stan allen essays practice architecture, technique and representation. Routledge: TjL Digital
- ARS (2007). The Archaeologists, by Georgio de Chirico, Oil on canvas, © 2007 Artists Rights Society (ARS), New York / SIAE, Rome. © Fondazione Giorgio e Isa de Chirico, Rome. Inv. 94. Retrieved from http://www.artdaily.org/index.asp?int_sec=2&int_new=22077#.UHCUbxXR6_i
- Benke, B. (2012) Content produced by Brad Benke
- Berger, J. (1977) Ways of seeing. London: Penguin Publishing
- Calvino, I. (1988) Six memos for the next millenium. Cambridge: Harvard University Press
- City of Winnipeg. (1996). Historic profile of winnipeg. Retrieved from <http://www.winnipeg.ca/Services/CityLife/HistoryOfWinnipeg/HistoricalProfile.stm>
- Crosbie, M. J. (Article Author). (2009). Peter zumthor's kunsthau bregenz museum plan sketch. [Web Drawing]. Retrieved from http://www.architectureweek.com/2009/1021/culture_2-4.html
- Dunn, N. (2010). Architectural Model Making. London: Laurence King Publishing
- Durer, A. (Artist). (1527). Alberti's window. [Web Photo]. Retrieved from http://www2.latech.edu/~wtwillou/A331syl_s01.htm
- Evans, R. (1997). Translations from drawing to building. In *Translations form drawing to building and other essays*. Cambridge: The MIT press.
- Fiore, Q. (1967). The medium is the massage. Berkley: Ginkgo Press
- Fletcher, D. (Artist). (2012). The lighter side of the cloud – transformation. [Print Photo]. Retrieved from <http://www.cloudtweaks.com/2012/02/the-lighter-side-of-the-cloud-transformation/>
- Frascari, M. (2007). A reflection on paper and its virtues within the material and invisible factures of architecture. In M. Frascari, J. Hale & B. Starkey (Eds.), *From Drawings to Models* New York: Routledge.
- Greenpeace. (2012). Why clouds aren't green In K. May, J. Hout, J. Reidel, H. Wu & J. Franklin (Eds.) p. 54, *Data Spacedoi:www.clog-online.com*
- Gimpel, Jean (1983). *The Cathedral Builders*, Translated by Teresa Waugh Grove Press, Inc., New York
- Gomez, A. (2007). Architectural representation and the perspective hinge. (pp. 10-36). Cambridge: MIT Press.
- Gomez, A. (2007). "Questions of representation." In M. Frascari, J. Hale & B. Starky (Eds.), *From Models to Drawings: Imagination and Representation in Architecture*. New York: Routledge.

- Leatherbarrow, D. (1998, Fall). Showing what otherwise hides itself. *Harvard design magazine*, 51-55.
- Leatherbarrow, D. (2009) *Architecture oriented otherwise*. New York: Princeton Architectural Press
- Lindman, A. (Photographer). (2008). Pionen white mountain. [Web Photo]. Retrieved from <http://www.archdaily.com/9257/pionen---white-mountain-albert-france-lanord-architects/>
- Lozado, T. (2012). Data-space invaders. In K. May, J. Hout, J. Reidel, H. Wu & J. Franklin (Eds.) p. 74, *Data Space* doi:www.clog-online.com
- Liebenau, J. (2012). The changing geography and architecture of data. In K. May, J. Hout, J. Reidel, H. Wu & J. Franklin (Eds.) p. 30, *Data Space* doi:www.clog-online.com
- Manitoba Historical Maps. (Designer). (2010). Birds eye view of winnipeg. [Print Photo]. Retrieved from <http://www.flickr.com/photos/manitobamaps/5036320446/sizes/l/in/photostream/>
- Microsoft. (Designer). (2012). Bing maps. [Web Map]. Retrieved from <http://www.bing.com/maps/>
- Sagrada Familia Foundation. (Producer). (2000). Plan of sagrada. [Web Photo]. Retrieved from http://www.sagradafamilia.cat/sf-eng/docs_instit/architectura.php
- Scolari, M. (2012). *Oblique drawing a history of anti-perspective*. Cambridge: The MIT Press.
- Shelby, L. R. (1961). Medieval masons' tools: The level and plumb rule. *Technology and Culture*, 2(2), 127-130. Retrieved from [http://www.designspeculum.com/Historyweb/shelby medieval masons tools l.pdf](http://www.designspeculum.com/Historyweb/shelby%20medieval%20masons%20tools%20l.pdf)
- Tschumi, Bernard. (1976). *Manhattan Transcripts*. New York: John Wiley & Sons
- The history of architectural drawing. In (1982). H. Powell & D. Leatherbarrow (Eds.), *Masterpieces of Architectural Drawing*. New York: Abbeville Press.
- Tierney, T. (2007). *Abstract space beneath the media surface*. New York: Taylor & Francis, 58.
- Unknown. (Artist). (2004-2012). Plan drawing of saint gall. [Web Photo]. Retrieved from <http://www.historyofinformation.com/expanded.php?id=246>
- Vertov, D. (Photographer). (1923). Still from man with a movie camera. [Web Photo]. Retrieved from <http://saint-lucy.com/conversations/kristen-hileman/>
- Williams, W. C. (1963) *Paterson*. New York: New Directions
- Zumthor, P. (2010) *Thinking architecture*. Basel: Birkhäuser Publishers for Architecture.

Climate Data Sources

- Joe, C. (2010). Climate, global warming, and daylight charts and data. Retrieved from <http://www.climate-charts.com/Locations/c/CN71852050232220.php>
- Allmetsat. (2012). Climate : Winnipeg, manitoba, canada. Retrieved from <http://en.allmetsat.com/climate/north-america.php?code=71852>
- Living in Canada. (2013). The climate and weather of winnipeg, manitoba. Retrieved from <http://www.livingin-canada.com/climate-winnipeg.html>

Personal Identification

Brad Benke
1440 Dakota Dr. N Apt # 24
Fargo, ND 58102

e: benke.brad@yahoo.com
p: 701.741.4187
w: www.bradbenke.com

Home Town: Grand Forks, ND



“Work stops at sunset. Darkness falls over the building site. The sky is filled with stars. “There is the blueprint,” they say.”

-Italo Calvino, Invisible Cities

