AN INDOOR PUBLIC SPACE FOR A WINTER CITY

by
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A.B. Visual and Environmental Studies
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Submitted to the Department of Architecture in Partial Fulfillment of the Requirements for the Degree of Master of Architecture
at the Massachusetts Institute of Technology.
February 2005

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ABSTRACT

Winter is a marginalized season in North American design. Even though most cities in the northern United States and Canada have winter conditions—snowfall, ice, freezing temperatures, and long nights—for substantial portions of the year, their built environments do little to embrace their climate.

Architecture confronting the problems of design for a winter city must have two complementary components—a social one that addresses comfort and the interaction between the public and private realms, and a technical one that addresses energy-efficiency.

First, winter cities lack equitable and attractive indoor places of refuge from the elements. The most common contemporary response to the climate is to create huge commercial developments. These take the form of free-standing megamalls or networks of indoor storefronts winding through downtowns via tunnels and elevated skyways. These draw people who can afford to shop away from the public realm while leaving city streets deserted.

Second, winter cities use superlatively high amounts of energy for heating, and this consumption continues to grow as a result of sprawling suburbs and generic building that disregards its context.

The proposed mediatheque for St. Paul, Minnesota confronts these problems by using thermal qualities as a driver for its design. Like winter, thermal qualities are an often ignored factor in architecture. However, by using them to shape space, choose materials, and complement social interaction, the design for an indoor urban space will welcome all members of the public, use energy responsibly, and celebrate diverse activities throughout the day and the year.

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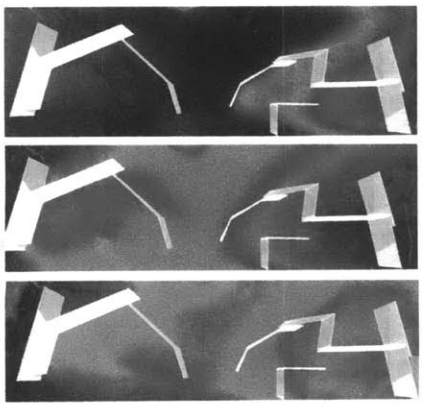

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MANY THANKS . . .

to **John Fernandez**, for your calm encouragement, consistently inspiring insight, and devoted interest that created a project I will take with me throughout future work and research in the profession.

to **Bill Hubbard**, for your love of Las Vegas and surprising, creative ideas that helped me clear some of the major hurdles in developing my project.

to **Hubert Murray**, for helping me understand the importance of my project in relation to its broader context, and for your critical observations throughout the process.

to **Pierre Thibault**, for your reassuring manner and clear, elegant understanding that countered my own frenzied method.

to the **MIT M.Arch. class of 2005**, for teaching me all those things about designing I now take for granted, including surprise birthday parties.

to **Nancy Jones**, for doing all those administrative things I have always taken for granted.

to **Marilyne Andersen**, for filling gaps in my technical knowledge.

to **Jelena Pejkovic**, **Luke Voiland**, and **John Snavely**, for doing tasks that are below you.

to **Weiming Lu** and the Lowertown Redevelopment Corporation, for introducing me to my site, welcoming me into the neighborhood, and giving critical insight into urban design for winter.

to **Tim Griffin** and the St. Paul on the Mississippi Design Center, for your enthusiastic comments throughout the process as well as for providing key information and documents on downtown St. Paul.

to **Lucy Thompson** and the St. Paul Department of Planning and Economic Development, for your supportive interest in my project and for dealing with St. Paul bureaucracy on my behalf.

to **George Latimer**, for sharing your experiences in working with the public and private sectors during your time as mayor of St. Paul.

to **Eldon Burow**, for introducing me to key contacts in the Twin Cities and showing me around the most popular indoor space in the country, the Mall of America.

to **Lee Tollefson**, for providing a St. Paul architect's invaluable time and perspective.

to **Nick Koch** for introducing me to members of the St. Paul design scene and inviting me to its social hour.

to the **Bolinders**, for hosting me and reintroducing me to the rapidly-sprawling joys of suburban St. Paul.

to **Sarah Roszler**, for your love and smarts, as well as for writing two theses at once so I didn't feel like I had that much work.

to my **mom**, **dad**, and **sister**, for moving me to various winter cities even though you all really want to live on the west coast.

INTRODUCTION

Félix-Hilaire Buhot's *Winter in Paris* exemplifies the horrors of an urban winter. The dead horses, homeless huddled around a burning barrel, and skeletal dogs contrast with the warmly-dressed pedestrians and their manicured poodle.

Many people living in the north hate winter. In a recent poll of Massachusetts residents, their number one problem with the commonwealth was its weather. The article did not state what aspect of the weather bothered the polltakers. But I (and probably you) assume that they first thought of winter's cold, dark, gray, windy days.

Yet problems associated with winter can be more severe than grumbling. Psychologists associate winter with a variety of negative responses, such as SAD (Seasonal Affective Disorder), depression, and stress from dealing with extreme weather. Winter also poses physical dangers ranging from hypothermia and dangerous roads to poor eating habits and lack of outdoor exercise. The negative results of winter can have varying impacts on different age and socio-economic groups, and in the end adversely affect entire urban regions.

Norman Pressman, the former president of the Winter Cities Association, critically claims that "Uniquely 'northern' architecture or urban design does not exist [in North America]."[1] Development in Minnesota is indistinguishable from that in Arizona; office buildings in Toronto have the same designs as in Houston. Meanwhile, the prevailing attitude in North American design for northern environments is to build large, introverted, privately-owned complexes that ignore the climate as much as possible.

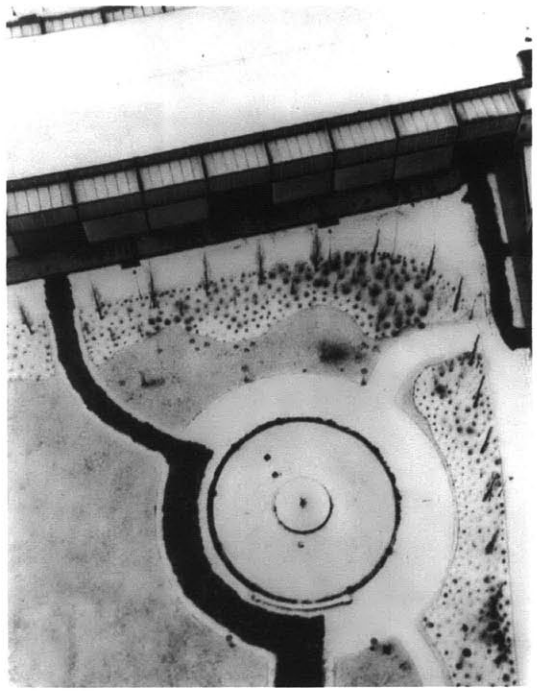
Alfred Stieglitz. *Icy Night.*

Childe Hassam. *Late Afternoon, New York: Winter.*

Still from *Love Story*: The cold and snow of winter turn Central Park into a tranquil escape unattainable in the summer.

However, winter is a season of alluring contrast and beauty. The sun's radiant heat is most abundant on the coldest, clearest days; interior hearths provide a welcome escape from stark temperatures outside. By acknowledging the contrasts in temperature special to the season and using thermal qualities of form and material as a driver for the design, an indoor public place will provide an exciting variety of spaces to satisfy different people and activities while using energy responsibly.

Design for northern cities that embraces the climatic and urban context while celebrating aesthetics unique to winter can enhance residents' experiences of the season. An indoor public space designed for winter can be an equitable place for social life during months of severe weather; it can also be an energy-efficient design responsive to the region's extreme temperatures, making the space welcoming and celebratory of its context.



Lazlo Moholy-Nagy,. *From the Radio Tower, Berlin.*

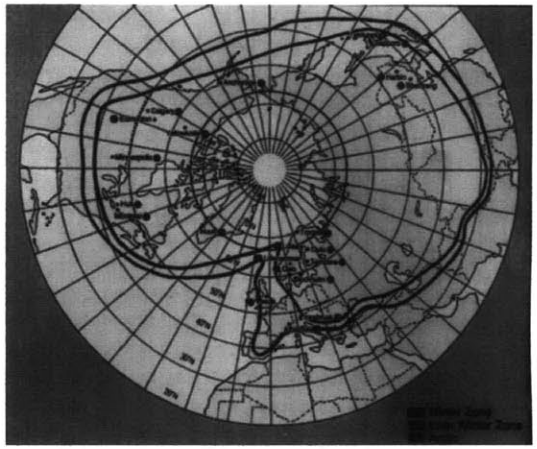
[1] Jorma Mänty and Norman Pressman, eds., *Cities Designed for Winter* (Tampere, Finland: Department of Architecture, Tampere University of Technology, 1988), "Winter Policies, Plans, and Designs: The Canadian Experience," by Norman Pressman, 27.

CONTEXT

Still from *Edward Scissorhands*.

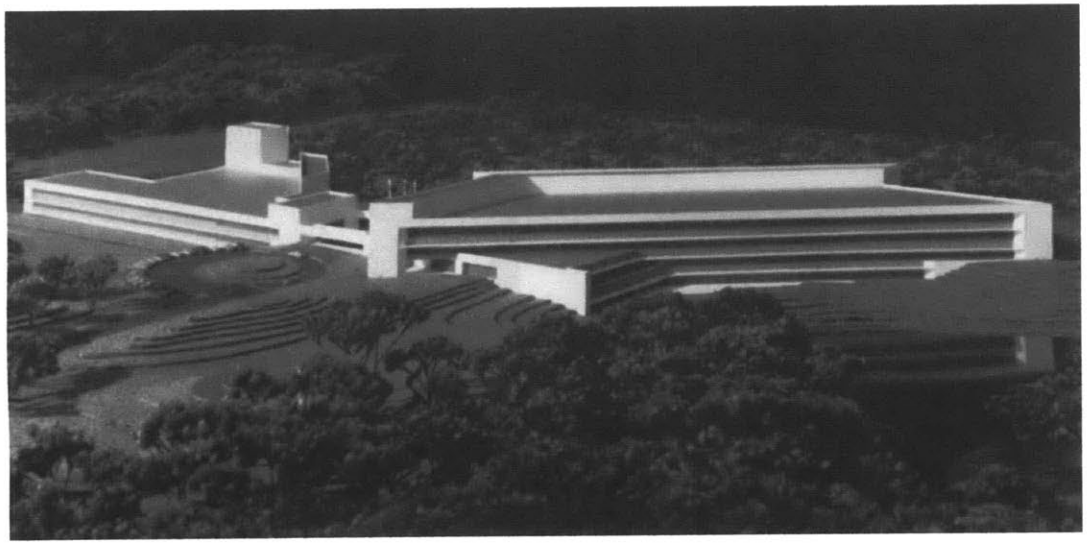
Energy Use in Winter Cities

The winter city movement in North America started in response to two major factors: the energy crisis of the Seventies and the emigration of jobs and people from the north to warmer cities in the U.S.[1] The first major exhibition of architectural design for cold climates took place in 1983 at the Hallwalls Gallery in Buffalo, and two years later a Toronto journalist began the Livable Winter Cities Association (LWCA), which spearheaded the first widely published analysis of urban and architectural design for northern climates.[2] While a select number of mayors, planners, and designers have signed up to be part of the LWCA the most significant problems of design for northern cities remain, including that of energy use.[3]

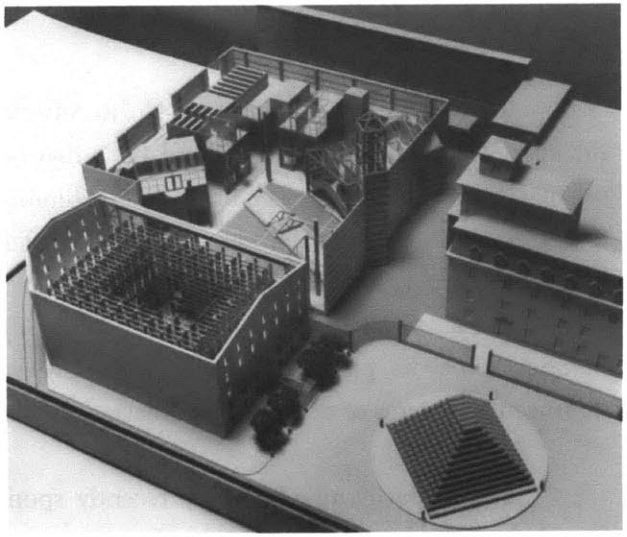


Winter City Zones, as defined by the Northern Intercity Conference Committee (NICC) Sapporo. Minneapolis, Minnesota is labeled at the upper left as lying within the Inner Winter Zone.

The Department of Energy recently sponsored a forum in Saint Paul, Minnesota focusing on the increasing shortage of non-renewable resources, as stocks of natural gas are unusually low while demand is projected to grow 50 percent over the next 25 years. We are quickly approaching another energy crisis, and architectural design in winter cities plays a major factor in how we deal with it. The National Climatic Data Center released a study in 2004 on seasonal energy use and demand between the years 1973 and 2001, with a focus on U.S. residences. Throughout the years studied, energy consumption during the winter was more than twice that in the summer. In 2000, residential energy consumption in the summer was 1913 trillion BTU, while winter consumption totaled 3889 trillion BTU. Energy consumption in 2001 reached a seasonal high of 4405 trillion BTU.[4] Similarly, a 1999 Commercial Building energy usage survey reveals that office buildings in the northeastern and north-midwestern U.S. use 10% more major fuels than buildings in the south.[5] Furthermore, due to the stress of snow, ice, and low temperatures, the costs of construction, management, and maintenance of buildings and infrastructure are much higher in northern cities. Energy costs rise exponentially with the continued construction of low-density suburbs around winter cities. In Canada the



Model of Land O'Lakes Corporate Offices, an example of "Expressive Ensemble" winter architecture, as defined in the Hallwalls Gallery exhibition, *Aesthetics for the Cold*.



Model of the Seagram Museum, an example of "Space Transformation" winter architecture for its ambiguity of indoors and outdoors.

single-story detached house is one of the biggest energy consumers amongst buildings, while private automobiles account for two-thirds of the 25% of energy allocated to transportation while public transport consumes only 2%.[6]

As supplies of renewable energy sources decrease, current trends of building in the north become increasingly irresponsible. Low-density suburban sub-divisions and huge shopping malls use major fuels inefficiently and without consideration of sustainable sources of insulation and energy. An indoor public place designed for the winter climate can effectively use passive heating sources, such as the sun, the earth, and snow, and can encourage dense development in city centers by providing exciting and equitable spaces for social life during months of severe weather.

Total Nationwide Residential Energy Consumption (National Climatic and Data Center):

SUMMER 1999:	1894 TRILLION BTU
WINTER 1999:	3792 TRILLION BTU
SUMMER 2000:	1913 TRILLION BTU
WINTER 2000:	3889 TRILLION BTU
WINTER 2001:	4405 TRILLION BTU

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[1] Both factors are discussed widely in winter city literature. *Cities Designed for Winter* gives more focus to the energy crisis. Gary Gappert, ed., *The Future of Winter Cities* (Newbury Park, California: Sage Publications, 1987), puts an emphasis on the issue of population loss to the Sun Belt.

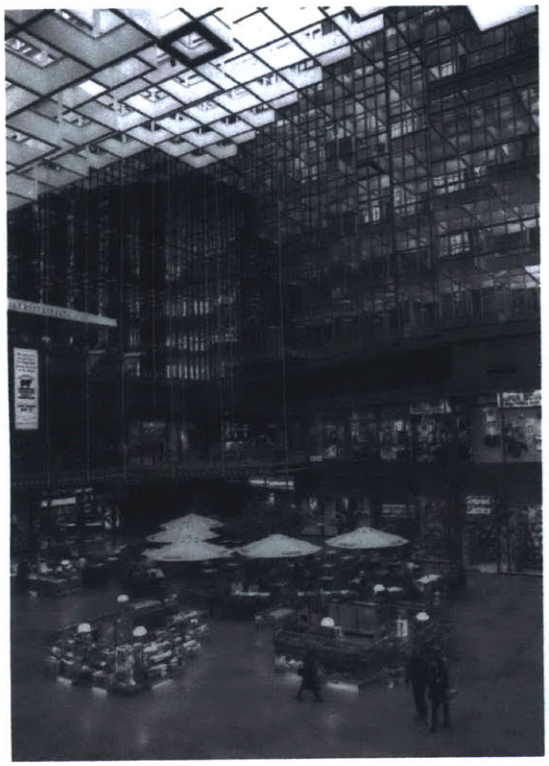
[2] Norman Pressman, *Northern Cityscape: Linking Design to Climate* (Yellowknife, Northwest Territories: Winter Cities Association, 1995), v.

[3] The Liveable Winter Cities Association publishes books and a monthly magazine addressing these issues in detail. Among their publications are Norman Pressman's *Northern Cityscape* and *Shaping Cities for Winter*.

[4] National Climatic and Data Center, "Residential Energy Demand Temperature Index," lwf.ncdc.noaa.gov/oa/climate/research/cie/redti.html. Accessed 4 January 2005.

[5] Energy Information Administration, "1999 Commercial Building Energy Consumption Survey," Table C1. www.eia.doe.gov/emeu/cbecs/set1/. Accessed 4 January 2005.

[6] *The Future of Winter Cities,* "Toronto: Policies and Strategies for the Livable Winter City," by Xenia Zepic, 74.



IDS Crystal Court, Minneapolis, Minnesota. Philip Johnson.

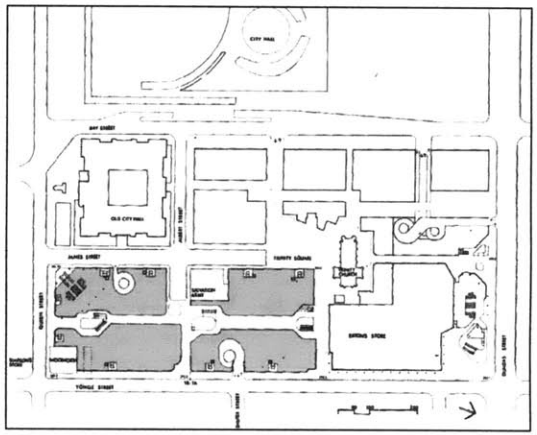
Mall of America, Bloomington, Minnesota. HGA / KKE and the Jerde Partnership.

Eaton Centre, Toronto, Ontario. Bergman + Hamann and Zeidler Roberts Partnership / Architects.

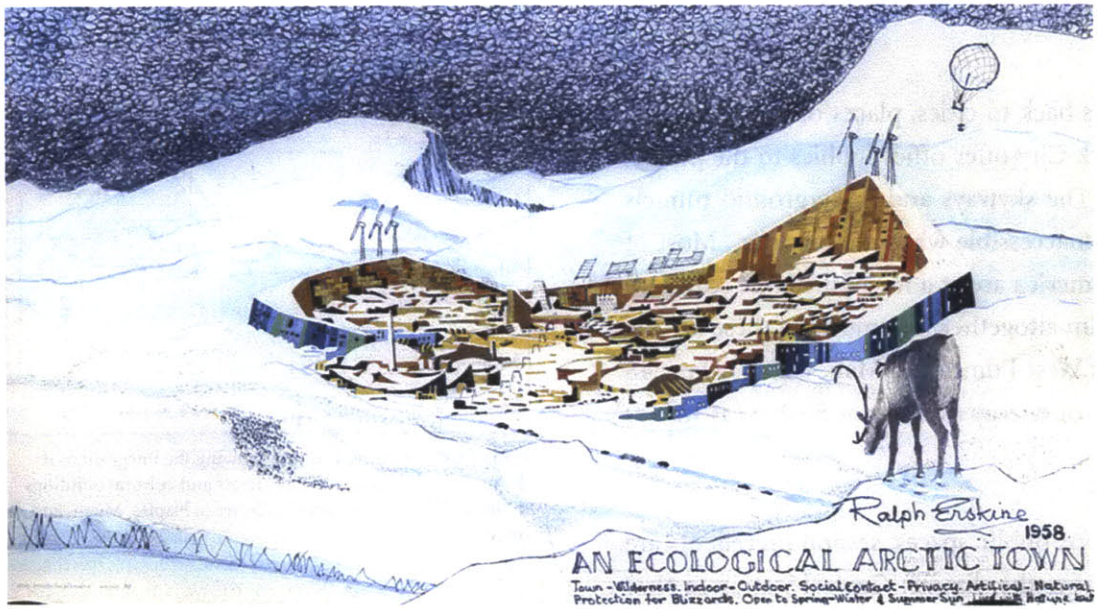
Architectural Precedents in Winter Cities

Despite increasing attempts to bring residents back to cities, places of urban, indoor public refuge remain limited. Montreal and New York City offer office lobbies to the public, though these are locked outside of business hours. The skyways and underground tunnels of St. Paul and Toronto likewise become deserted or inaccessible when shops close. Most of the significant responses to winter climate in North America are at a forcefully large scale and disregard a city's climate, urban fabric, and public realm altogether. Examples of these are the Mall of America in Bloomington, Minnesota and the West Edmonton Mall, which covers 48 square city blocks and boasts to use the same amount of energy as a city of 50,000 (as well as having the world's largest parking lot).[1]

While North America has few celebrated indoor public spaces, several precedents are worth studying for their distinctive or seminal responses to the climate. Central Station in New York and Union Station in Washington, D.C. host thousands of travelers, shoppers, and visitors every day; the IBM Building Atrium in New York City provides a famous example of privately-owned indoor space open to the public during certain hours; Eaton Centre in Toronto skillfully integrates a large-scale shopping mall into the existing fabric of city streets and public transport, attracting shoppers who would otherwise go to suburban shopping centers; Devonian Gardens in Calgary's +15 system is a popular if gaudy 2.5-acre atrium with tropical plants, pools, and stage areas surrounded by shops, offices, and restaurants; and Rideau Street in Ottawa uses a system of adjustable glass canopies for climate control throughout the year. In Europe, notable precedents for urban micro-climatic spaces are Hamburg's Passagen-viertel, Bern's 8km of covered street-level walkways, and various arctic projects by Ralph Erskine.



Plan of Eaton Centre, Toronto, showing the integration of the mall's circulation with city streets and cultural buildings in the tradition of the famed galleries in Naples, Milan, and Brussels.



Ralph Erskine's drawing of *An Ecological Arctic Town* presents many of his ideas for building in a cold climate: a stark contrast between the warm colors of the interior and the frigid exterior, a circular plan that minimizes the surface to volume ratio, a wall building that protects the settlement from northern winds, and easy access and views to the landscape.

Calgary's seminal Devonian Gardens takes an opposing approach to urban design for cold climates by avoiding winter and the outdoors completely: it is 2.5 acres of tropical plants, waterfalls, wooden bridges, and performance stages, built 15 meters above street level. The "winter garden" has been copied by many other projects across North America including St. Paul's Town Square Park.

Yet more commonly, the forces of globalization and the scale of economies resulting from mass fabrication have created high-tech parks in Minnesota indistinguishable from that in Arizona; hospitals in Winnipeg with the same layouts as in Houston. The lack of design that is critical about a region's distinct context, climate, and culture has created major structures, such as the Mall of America, in winter cities that could be in any other metropolis, ignoring the public realm and responsible energy use. People continue to leave winter cities, moving from one city with generic infill to a similarly generic city that at least has a comfortable climate.

Regrettably, most design in winter cities continues to ignore the season's unique and enchanting features: snow remaking the environment completely; warm hearths providing a welcome contrast to stark temperatures outside; unnatural quiet falling on cities during snowstorms. The season features special activities in eating, sporting, and storytelling; unique varieties of light and form; and superlative contrasts of color and temperature that could not only be acknowledged by a building but could be the driver for its design.

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[1] Website of the West Edmonton Mall. http://www.westedmall.com/about/default.asp. Accessed 2 August 2004.

Downtown Saint Paul, Minnesota.

"Another Siberia"

Minnesota's Twin Cities, St. Paul and Minneapolis, are perhaps the only large cities in the United States that proudly think of winter as their primary season. Dr. William C. Rogers of Minneapolis coined the phrase "livable winter cities," and promoted the idea through the LWCA. Weiming Lu, a planner for Lowertown, St. Paul, is a frequently-published member of the LWCA and continues to promote design for winter in both Minneapolis and St. Paul. Former mayor of Minneapolis, Donald Fraser, claims that the city's well-organized and enduring public-private cooperation results from the "city's winter climate [which] encourages people to attend meetings rather than concentrate on more individualistic recreation."[1] Many people move to the region to take advantage of winter sports in the north woods, and St. Paul has been hosting the country's largest winter carnival for 118 years. The website for this festival proudly quotes a New York reporter from 1885 calling St. Paul "another Siberia, unfit for human habitation."[2]

Twin Cities residents stay active throughout the winter and the metro area provides abundant year-round recreational spaces. Through generous public support and private patronage, the Twin Cities have a disproportionate array of arts centers and organizations: two nationally recognized orchestras, 217 theater groups, 167 museums and galleries, and 336 music organizations.[3] The severe winter months are the busiest ones for a variety of indoor cultural centers, including the well-known Fitzgerald Theater (home of Prairie Home Companion), Ordway Theater, Guthrie Theater, and Walker Art Museum. Complementing the widespread notion of Minnesota as a destination for outdoor recreation, Minneapolis has an extensive public park system connecting its twenty-two lakes and Mississippi riverfront. Residents of the Twin Cities do not shut themselves in their houses during winter—they readily take advantage of the recreational opportunities offered by the season.

St. Paul Climate:

LATITUDE:	44 degrres 53' N
LONGITUDE:	93 degrees 13' N
AVERAGE ANNUAL TEMPERATURE:	44.1 degrees F
NUMBER OF MONTHS WITH AVERAGE TEMPERATURE BELOW FREEZING:	5 (November - March)
ANNUAL COOLING DEGREE DAYS:	585
ANNUAL HEATING DEGREE DAYS:	8158
AVERAGE WINTER WIND SPEED:	10.4 mph
AVERAGE WINTER SUNSHINE:	51 %
AVERAGE WINTER MONTHLY SNOWFALL:	9.7 inches

However, areas of the outdoor public realm without specific recreational or commercial program, such as city streets and pocket parks, do not benefit from residents' unabated activity through the winter. Public events within Minneapolis and St Paul concentrate in parklands or theaters. Recreaters, shoppers, and workers travel through the city directly to their destinations without stepping outside—they get in their cars in heated garages, drive to parking ramps in the city centers,[4] then walk to their destinations via tunnels or enclosed skyways.

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[1] Gappert, 132.

[2] Official website of the Saint Paul Winter Carnival. www.winter-carnival.com/history/. Accessed 2 January 2005.

[3] According to the Minnesota Council of Foundations, private, corporate, and public foundations gave more than $95 million to arts and cultural groups in 1999. Likewise, 92% of surveyed residents stated that the arts are crucial to their quality of life. Peter Jennings, "An Arts Investment: Twin Cities Thrive Through Arts That Attract People and Businesses," ABC News website. http://abcnews.go.com/sections/wnt/50states/wnt50states020515minneapolis_arts.html. Accessed 15 May 2004.

[4] Currently 80% of commuters to downtown St. Paul use cars. From *Saint Paul Downtown Development Strategy: A Chapter of the Comprehensive Plan*. Adopted by St. Paul City Council 26 March 2003.

Skyline of St. Paul. Union Depot is visible as a dark horizontal bar in the lower left.

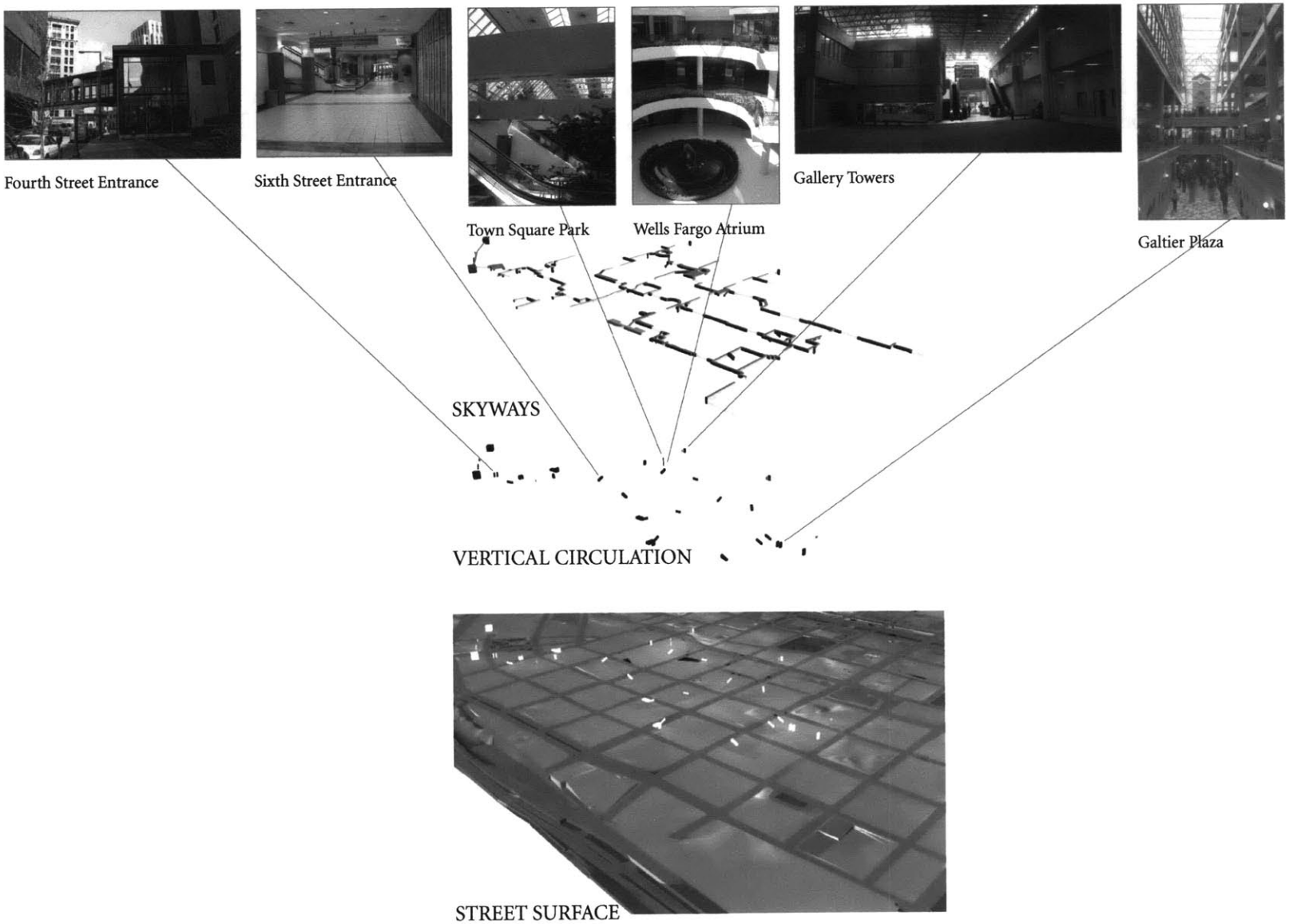
Macro-systems . . .

St. Paul and Minneapolis boast the first skyway systems in the United States, built in the 1960's as a response to flight from the downtowns to the suburbs. The systems continue to grow—the 550 acres of downtown St. Paul have 41 skyways connecting 32 city blocks and the 1,500 acres of central Minneapolis have 41 skyways connecting 38 city blocks. More than 250,000 people use the skyways each day.[1]

Developers in downtown prefer blocks connected to the skyway system, as they see this as necessary to attract retail tenants. Furthermore, they have a chance for two retail frontages—at the street level and along the skyway. Planners, developers, and politicians involved in downtown insist that the skyway system benefits residents by providing a choice in how they deal with the climate. They also insist that the system is necessary to compete for jobs, residents, and retail with suburbs and southern cities, even if it does create a split-level system of circulation for cities without the density to support both.[2] In practice, pedestrians use either the skyway or the street depending on the weather[3] while the other system remains empty.

Sixth Street, 1922.

Sixth Street, 1996 - Skyways and parking ramps dominate the streetscape.


Fourth Street Entrance
Sixth Street Entrance
Town Square Park
Wells Fargo Atrium
Gallery Towers
Galtier Plaza
SKYWAYS
VERTICAL CIRCULATION
STREET SURFACE

The skyways are publicly owned and tightly controlled—maintained by city workers and patrolled by the police department and surveillance cameras. Automatic doors prevent adjacent buildings from losing heat to the skyways while still allowing for ADA compliance. Though St. Paul tried to keep doors to the walkways open until 2AM for a brief period, they now lock after 6PM after people have left work. The skyway inner blocks are generally fronted on either side by (empty) retail windows or office lobbies, with no immediate visual or circulatory connection to the outdoor public realm. From the street, St. Paul's skyways provide no indication of the inner blocks to which they lead. Retail frontages in the skyway system face inwards while street frontages face outwards. No glazing, signage, or open stairwells indicate stores and services in adjacent areas of the other system. While the lack of relationship between the skyways and streets results partly from attempts to preserve the facades of historic buildings, shop owners have also fought attempts to provide easy transition between the two systems for fear of losing business to more competition.

Unfortunately competition is not a problem in St. Paul. Street fronts are primarily occupied by introverted office lobbies and parking structures, while all major attempts at skyway malls have failed. Galtier Plaza, featuring a glazed atrium facing the street and the still-popular Mears Park, opened fifteen years ago with three levels of retail including the only movie theater in downtown. All stores have moved out with the exception of several fast food joints on a ground floor food court. In the Wells Fargo building's interior mall, only the office lobby still occupies store front. Meanwhile, the adjacent outdoor pedestrian Seventh Street, developed at the same time, continues to thrive.

Fourth Street, 1910.


Fourth Street, 1996 - No signage and few doors make the streets and building frontages uninviting.

Closing times and security camera on an automatic door to a skyway in downtown St. Paul.

Skyway corridor near Wells Fargo Place and Town Square Park.

One block from the Wells Fargo interior mall is the shell of Town Square Park, the city's only attempt at a public winter garden. Encouraged by the success of Calgary's Devonian Gardens, Mayor George Latimer worked with the Saint Paul Chamber of Commerce, Oxford Development of Winnipeg, and Skidmore Owings and Merrill to design the park on the third floor of Block A. The indoor park featured plants representing different parts of the country, a stream, a performance stage, and daylight flooding through a wide steel-trussed glazed ceiling.

The park opened in 1980 and remained in use for about one decade. The park was not noticeable from the street or adjacent skyways. It was not immediately surrounded by any other uses, though it connected to an indoor mall one story below via escalators. The park grew shabby as the city did not agree with nearby tenants on assessments for maintenance,[4] and meanwhile the park became a hangout for the homeless and shunned by workers and shoppers. In the early 1990's, the city turned the park over to a private restaurant and today the glazed space remains intact but inaccessible.

Two outdoor parks in St. Paul - Rice and Mears Parks - together with the Seventh Street pedestrian way, have been popular public spaces since opening. However, though the skyway system remains a distinctive, utilized, and even necessary contribution to the public realm of the city, it remains dismal, introverted, and commercially distressed.

Escalators to the former Town Square Park, St. Paul.

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[1] Weiming Lu. "Public Spaces and Winter Landscape." Before the *5th International Winter Cities Biennial.* Montreal, 20 January 1992, page 4.

[2] Former Mayor George Latimer of St. Paul, interview by author, 22 July 2004, St. Paul. President of Lowertown Development Corporation Weiming Lu, interview by author, 21 July 2004, St. Paul.

[3] Ibid.

[4] Ann E. Webber, "Town Square," page 190.

Exterior view of Town Square Park from Wabasha Street.

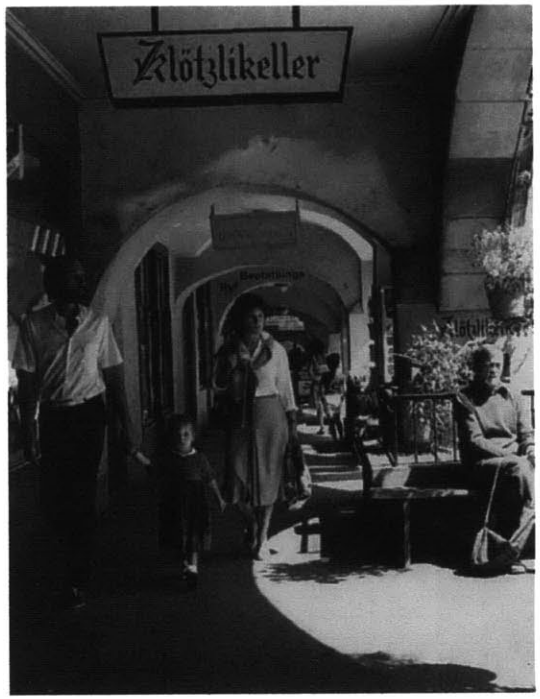
. . . and Micro-climates

While the convoluted and introverted designs of interior blocks in the Twin Cities' skyway systems primarily benefit retail tenants, a truly public indoor space should be a comfortable and exciting place for anyone to sit, stroll, and assemble. The current layout of interior blocks in the skyway system encourages confused wandering to the benefit of shop-owners, with little consideration for the system's potential to orient or encourage pedestrians through city blocks to other destinations in the skyway or street system.

A conceptually simple but practically radical response would be to put the skyway passages along the edges of buildings. Means of passive climate control suggest varying relationships between the skyway, first floor, and sidewalk depending on whether the façade faces southeast, southwest, northwest, or northeast, creating a distinct urban form serving as an architecturally-scaled compass. This set of arrangements also creates more possibilities for direct visual and physical interaction between the skyway and street systems. While property- and storeowners may worry about increased competition, the added excitement of a dense urban shopping street, reminiscent of popular bi-level destinations such as Newbury in Boston or St. Marks in New York, together with a choice in micro-climates would make the downtown blocks a distinct alternative to sprawling suburban shopping malls.

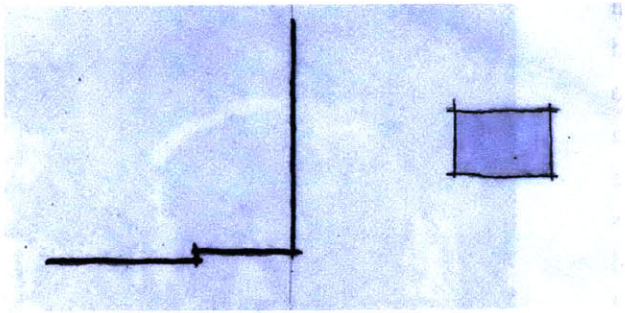
No planners, public officials, or architects with whom I spoke advocated eliminating or even curtailing extension of the skyway system. All use it during extreme or sloppy weather, and many took pride in it as a unique response to the city's climate. However, the system can do more to respond to the season than just shutting it out. A variety of micro-climates would add interest to the built environment while inviting users into and through city blocks—a small, enclosed, and brightly-lit shop would entice pedestrians from the bitter winter cold; a semi-enclosed space cooled by ventilation would attract people on humid ninety-degree days in August while moving them further indoors during January. Layering of micro-climates can eliminate boundaries between interior and exterior as well as between the skyway and surrounding uses. Doors will not have to be locked to save energy, restaurant tables and clothing discount racks can spill into sidewalks, and people will be encouraged to explore all parts of downtown St. Paul's public realm.

An indoor public space in St. Paul should integrate into the city's distinctive skyway system and can do so with the replacement of hard, exclusive boundaries by a layering of micro-climates inviting people into and through the block. Furthermore, the space should be accessible or visible from and beneficial to both the skyways and the streets. It will energize both systems through circulation of pedestrians, distribution of thermal zones, and hosting of programs inspired by popular winter activities and the surrounding community's strengths.

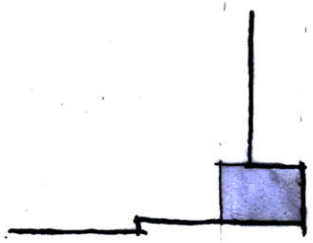


Arcades in Bern, Switzerland provide a variety of microclimates in addition to protection from the noise and fumes of automobile traffic.

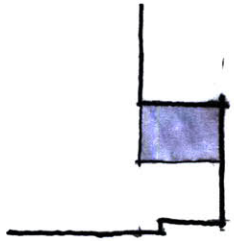
ALTERNATIVE RELATIONSHIPS BETWEEN STREETS AND SKYWAYS



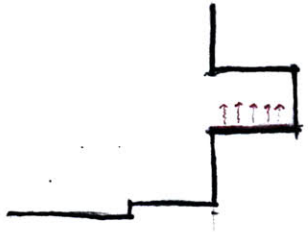
ALL ORIENTATIONS - CURRENT RELATIONSHIP BETWEEN STREETFRONT AND SKYWAYS



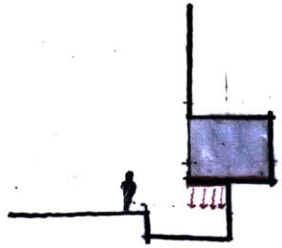
ANY ORIENTATION - ADJACENT SIDEWALK AND SKYWAY



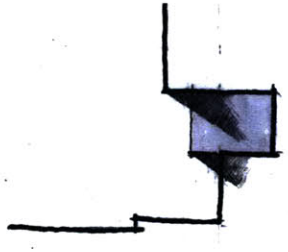
SOUTHEAST - OPEN STREETFRONT



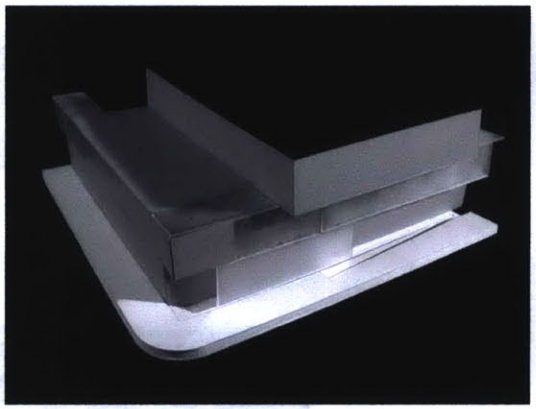
SOUTHEAST - OPEN SKYWAY



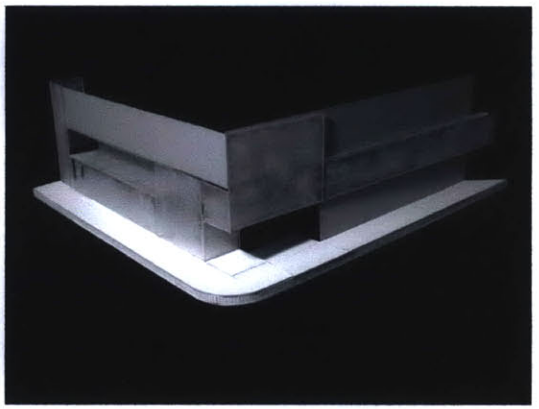
SOUTHEAST - RADIANT HEATING WITH PIANO NOBILE



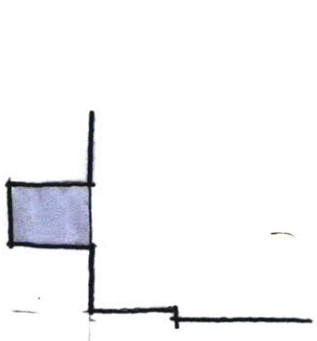
SOUTHWEST - SHADING AND PASSIVE HEATING



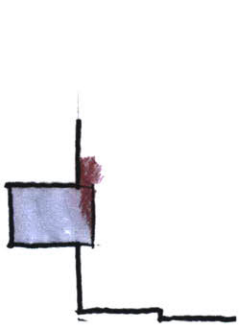
Sketch model showing possibilities for northwest and southwest facades using system shown below.



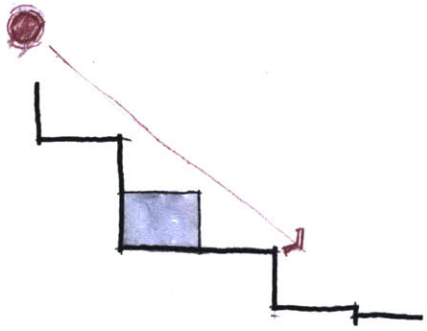
Sketch model showing possibilities for southeast and northeast facades.



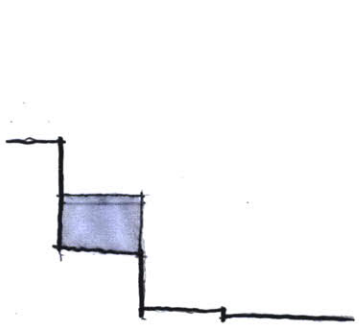
NORTHWEST - MINIMUM EXPOSED SURFACE



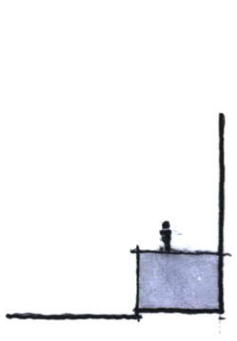
NORTHEAST - PROJECTION TO CATCH MORNING SUN



NORTH - MAXIMIZE SUNLIGHT TO STREET LEVEL



NORTH - MAXIMIZE SUNLIGHT WITH LESS EXPOSED SURFACE



SOUTH - INVERTED

SITE: LOWERTOWN, ST. PAUL

Northeast corner of parking platform currently on site.

Site looking south across the Mississippi River.

Site looking north towards Lowertown.

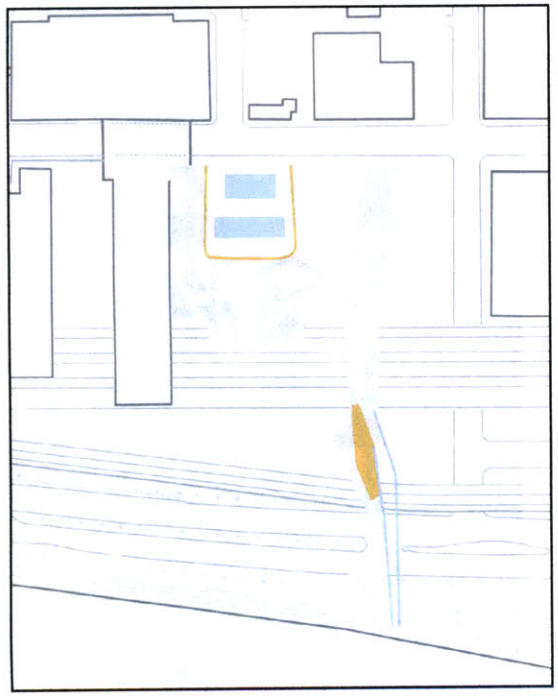
PUBLIC REALM

CULTURAL DESTINATIONS

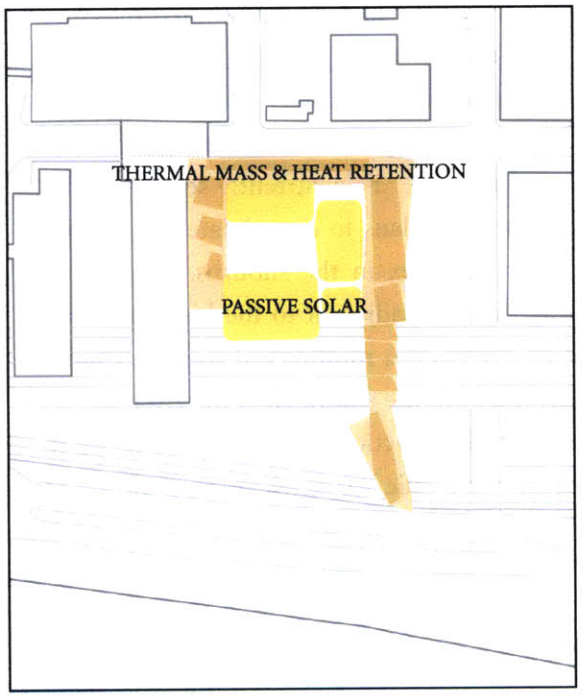
The project locates in Lowertown, a neighborhood of high-end renovated masonry lofts, mixed-use glass towers, and low-income brick-clad housing projects, all cornered by infrastructure in the east end of downtown St. Paul. While the surface parking that once covered much of the district has largely been built-up, the neighborhood remains separated from the Mississippi riverfront by nearly six acres of parking. This currently serves the city post office's distribution center; however, the postal service plans to consolidate the St. Paul and Minneapolis offices into one larger distribution complex in the suburbs. The move will leave behind a valuable swath of land fronting the river, adjacent to the historic Union Depot (currently hosting a restaurant but slated to reopen as a multimodal transport hub), and proximate to several natural and cultural amenities. To the southeast is the river and its recreation trails; to the northwest is a concentration of civic attractions including Union Depot, the summer and winter sheds for the farmers market, the public access television station, and numerous galleries.

Atrium of Galtier Plaza soon after its opening in the late Eighties.

URBAN DESIGN STRATEGIES



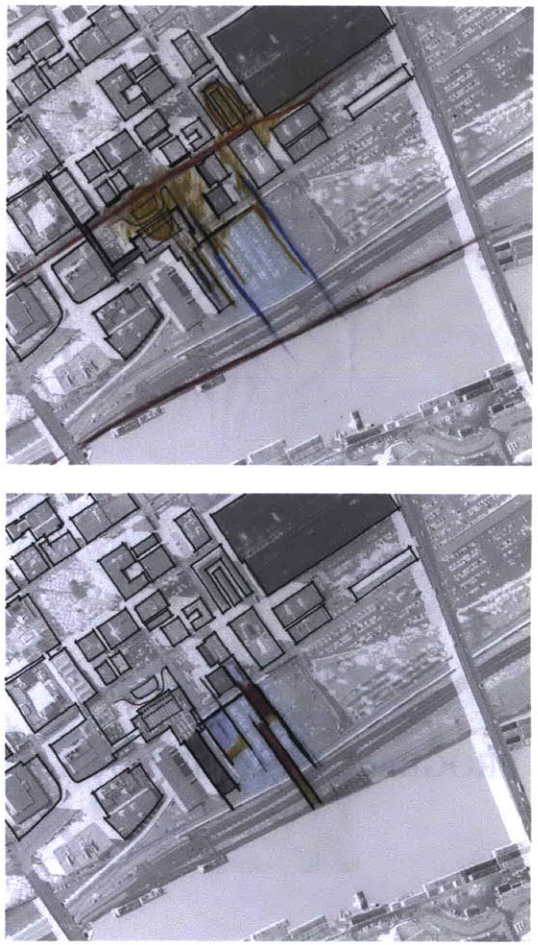
CIVIC-SCALE THRESHOLDS



PASSIVE HEATING SYSTEMS

VILLAGE WITHIN INSULATING WALL

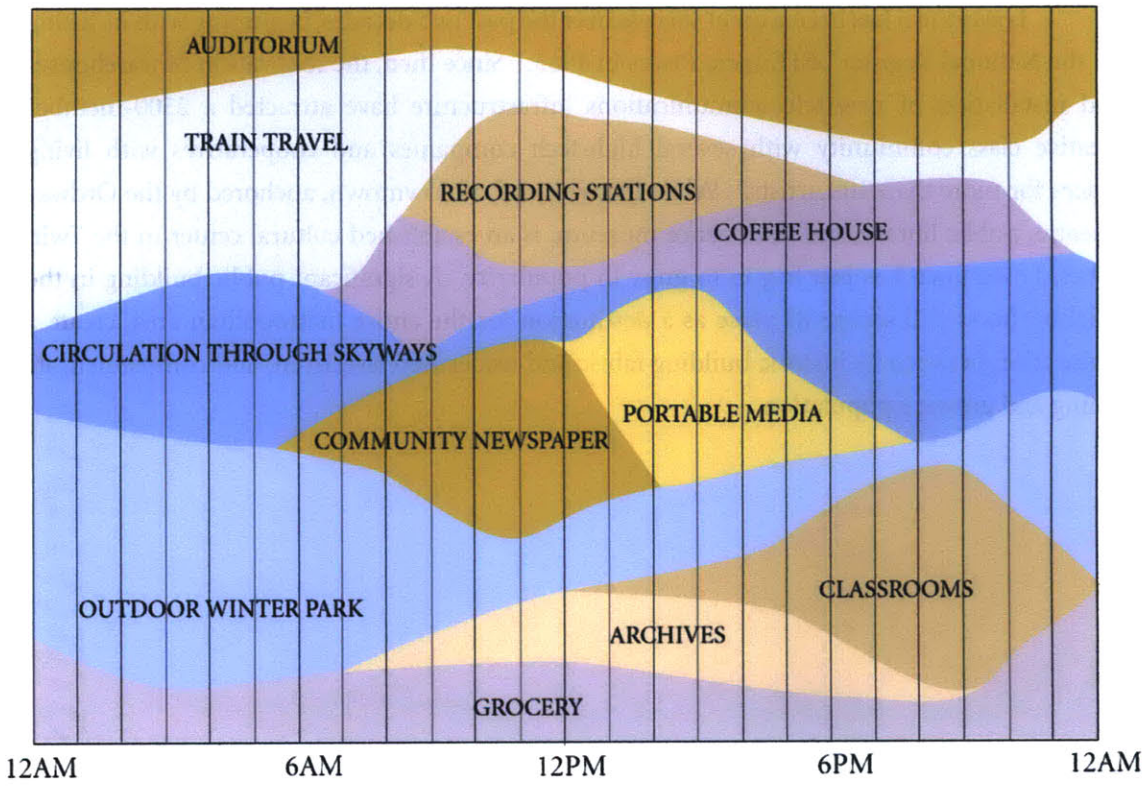
Lowertown has been a quiet success over the past two decades, beginning with its listing on the National Register of Historic Places in 1983. Since then, the renovation of warehouses and installation of new telecommunications infrastructure have attracted a 2500-member creative class community with several high-tech companies and cooperatives with living spaces for more than 100 artists.[1] While the west end of downtown, anchored by the Ordway Theatre, public library, and the science museum, is an established cultural center in the Twin Cities, Lowertown has just begun to grow in popularity. A significant public building in the neighborhood will secure its place as a destination for the entire metropolitan area, create a connection between its historic building fabric and underused riverfront, and complement its young and growing population.



Sketches of initial site responses showing relation to cultural attractions, urban fabric, and riverfront.

[1] Karl J. Karlson. "Downtown Becoming Boomtown." *St. Paul Pioneer Press.* 3 May 2000. 1A, 12A.

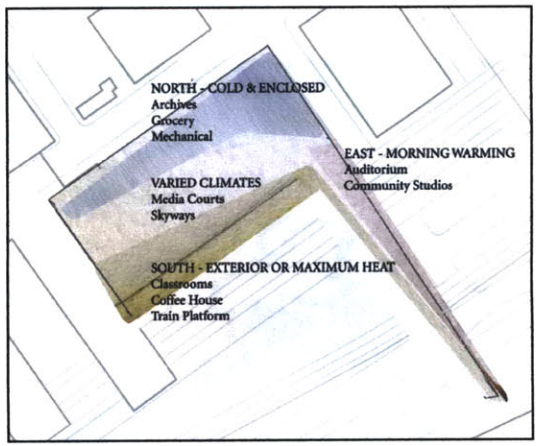
PROGRAM: MEDIATHEQUE



The primary program of the indoor public space is a mediatheque providing access to new media—web sites, video, film, music, and digital games—for which the city's central library has little space. An increasing amount of information is stored on the internet and conveyed by digital and audio-visual media, yet access to these remains restricted to those able to afford a personal computer or time at an internet café. While many libraries use their resources to provide access to books through their stacks and storytimes, they do little to keep the public educated in the most popular contemporary media. A mediatheque can not only provide computer access but also instruction in digital technology that will empower citizens throughout St. Paul. One successful precedent, the Computer Clubhouse started in Boston in 1993, provides after-school programs for economically-disadvantaged children. By virtue of work done at the Clubhouse, many of the teenagers have been offered jobs in the corporate sector.[1]

As a further improvement on existing access to new technology, the mediatheque can provide portable equipment allowing visitors to wander through the building, as they would with a book, rather than being tethered to a cold, sterile computer cluster. Bridging the gap between the virtual and real environments, patrons can take their laptop, portable CD player, or camera to a wood niche warmed by direct sunlight, a thick concrete wall casting strong shadows, or a tall, bright atrium catching summer breezes.

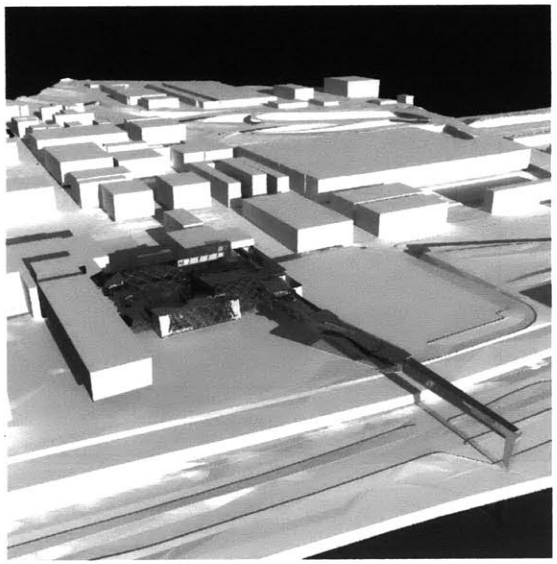
Similarly, the design's program is distributed so as to benefit from micro-climates. The grocery and skating rink are at the north side of the building where they will stay cool. Likewise the café, which should be warm and used until late evening, catches sun in the afternoon while much of the building is in shadow to avoid overheating. The stacks and equipment check-out are on the ground floor, so as to stay relatively cool, and next to the heat sink of the massive train platforms, so as to minimize temperature variation. The media court sits on top of the archives and faces south, capturing heat rising from below and falling from the sun. This civic-scale space breaks into smaller components, serving individuals and groups with a variety of scales and creating a diversity of thermal zones with a variety of forms and materials.



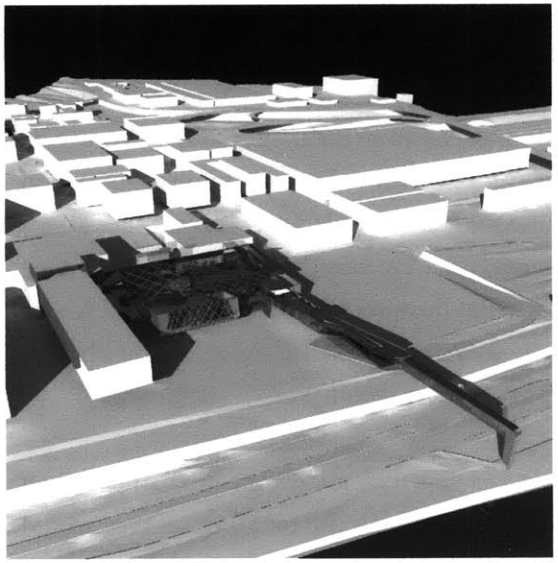
Relationship between program and thermal needs.

Aligning program with street grid creates microclimates.

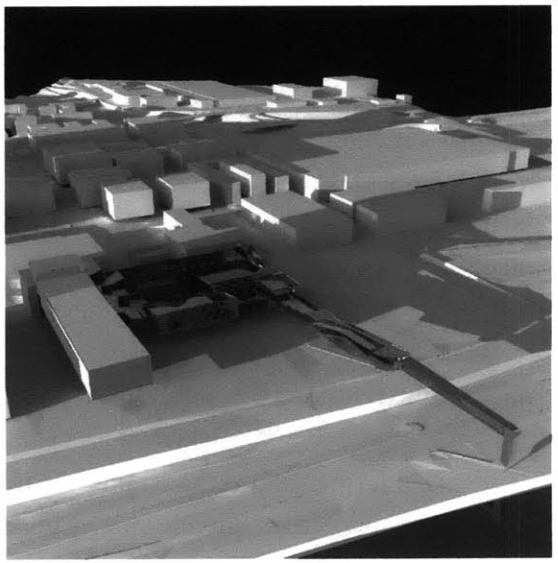
SUN STUDIES (RENDERED USING BERKELY LABS' RADIANCE PROGRAM)



9 AM



NOON



3 PM

Just as a plurality of micro-climates serves a variety of people with minimum energy consumption, a diversity of program guarantees users through the day and all four seasons. Studios host community projects such as an online newspaper, audio recording of personal histories, or computer training mentored by Lowertown's high-tech professionals. An auditorium screens digital art and videos created at the mediatheque as well as art-house or family films on evenings and weekends. A winter court decorates the interior with snow, broadens the range of micro-climates, and provides a forum for the neighborhood's artists and children to work in ice sculptures and snowmen. A grocery and café provide fruits and vegetables, baking ingredients, and warm libations for downtown residents. Finally, an ice skating rink in the entrance atrium extends street life into the building while direct skyway connections to Union Depot bring in travelers arriving in the city or spending time while waiting for their train.

The mediatheque for Lowertown counters the hegemony of the private realm over indoor places of refuge while providing contemporary technological resources and training. By utilizing a variety of micro-climates, the indoor space attracts the public because it provides not only a wealth of media but also a comfortable gathering place in the severe months of winter.

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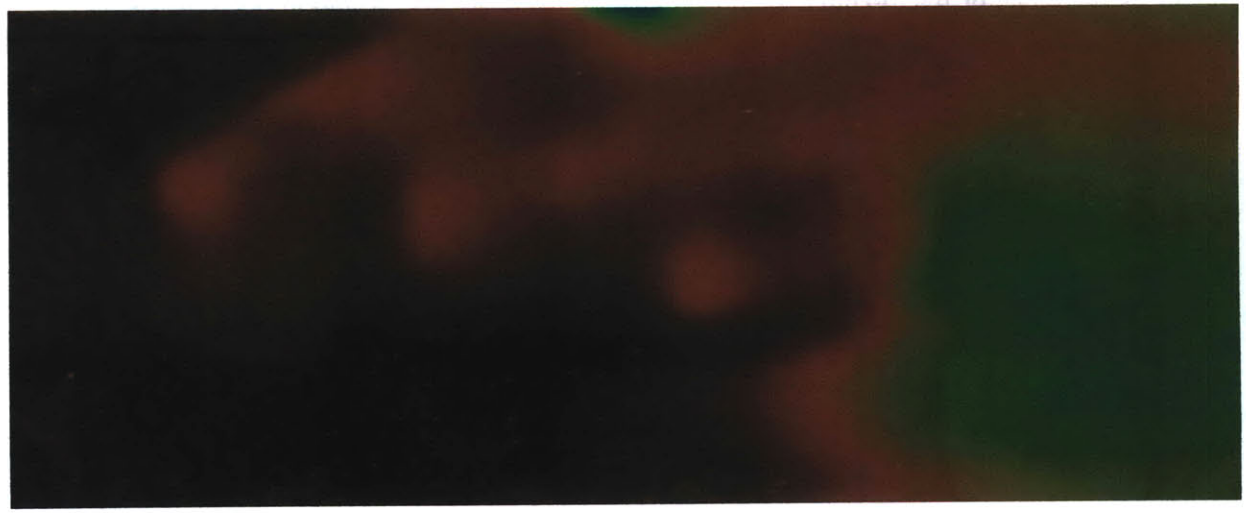
[1] *Library Builders* (London: Academy Editions [1997]), 18.

THERMAL QUALITIES IN ARCHITECTURAL DESIGN



A Marginalized Sensation

Thermal qualities of architecture are little appreciated as an important factor in design, and are rarely focused on in school outside of building technology courses. A good thermal environment is now considered to be one that is highly controlled and unnoticed—Americans expect an unvarying indoor thermal environment maintained by an invisible mechanical system. Luis Fernandez-Galiano, a professor at the Madrid School of Architecture, discusses this phenomenon in the context of its appearance in the mid-nineteenth century with the introduction of remote iron stoves to greenhouses: "Fire was banished to the basement, with heat brought up and distributed evenly within the botanical space by hot water tubes hidden along the perimeter. Plants, which could now enjoy the advantages of peripheral heating and thermal homogenization, were thus the first to benefit from the inversion of the primitive central hearth and its thermal hierarchization of space."[1] However, not all people are comfortable at the same temperature. One report claims that the British comfort zone lies between 58°F and 70°F, the comfort zone in the United States lies between 69°F and 80°F, while for the tropics it is between 74°F and 85°F.[2] Furthermore, people can adapt through physical activity, putting on a sweater, or through the longer process of acclimatization.

Yet the embrace of thermal qualities should not just be for functional purposes. As Heschong writes:

> A proper gourmet meal has a wide variety of tastes—salty, sweet, spicy, savory—so that the taste buds can be renewed and experience each flavor afresh. This renewal mechanism seems to be especially active for the thermal sense when we experience a temperature change within the basic comfort zone. There is an extra delight in the delicious comfort of a balmy spring day as I walk beneath a row of trees and sense the alternating warmth and coolness of sun and shade.[3]

Program and Temperature:

WARM BATH: 100 degrees F

HUMAN BODY: 98.6 degrees F

YOGA STUDIO: 75 to 85 degrees F

SEDENTARY ACTIVITY:
68 degrees F (winter)
to 78 degrees F (summer)

ICE SKATING RINK SEATING:
63 degrees F

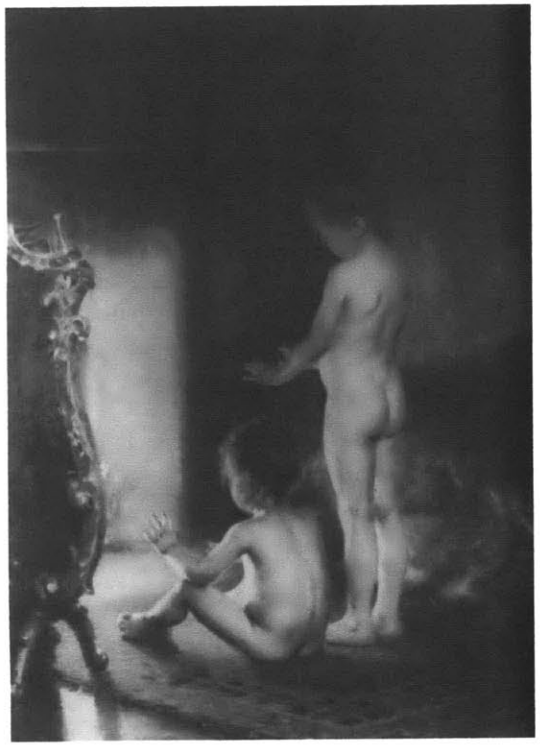
GYMNASIUM: 62 to 68 degrees F

CASUAL OUTDOOR ACTIVITY SIGNIFICANTLY REDUCED:
50 degrees F

ICE SKATING RINK ICE SURFACE:
24 to 28 degrees F

ICE HOTEL ROOM TEMPERATURE:
23 degrees F

FLESH FREEZES AFTER ONE MINUTE EXPOSURE: 10 degrees F + 20 mph wind



Paul Peel. *After the Bath.*

Architecture that provides a variety of thermal qualities—warm, cool, humid, airy, radiant, cozy—will improve the quality of our homogenous and overly-mechanized indoor space through encouraging various activities by matching temperatures to suit sedentary and active uses; through responsible energy use by concentrating available heat or coolness; and through heightening our appreciation of spaces by serving different tastes and highlighting thermal varieties.

Some architects from the last century have attempted to maintain the romantic notions accompanying the concentration of heat in a hearth. Frank Lloyd Wright's Prairie Style homes pinwheeled around hearths, but in practice these were thermally redundant. Any time fireplaces were present, thermal regulation was still provided primarily by other means, including steam and radiant heating systems hidden behind walls and under floors. While the hearth may still symbolize gathering, its relationship with this function grows distant. Furthermore, hearths have been largely relegated to private single-family homes. Thermal expression must be possible at a civic scale while using responsible amounts of energy. This can happen with elements, forms, and materials that respond to, complement, and exaggerate thermal variation generated by passive heating systems utilizing unending supplies of sun, snow, and rainwater.

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[1] Luis Fernández-Galiano, *Fire and Memory: On Architecture and Energy*, Trans. Gina Cariño, (Cambridge, Massachusetts, The MIT Press, 2000), 224, 226.

[2] Lisa Heschong, *Thermal Delight in Architecture*, (Cambridge, Massachusetts, The MIT Press, 1979). 16, referencing Olgay.

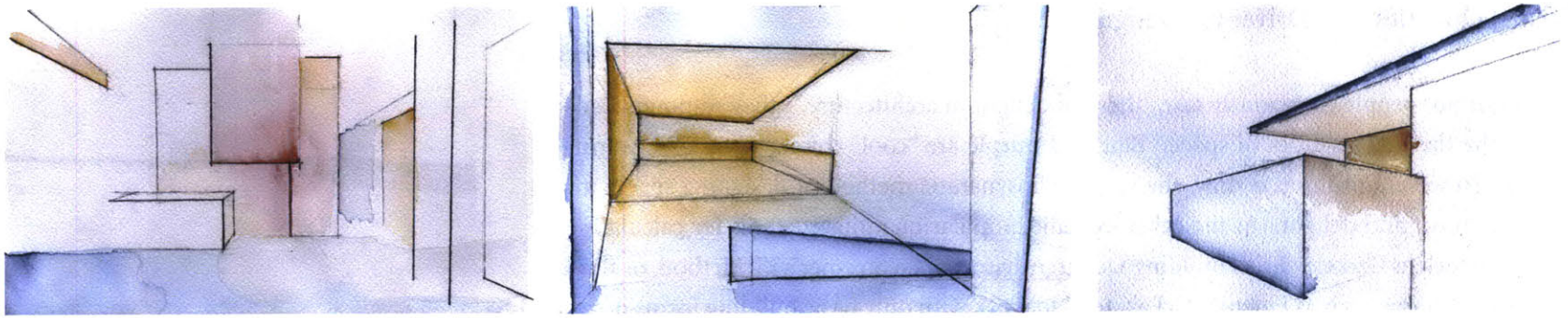
[3] Ibid., 19.

Thermal Qualities as a Driver for Design

Whether or not people consciously take "thermal delight in architecture,"[1] they respond intuitively to the thermal qualities of space. Blue and purple are "cool" colors, wood is a "warm" material. However, intuition is only one vague, idiosyncratic method of designing spaces for thermal comfort and delight. At the other extreme, popular quantitative tools for calculating energy use, such as Berkeley Lab's Building Design Advisor, Koen Steemer's LT Method, or fluid dynamics programs such as Fluent's AirPak, tend to work with only basic building forms or are so complex as to be esoteric. New, flexible, and inspirational tools are needed for architects to begin creating buildings that celebrate thermal qualities through form, material, and use.

Thermal qualities of architecture remain an undervalued factor in design because they are difficult to understand and to control. Thermal comfort remains impossible to calculate accurately, even with an integration of building energy simulation and computational fluid dynamics programs[2] due to the many factors affecting human response and the constantly changing conditions in any space. Heat sources, from the sun to mechanical equipment to people, radiant heat, convection, wind velocity, the conductance and heat storage capacity of materials, and humidity all affect thermal comfort, and each is subject to many hard-to-control variables. Furthermore, the ephemerality and lack of visual representations (beyond the prosaic and misleading red and blue arrows) of thermal qualities make them a preferably avoided and forgotten feature in the process of architectural design.

Andy Goldsworthy. 5 March 1988, Tewet Tarn, Cumbria.



Initial thermal studies, watercolor.

While other mediums and methods for generating architectural space from warmth and coolness should be explored (electronic sensors, melting ice, wax, or Freon), my own process uses thermochromic paper to bring thermal properties to the forefront of design for a winter city [see page 5].

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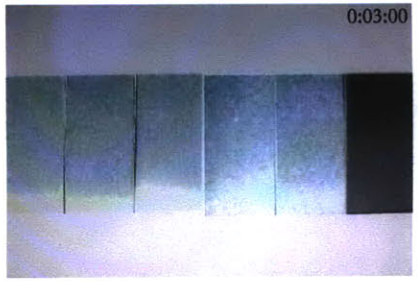
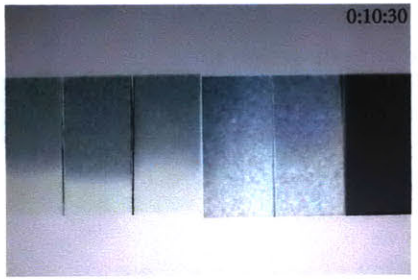
[1] A phrase borrowed from the title of Lisa Heschong's book, originally written as a thesis at MIT – an excellent historical study into the importance of thermal design in architecture.

[2] Zhiqiang Zhai's doctoral thesis, *Developing an Integrated Building Design Tool by Coupling Building Energy Simulation and Computational Fluid Dynamics Programs*, works to overcome many of the shortcomings of energy simulation and computational fluid dynamics programs through a new program, E+MIT-CFD, in which the complementary nature of the tools eliminates assumptions used in each type of program individually.

HEATING



CERAMIC
CONCRETE
WOOD
AIR
GLASS
METAL



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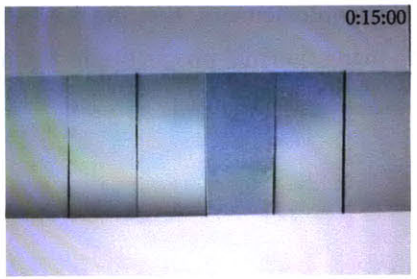
COOLING



CERAMIC
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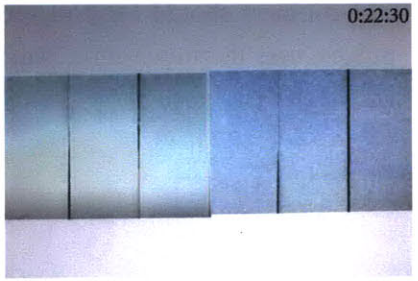


CERAMIC
CONCRETE
WOOD
AIR
GLASS
METAL

Materials Through Time

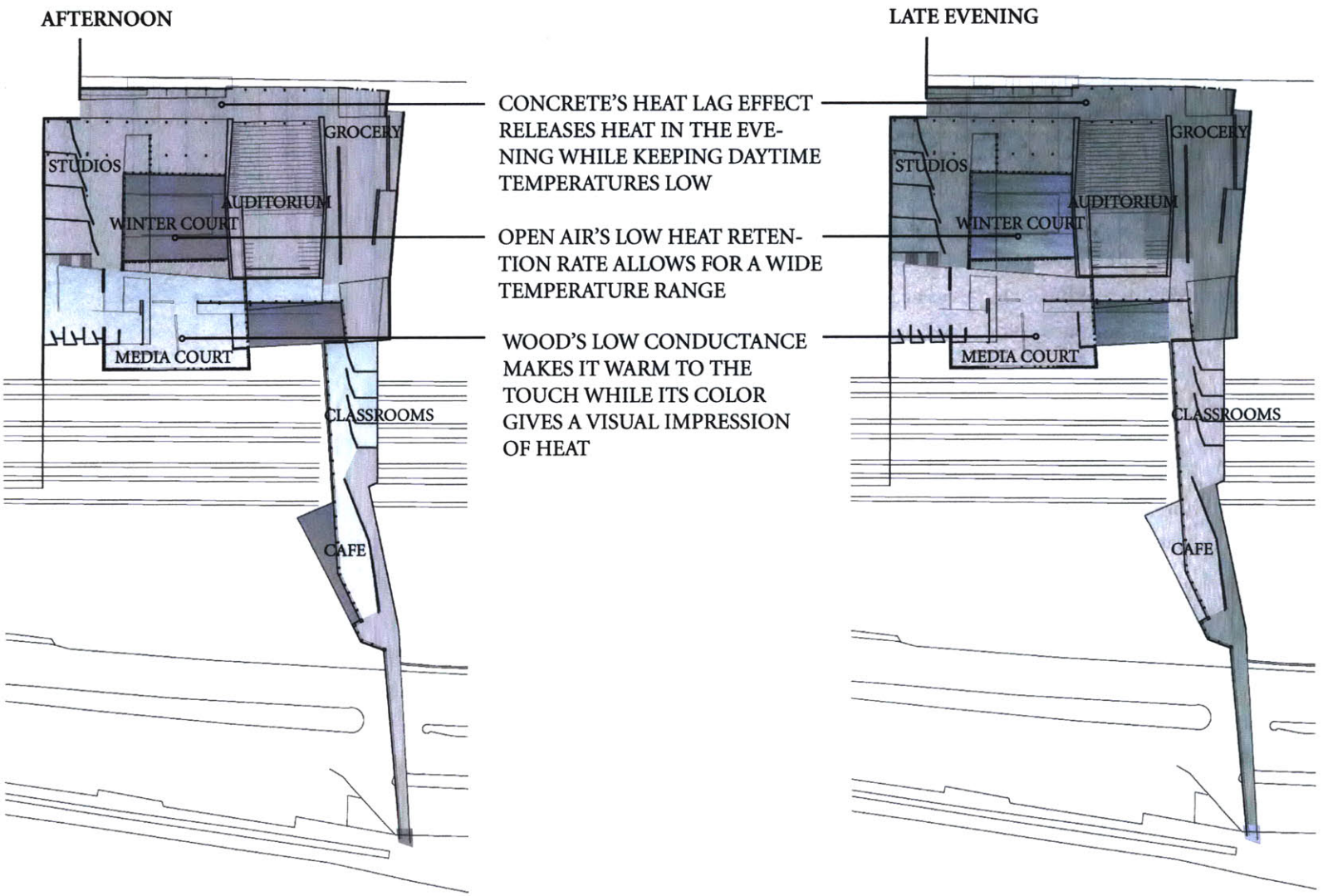
Initial investigations used *Educational Innovations*' Touch-It thermochromic paper, which turns from a marbled blue at 75°F to white at 87°F, for graphic studies of the thermal resistance and heat capacity of common building materials. Pieces of thermochromic (TC) paper were laminated onto samples of ceramic, concrete, wood, glass, and metal, while one strip of paper remained by itself, in contact with only the air. The samples were heated simultaneously and evenly with a hot plate for fifteen minutes then allowed to cool for fifteen minutes by removing the heat source. A video camera recorded the process, capturing the temporal thermal qualities of the materials as heat crept up the samples, turning the paper white, then disappeared, returning it to blue. More commonly-considered qualities of architecture materials—reflective, hard, dark—are no longer perceivable as each becomes recognizable only for its thermal qualities:

- Concrete's high heat capacity causes it to heat more slowly than other materials; however, this also produces a heat lag effect that emits heat at a slower rate keeping the sample warm longer.

- Wood heats more quickly than ceramic or concrete, but its high thermal resistance prevents it from retaining much heat as apparent in the quickness in which the paper returns to blue.

- Metal's high conductivity causes the sample to heat almost twice as quickly as any other material (including air), to become hotter than any other sample, and yet to return the paper to marbled blue relatively quickly.

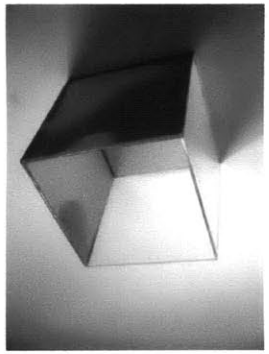
MATERIAL DISTRIBUTION AND PROGRAM



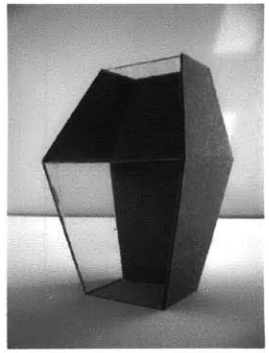
- Air's low heat retention rate causes it to cool down almost immediately even though it heated at a rate similar to glass—more quickly than concrete, wood, and ceramic, but still slower than metal.

These qualities suggest optimum uses for different programs or elements. For example, concrete's heat-lag effect makes it ideal for spaces used in the evening as well as for program requiring more consistent temperatures throughout the day. Concrete construction encloses the grocery at the north corner to ensure a low temperature swing, keeping temperatures low during the day to preserve stock while maintaining a comfortable temperature during the night to attract patrons. Wood works well for spaces that need the appearance of warmth even if they have not been properly heated, as the material's low conductance makes it warm to the touch, its color gives a visual impression of heat, and its air pockets give it good insulating properties for a finish material. Much of the media court is accordingly clad in wood so as to make it a comfortable place to sit with a laptop as well as to make it appear inviting, bringing visitors from the street front to the south edge of the building.

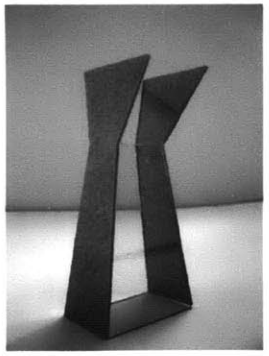
Chimneys forThermochromic Studies of Form



Orthogonal chimney.

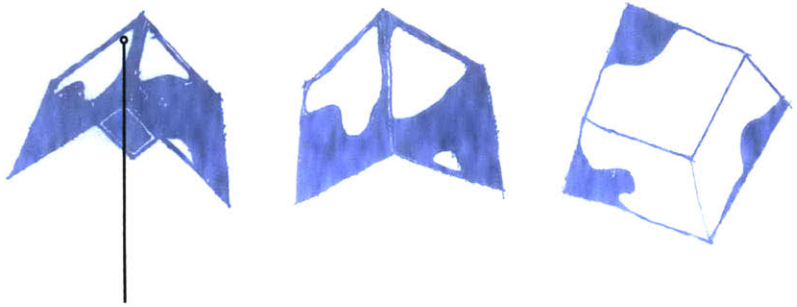


Convex chimney.



Concave chimney.

ORTHOGONAL CHIMNEY - HEATING



HEAT TRAPPED AT HIGH POINT

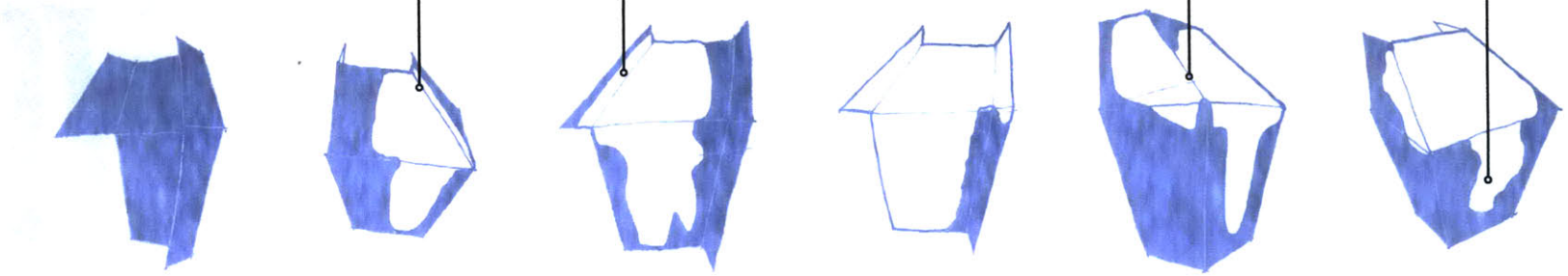
COLLECTED HEAT AT SHALLOWEST RIDGELINE

COLLECTED HEAT AT SHALLOWEST SLOPE

CONCAVE CHIMNEY - HEATING

HEAT LOSS AT CORNER

RETAINED HEAT IN MIDDLE OF WALL

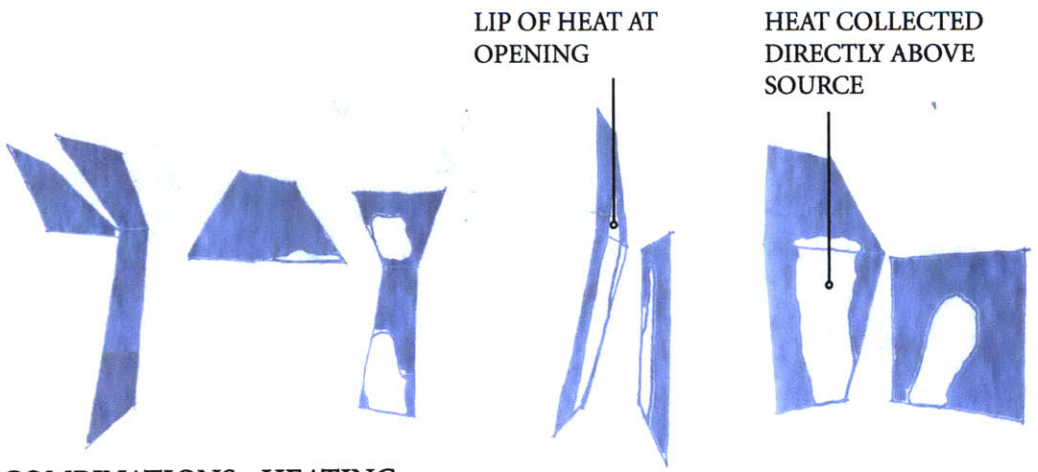


CONVEX CHIMNEY - HEATING

COOLING

Thermal Design Through Form

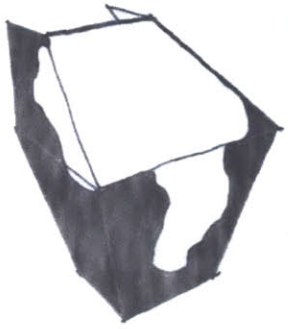
Graphic and spatial studies relating form and thermal behavior documented the channeling of heat through a series of "chimneys" using the buoyancy of warm air. The heat source was then removed and the chimneys left to cool. The coloring of the TC paper during the heating and cooling provided traces indicating how heat responds to the form—rising to higher surfaces, hanging below shallow surfaces, disappearing more quickly at corners, collecting above tight openings. In turn, each study suggests a formal and material response.



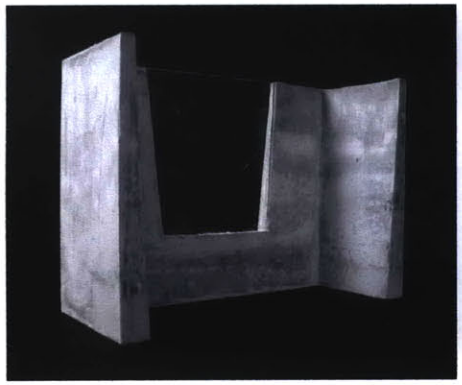
COMBINATIONS - HEATING

For example, results from tests on the convex chimney give visual evidence that the surface loses heat more quickly at its bottom and corners. Accordingly, a design response that homogenizes thermal qualities of the enclosed space while saving energy would place more material towards the bottoms and corners, a design move that conveniently coincides with the strategy of thickening structural masonry walls towards the foundation.

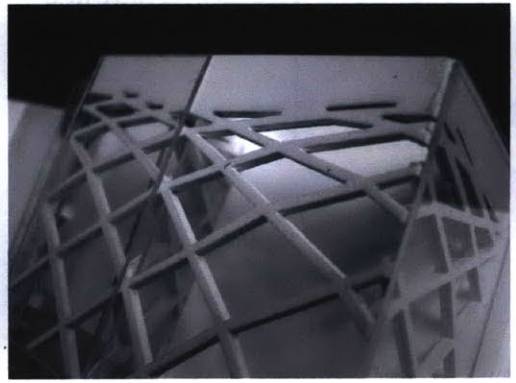
Conversely, if one wanted to focus activity in the center of a room on a cold day, a room could be designed with the most conductive materials at the corners. Complementing this with radiant energy from heat lag would be a curved interior to a concrete or masonry wall. If the exterior face of this wall is flat its surface area exposed to the cold exterior is minimized, while a majority of the radiant heat emits to the interior and concentrates at the focal point of the wall's arc, creating a passive heating hearth.



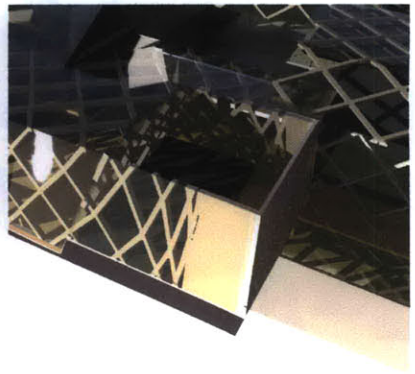
Model of structural lattice with increasing mass at corners.

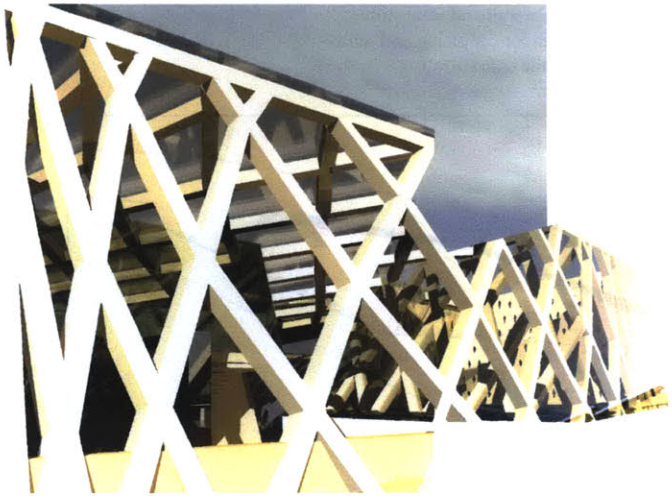


Model of structural lattice with increasing mass at corners.

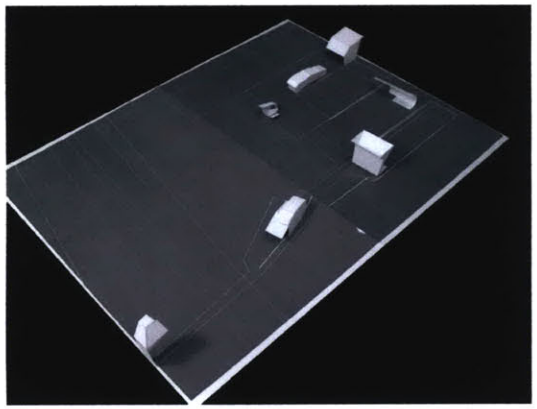


Clad with glazing, the lattice's mass acts as a trombe wall, retaining heat from the day and releasing it in the evening to create a warm corner.





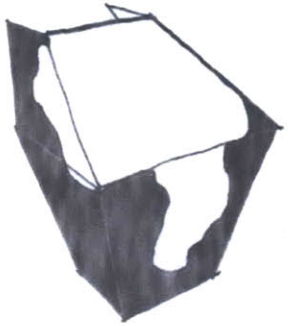
Perspective collage of view into media court from south. The second chimney is at the left, clad in black stone that acts as a thermal battery releasing heat throughout the evening.



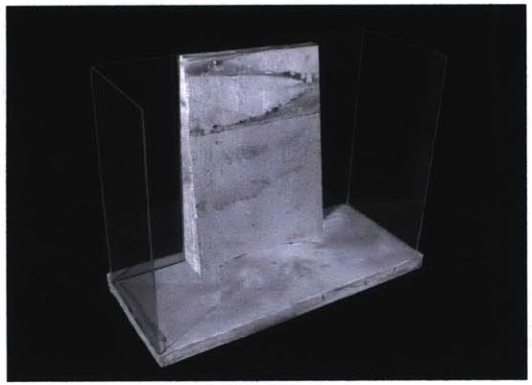
Study of space broken up by chimneys.

By a similar strategy, shallow slopes can be constructed of highly conductive material to counter the collection of heat below them while a more vertical surface, along which heat would pass quickly to the opening above, can be more massive construction. This form also suggests the capture of radiant heat from the sun during the day and the release of it to a clear sky during the night.

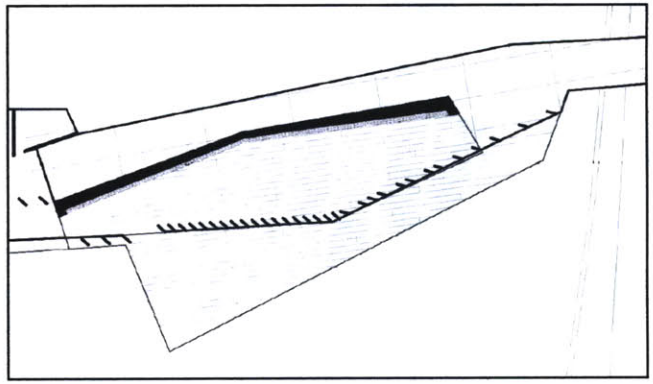
The chimney studies do not capture all aspects of a thermal environment. However, they provide the first step of a flexible, qualitative, and inspirational method by which to use thermal qualities as a primary driver for design while also suggesting a series of micro-climates that can break up a civic space into pockets at a scale conducive to manipulating heat.

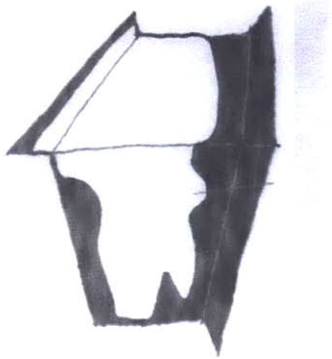


Scaleless thermal model with curving mass and glazed corners concentrating warmth in middle of space.



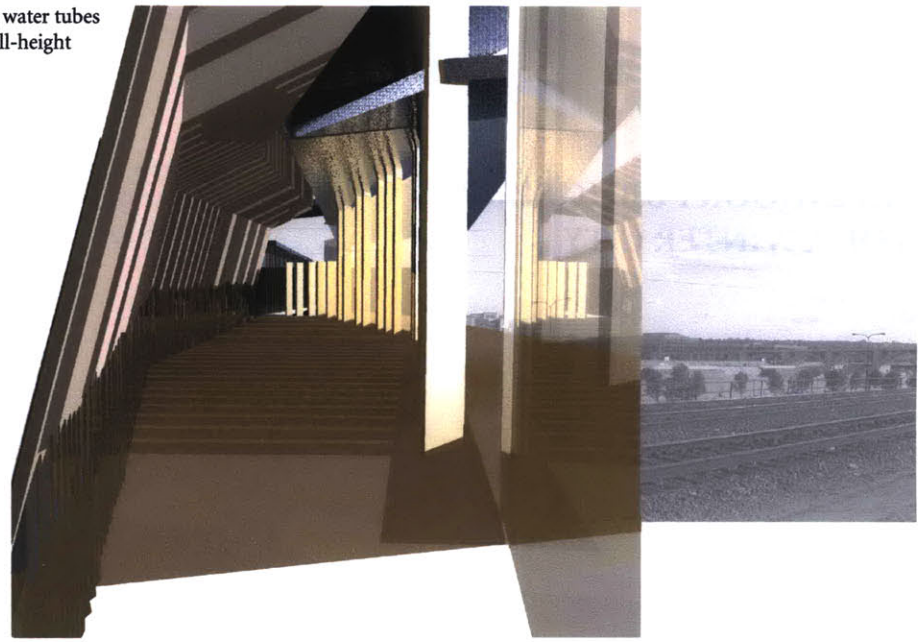
Plan of cafe: concrete wall and water tubes increase surface area for capturing and releasing radiant heat while concentrating it in the middle of the room.



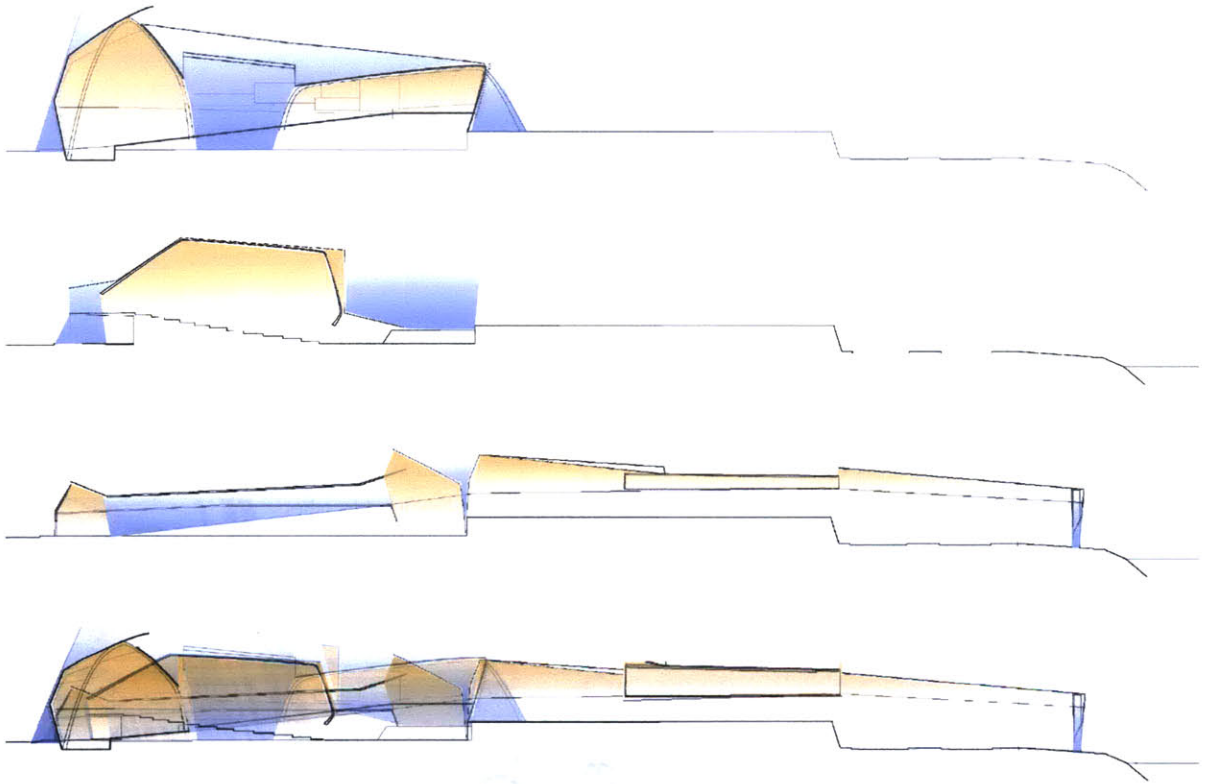


Scaleless study model with glazing at shallow slope.

Perspective collage of cafe showing water tubes along lower edge of left wall and full-height insulating louvers at right.

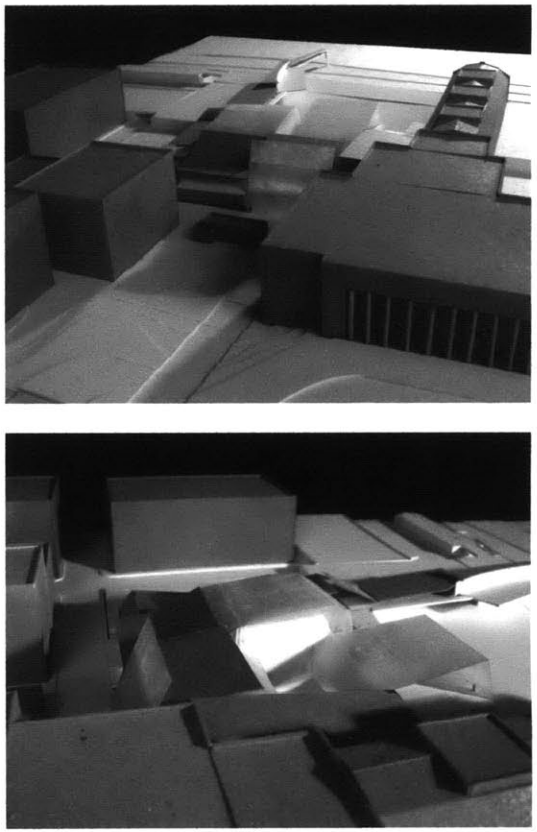


AN INDOOR PUBLIC SPACE FOR A WINTER CITY

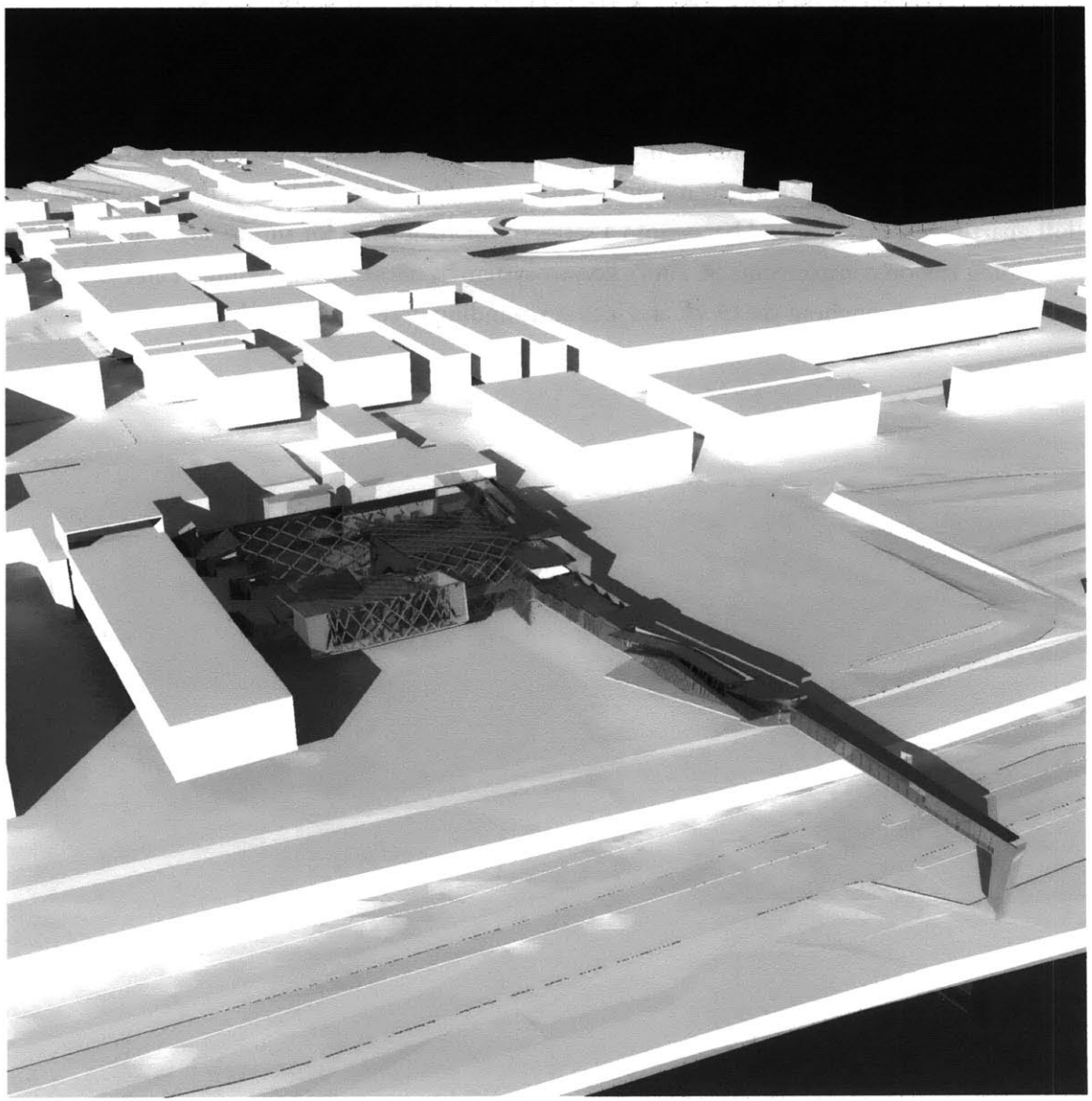


A New Coat for a Winter City

The mediatheque unfolds from Lowertown to the Mississippi in a series of architectural coats, shedding layers and putting them on again while traveling from Kellogg Boulevard to the riverfront. The layers break up the monumental civic building into the scale of the surrounding loft apartments, markets, and bars—into a series of microclimates for sundry activities. Each unfolding ribbon complements St. Paul's skyway system by allowing both sunlight and visitors to move easily throughout the block and into surrounding streets and buildings.



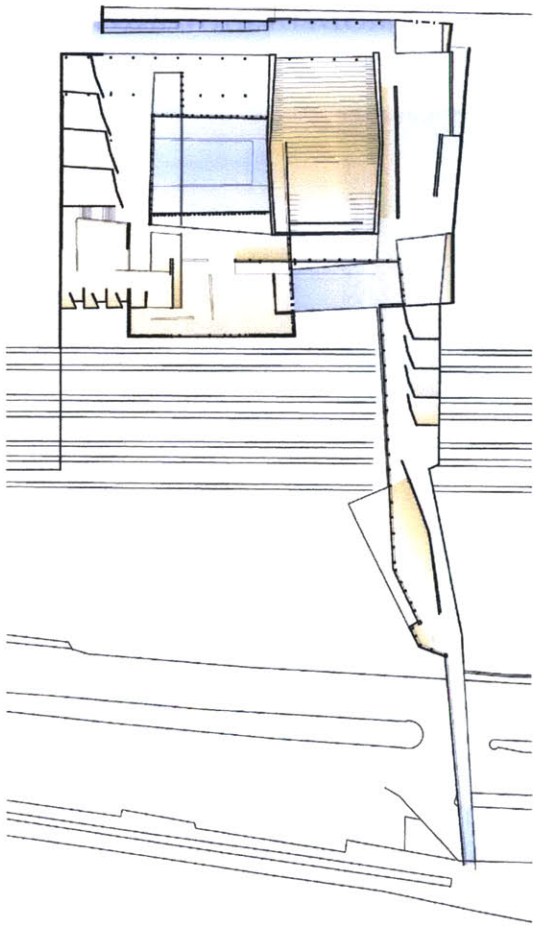
Site model, built at 1/32 scale, with Union Depot to the west of the mediatheque.



View of mediatheque looking north.

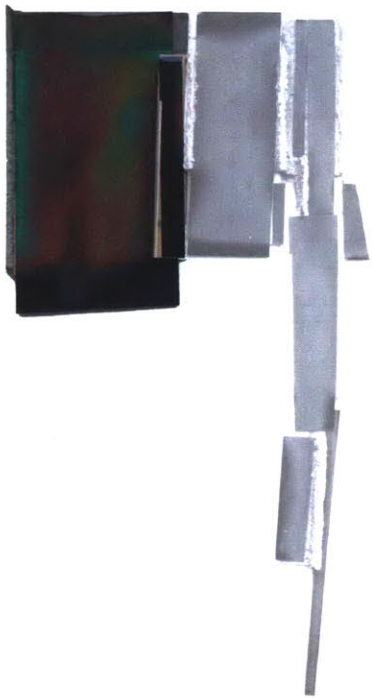
Most interior hallways in St. Paul's skyway system meander so as to increase store frontage and slow down consumers. However while the mediatheque's design promotes leisurely strolling, visibility along the length of the section keeps the public oriented to the site's context while encouraging them to move and assemble through thermal and visual cues. Such solar, visual, and circulatory connections maintain the ambulatory spirit of the skyway system while providing places for stopping—in sun pockets at particular times of day, at climatically-controlled viewpoints, or at an ice sculpture in the open-air winter court.

Studies of the layout, form, and material of the building began with sketch models using *Edmund Scientific's* liquid crystal thermophotochromic paper. The liquid crystals selectively reflect light based on temperature, moving through the entire spectrum from black (infra-red) at 68°F to red, green, and finally dark blue at 77°F. The spectrum allows for relatively sophisticated studies by representing a range of and subtle variations in temperature.

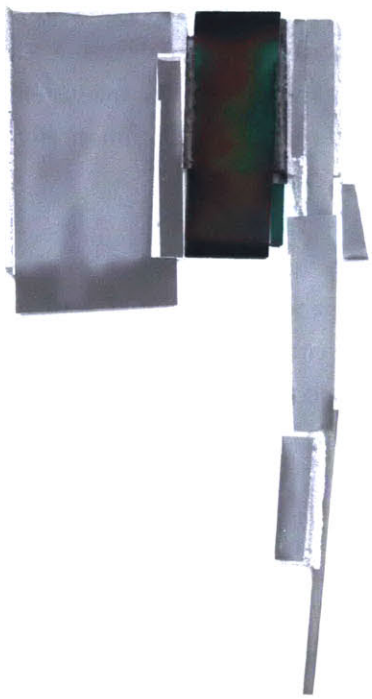


Alternating warm and cool zones accomodate a variety of activities and thermal tastes. Heat is concentrated in the studios in section A (left), the media court in section B, the auditorium in section C, and the cafe in section D.

SKETCH MODELS SHOWING RELATIONSHIP BETWEEN THERMAL QUALITIES AND SOCIAL FUNCTION



VARIATIONS IN SECTION AND MATERIAL PROVIDE UNIQUE MICROCLIMATES WITHIN THE CIVIC SCALE COURT

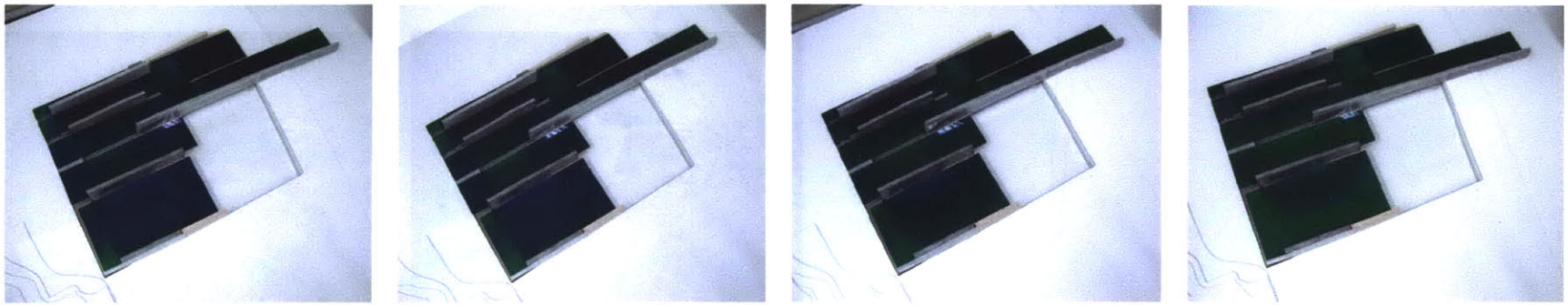


AN ENCLOSED AUDITORIUM SURROUNDED BY EXTREME CLIMATE ZONES CONCENTRATES THE PUBLIC

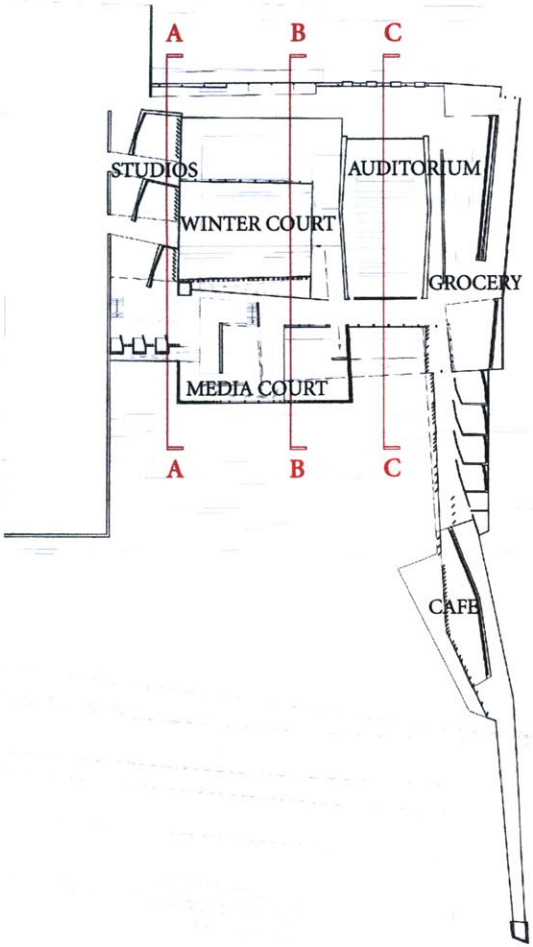
SPACES SCALED FOR SMALL GROUPS MOVE THE PUBLIC TO THE RIVERFRONT

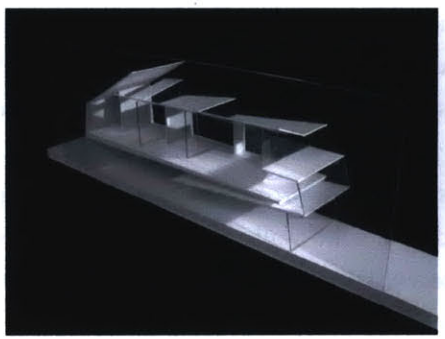
The models were heated by sunlight or a halogen bulb simulating the path of the sun. Concern for responsible energy use mandates that pre-existing and almost infinitely renewable resources, such as the sun, snow, waste water, ventilation, and people (the more public the space is the warmer it will be), be the primary heat sources for the mediatheque. Accordingly the building responds to and expresses these sources, most grandly by opening to the sun through a glazed south façade cradled by a solid wall wrapping the northwest and northeast facades. More specifically, the orientation of the unfolding sections' walls follows the 35° cant of downtown St. Paul's street grid with the thermally beneficial result that they catch the morning sun while blocking it in the afternoon to prevent overheating. While these sources may have to be supplemented by St. Paul's district steam heating system[1], these mechanical systems can selectively reinforce the micro-climates of spaces inspired by passive heating strategies.

[1] The exceptional system is powered by a cogeneration plant that uses local biomass for seventy-five percent of its fuel, and provides heating, cooling, and electricity to eighty percent of the central business district. District Energy of Saint Paul, "Elements of a Cleaner Future," 1,4.

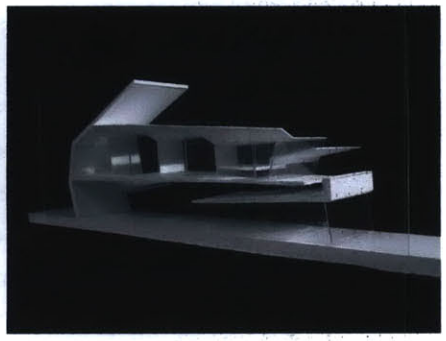


Concept model relating dominant axis to material and thermal qualities.

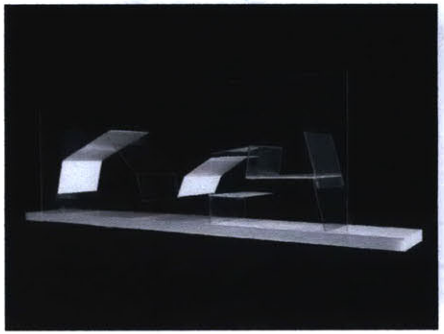




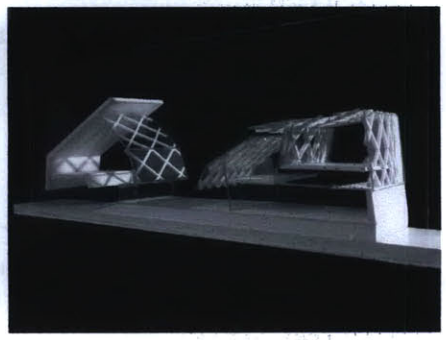
Section A, Study Model.



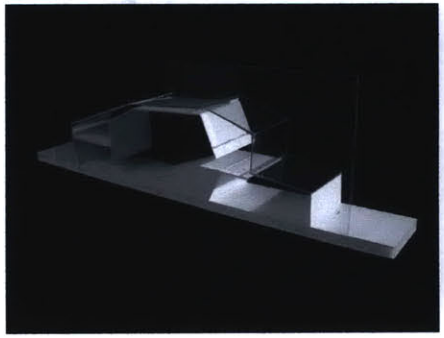
Section A, Final Model.



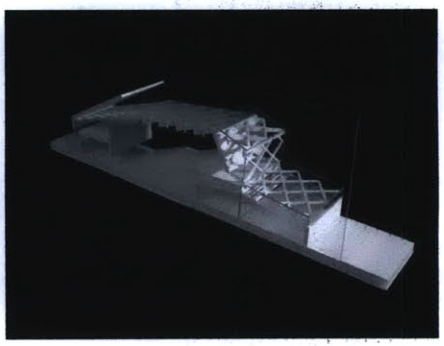
Section B, Study Model.



Section B, Final Model.



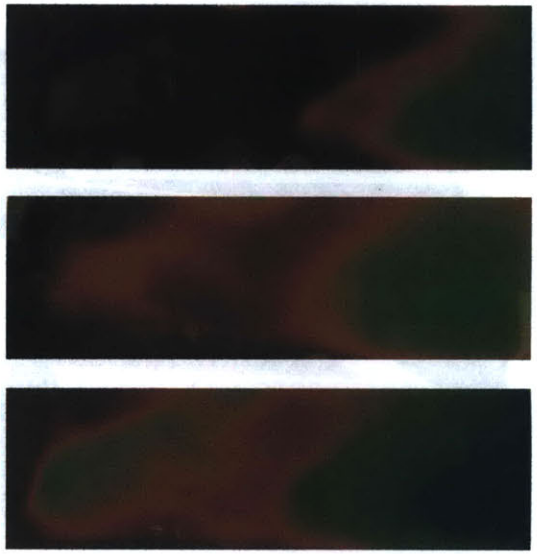
Section C, Study Model.



Section C, Final Model.

Thermal Qualities of an Indoor Public Space

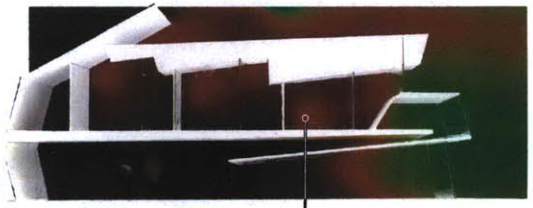
Three sections of the building developed further based on thermochromic studies. These experiments not only provide clues to reinforcing thermal qualities of spaces but also to how people will use them throughout the day. Spaces that heat quickly may be uncomfortable in the early afternoon but gathering spots in the early evening. This variation in behavior can be undergirded by providing more glazing to trap infrared waves during the day and more black radiant surfaces to release heat throughout the night. Spaces that heat slowly if at all and lose heat quickly can serve as transition zones moving people further into the building. This purpose can be reinforced by decreasing the amount of insulating material and increasing ceiling heights to augment thermal stratification. Each section of the mediatheque molds thermal qualities differently, providing for a range of sensations, activities, and social configurations.

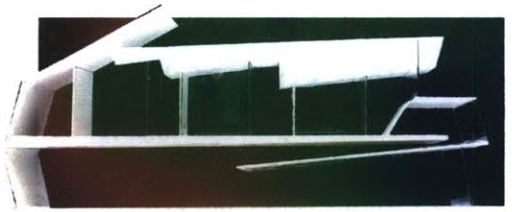


Representations of thermal space with thermochromic paper.

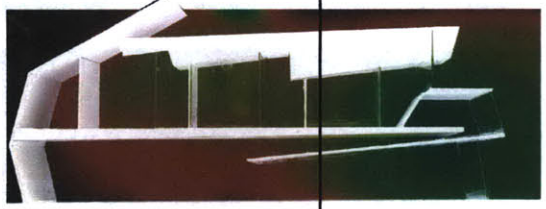
The thermochromic impressions were made by propping the sample securely against the section models. They were heated with a halogen lamp directed towards the section from the skinny end, and cooled by pointing the model towards a cold window.

SECTION A - HEATING



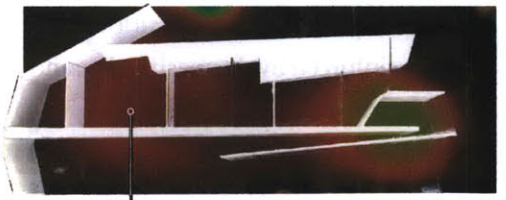


COOLING

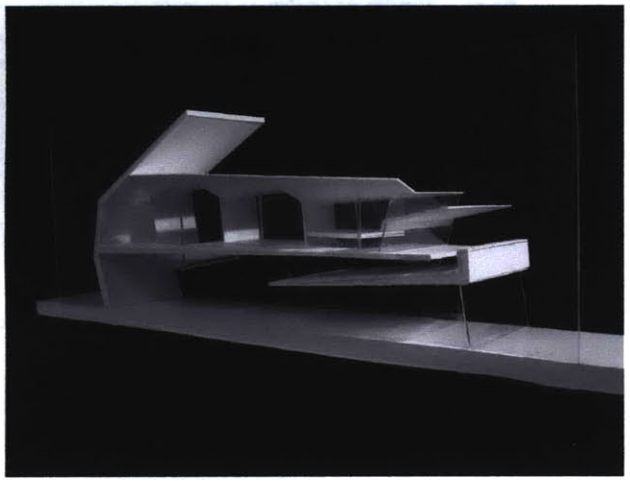


HEAT SOUTH STUDIO MOST QUICKLY

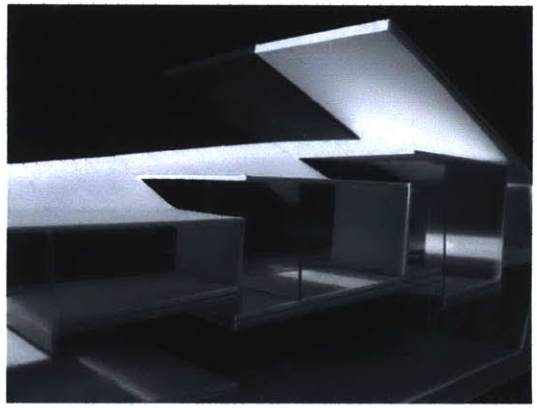
CAPTURE HEAT IN READING INGLENOOKS



RETAIN HEAT IN NORTH STUDIO BY PREVENTING RADIANT HEAT LOSS

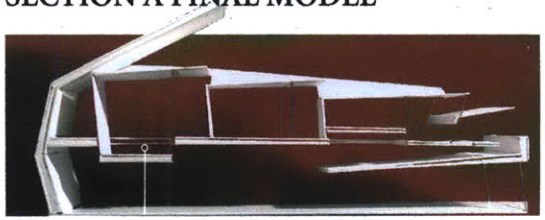


Section model A represents the studios to the west of the winter court. As this section stands adjacent to Union Depot, the strategy is to bring people from the station to the media court by enticing them with spaces that appear (and are) increasingly warm. For example, while the southernmost studio receives more insolation due to its positioning within the building, this effect is exaggerated by its smaller size (it heats more quickly) and, in the second iteration, by its higher elevation (it benefits from heat rising from surrounding sections of the building and suffers less from thermal stratification). In contrast, the northernmost studio is larger and sunken. All three studios in this section primarily capture morning light, ensuring that they are comfortable in the first part of the day when they are likely to be used. At the south end of the section are a series of wood-clad inglenooks sized for one or two patrons. The snug environment of the alcoves can be further personalized by adjusting the vertical insulating louvers at the windows.

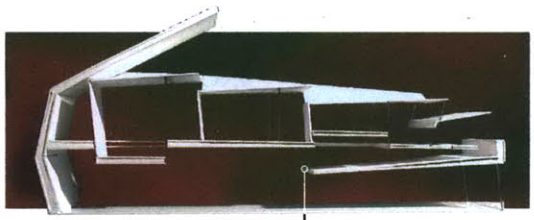


Direct sunlight coming into rear studios in late morning.

SECTION A FINAL MODEL

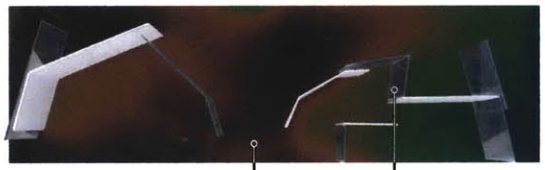


INCREASE HEIGHT AND THERMAL LAYERING TO MAKE NORTH STUDIO THE COLDEST

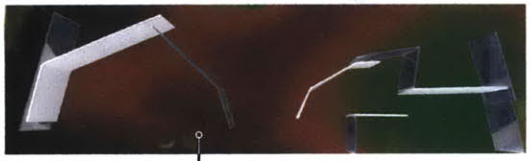


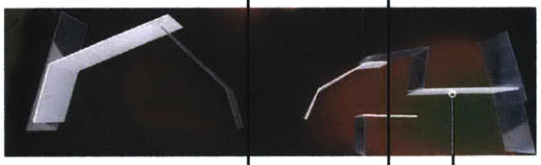
COLLECT HEAT FROM LOWER LEVEL

SECTION B - HEATING



COOLING





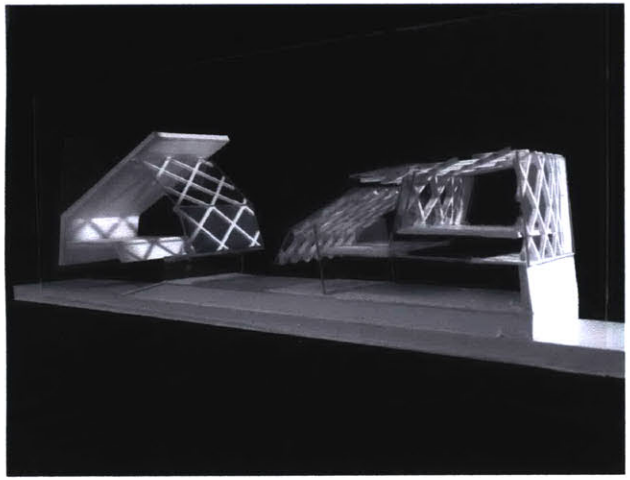
LOCATE COLD PROGRAM
(E.G. SKATING RINK)

CAPTURE HEAT FROM
LOWER FLOOR

CAPTURE COLD AIR IN
WINTER COURT

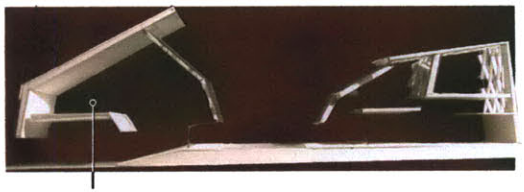
CREATE COMFORTABLE MI-
CRO-CLIMATE ADJACENT TO
WINTER COURT

RAISE TEMPERATURE BY
INCREASING INSULATING
LAYERS



Section model B runs from the main entrance through the winter and media courts. The media court is the warmest element of the section and is broken up by chimneys creating micro-climates within the court. The southern-most chimney is open-air, but can still be warm on cool days by benefiting from convective heat due to its elevated position and from radiant heat from the black surfaces of its floor and lattice wall. The adjacent chimney serves to channel heat from the archives (where it could damage media and equipment) through its narrow openings at its bottom and top. Accordingly, it is a warm refuge adjacent to the exterior chimney and the winter court. The winter court, in contrast, celebrates the mediatheque's distinct and extreme winters, catching falling snow, ice, and cold air. On either side of the court are covered exterior spaces where parents can watch their children play in the snow or patrons can watch a light and snow show. In the summer, the court serves as a cool forum for outdoor film screenings. Finally, at the north end of the section is the main entrance. While the glazed southern façade catches radiant heat from the sun, the height of the space prevents it from heating too greatly, making it a thermal transition from the street and an optimum space for a covered, public ice skating rink (and wading pool in the summer) that directly serves street life. The sloped north roof reflects daylight into the atrium, allows sun to reach apartment buildings across the street, and diverts north winds creating a low pressure zone at an opening in the roof to facilitate ventilation of the atrium.

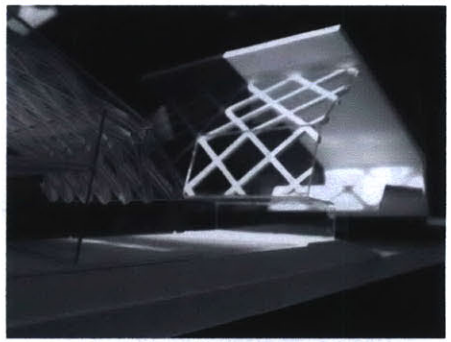
SECTION A FINAL MODEL



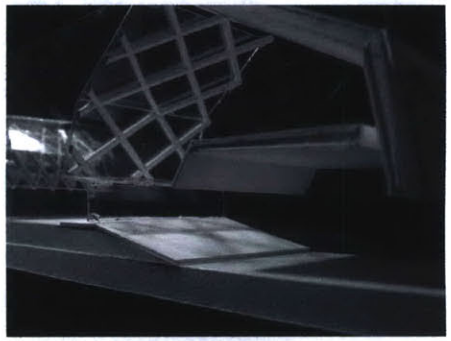
MAINTAIN WARMER TEMPERATURE AT SKYWAY LEVEL

COOL TEMPERATURE AT TRANSITION FROM STREET

CAPTURE RADIANT HEAT BY THERMAL MASS AT VIEWING SPOT



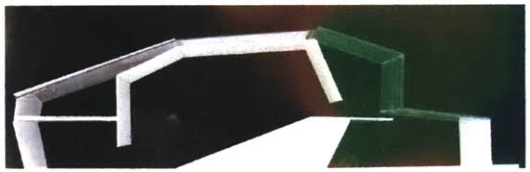
Winter court with sunlit skyway extension in background.

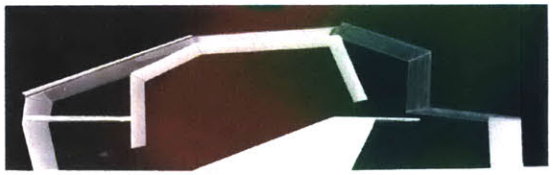


Entrance sequence.

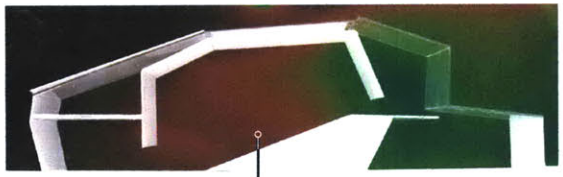
South chimney, with variety of wall thicknesses and lattice densities.

SECTION C - HEATING

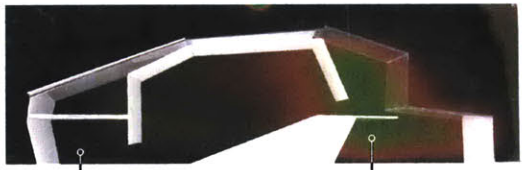




COOLING

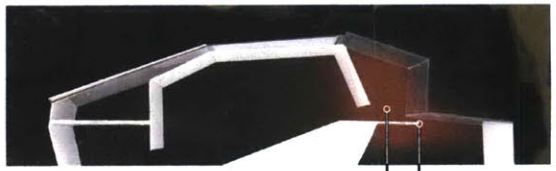


MAINTAIN BALANCED TEMPERATURE IN AUDITORIUM



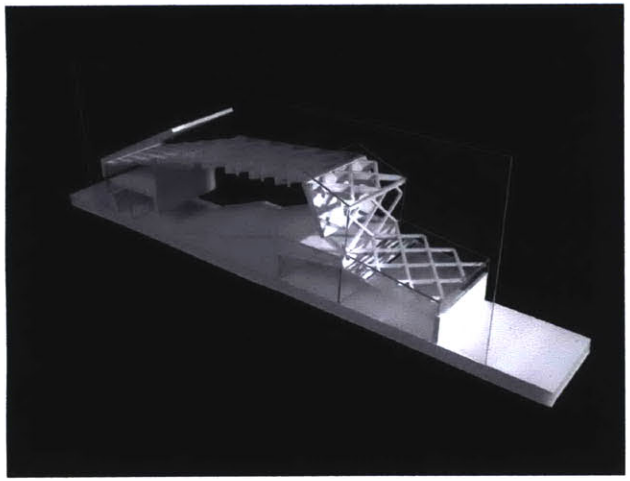
KEEP NORTH LOBBY COOL

POTENTIALLY KEEP WARM WITH LOW CEILING



COLLECT HEAT AT SOUTH LOBBY

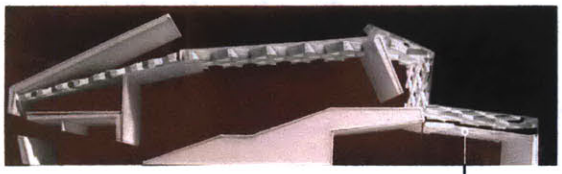
CHANNEL HEAT FROM LOWER LEVEL

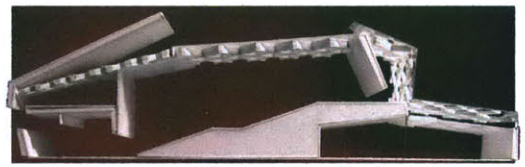


A concrete structural lattice supports the folded forms of the mediatheque's chimneys while also providing thermal benefit to the interior spaces. The varying density of the lattice allows for a balance between insolation and insulation. However, the thermal battery of the concrete structure complements this balance by sitting within the glazing and acting as a trombe wall, collecting infrared rays trapped by the glass and emitting them as radiant heat throughout the evening. Augmenting this effect and adding visual interest is black paint on the south faces of the lattice, helping the mass to absorb heat, and white paint on the interior faces, increasing the amount of reflected daylight.

Section C contains the auditorium, the primary place of congregation within the section. The north side is cool due to the lack of direct sunlight warming the space, whereas the south side can be especially warm since it collects heat rising through the auditorium and from the archives. The auditorium remains at a welcoming temperature between the two extremes on either side of it, as black stone on the southeast and southwest sides of it collect heat and release it throughout the night while excess heat escapes to the adjacent chimney. Thin, translucent stone clads the roof of the auditorium, and beneath it the structural lattice widens to filter light and act as an acoustic damper.

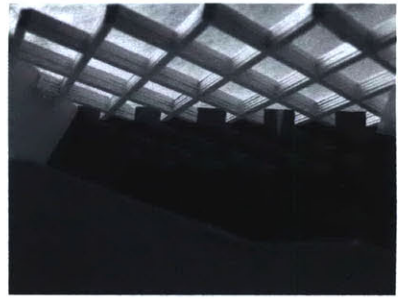
SECTION C FINAL MODEL





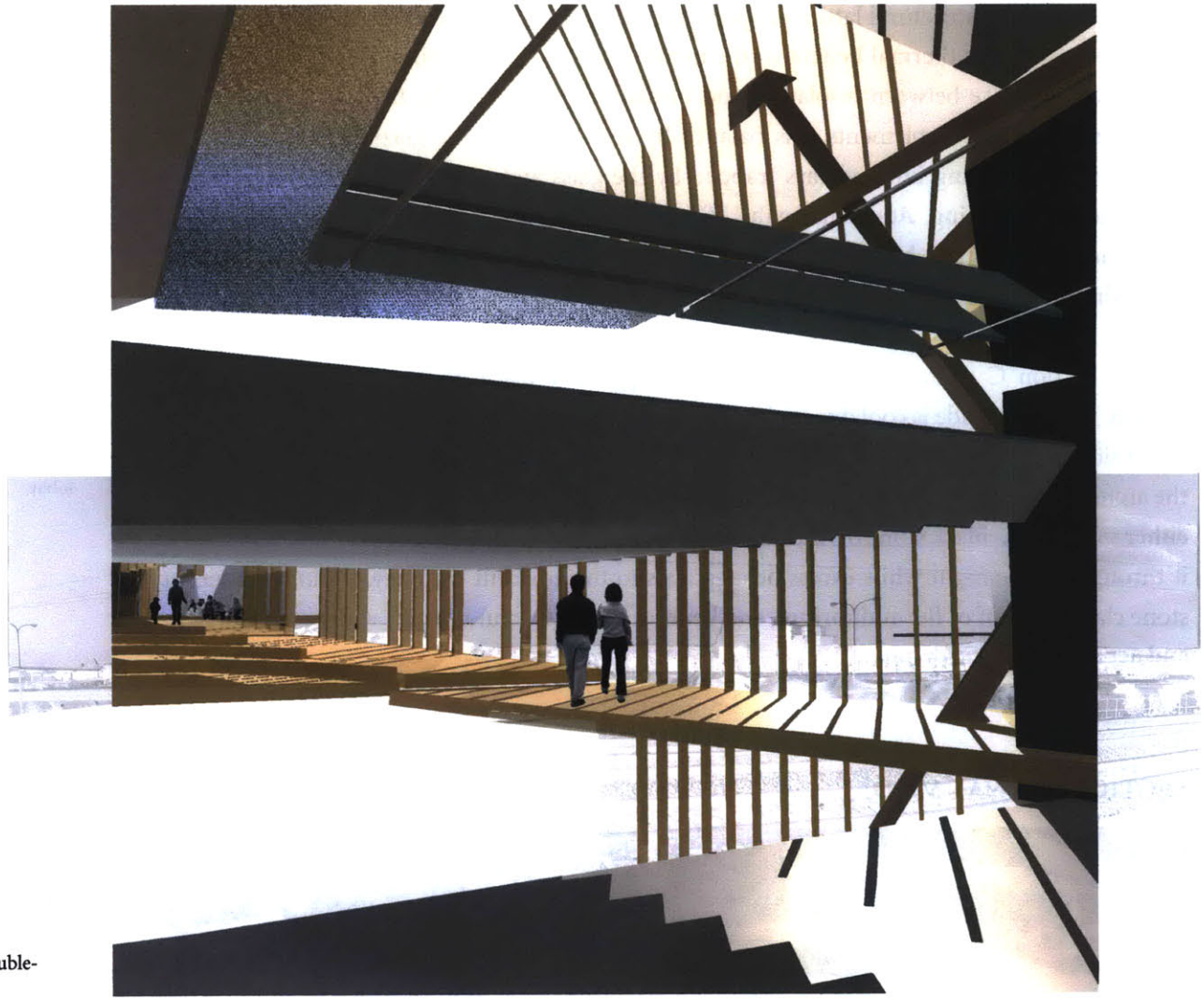
BLOCK RADIANT HEAT FROM SUN

View of south lobby.



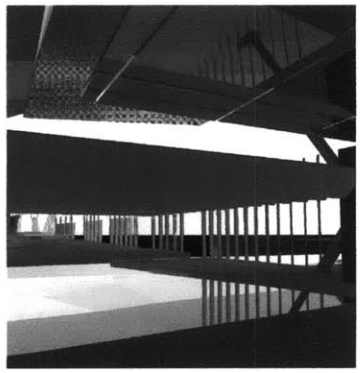
Auditorium roof.

Extension of skyway along rear of auditorium.



View along section D looking over the grocery's double-height atrium to the cafe.

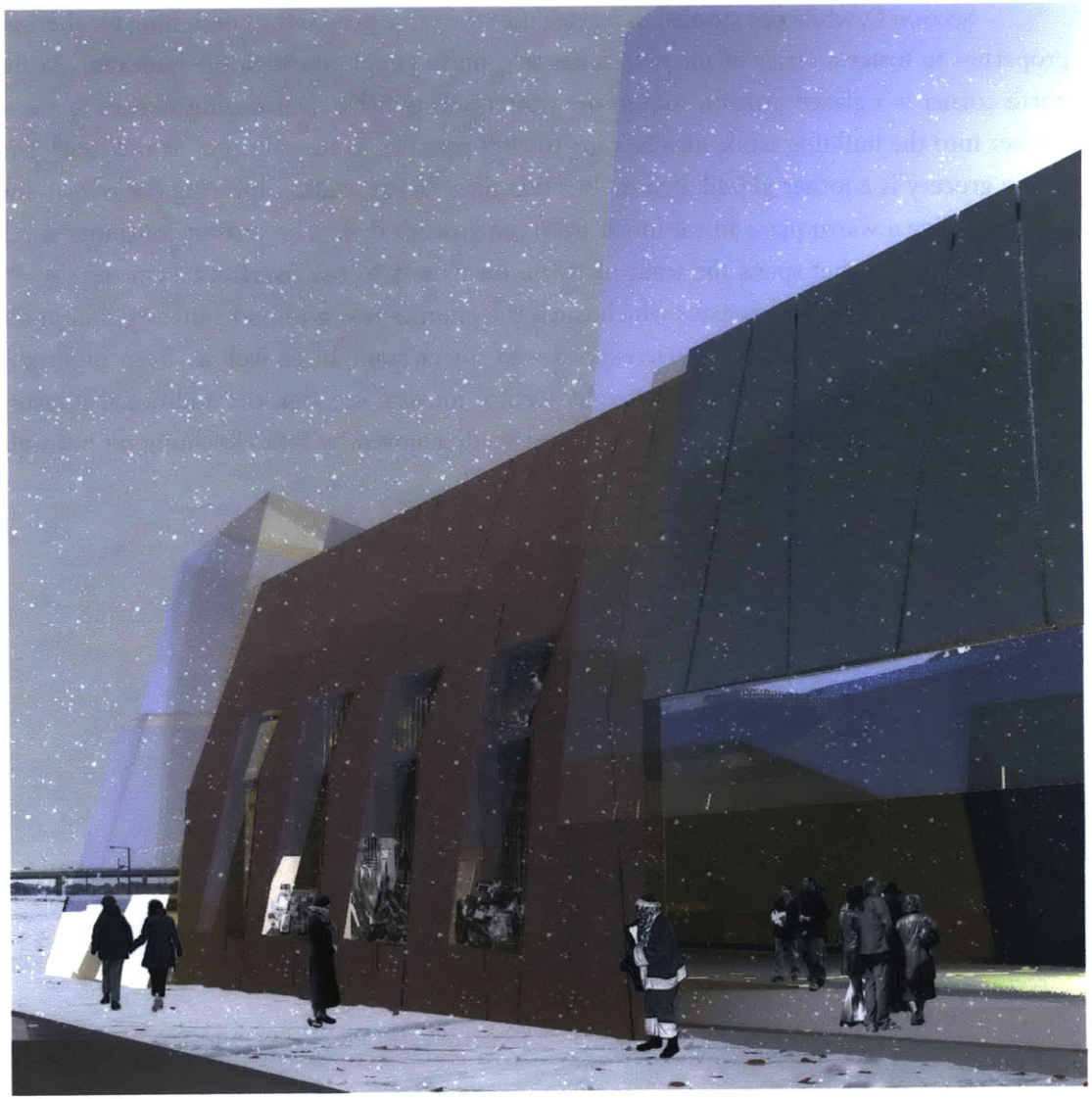
Section D, while not studied in model, uses the same principle of designing for thermal properties to foster a series of microclimates that move people through the building. At the north corner is a glazed atrium, cool in the winter and thereby encouraging visitors to move further into the building while also helping to chill produce in the grocery. At the south end of the grocery is another glazed atrium, but this time facing south, capturing the winter sun and providing a warm place to eat lunch from the grocer's deli. The section continues south through a skyway that spans the train platform on its way to the riverfront. On the skyway are classrooms and a café, pockets which catch the afternoon sun to make them genial in the evening. Protecting them from overexposure to direct sunlight as well as from nighttime radiant heat loss are a series of full-height vertical louvers, creating the additional pleasure of alternating warmth and coolness of sun and shade enjoyed by Lisa Heschong on her walk beneath a row of trees.



9 AM

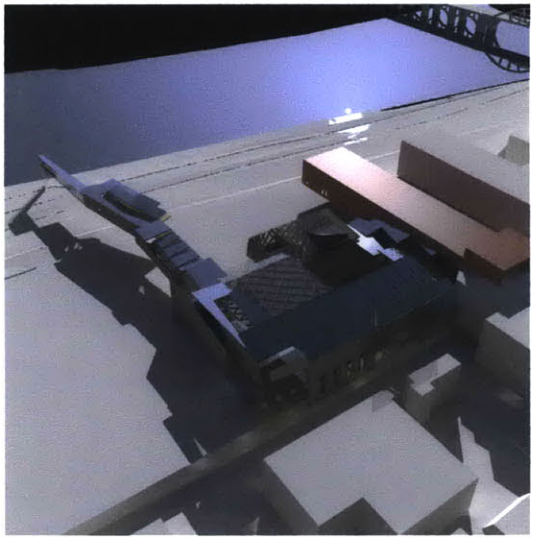
NOON

3 PM

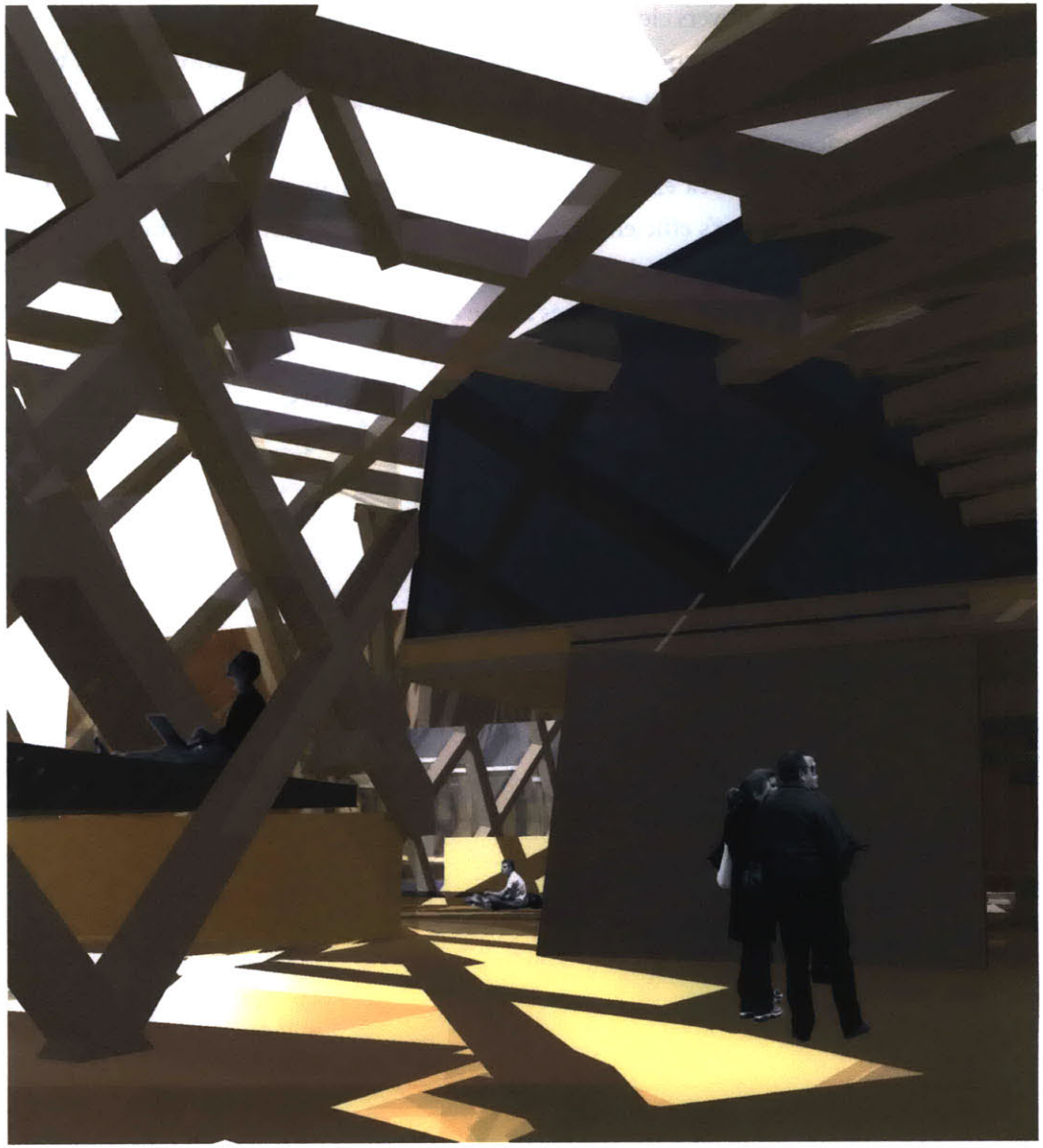


Perspective collage of facade facing Kellogg Boulevard. The four windows in the center take inspiration from the rockite thermal models by becoming wider towards the top. They also better insulate the first floor by containing a wider air space that serves as a shop window. At the top they provide views out from the skyway.

The insulating louvers close at night, trapping any radiant heat captured in the thermal batteries of the water tubes running along the section. Water has an unusually high volumetric heat capacity, allowing it to hold three times as much heat as concrete or stone. The storage system further increases the effectiveness of the thermal wall by holding the water in cylinders that increase the surface area exposed to and releasing radiant heat. Furthermore, the water tubes increase the building's efficiency by acting as a storage system for rainwater. The sloped metal roofs surrounding the mediatheque funnel snow and water into the tubes while also reflecting sunlight into the northern edges of the building. Once water is collected in the tubes it can be saved for grey water reuse or released into the ground free of the pollutants otherwise picked up by running off city streets, sidewalks, and parking lots.



Aerial view looking south.



Perspective collage of the media court, with the chimneys arranged so that the noontime sun shines between them and along the width of the space.

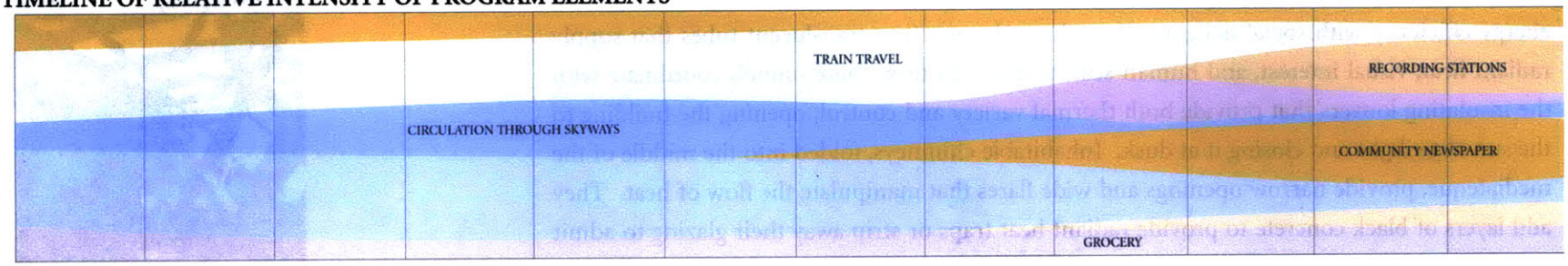
The chimneys break up the otherwise monumental civic mediatheque, integrating energy efficiency with social delight. They channel water into translucent tubes that supply radiant heat, visual interest, and human-scale texture. In turn, these funnels coordinate with the insulating louvers that provide both thermal variety and control, opening the building to the sun at twilight and closing it at dusk. Inhabitable chimneys, folded into the middle of the mediateque, provide narrow openings and wide flares that manipulate the flow of heat. They add layers of black concrete to provide radiant heat traps or strip away their glazing to admit spring breezes through the punctured structural lattice. Their variety provides a gradual transition from the outdoors together with the comfort and excitement of adjacent spaces with extreme thermal qualities. Their distinct forms and warm materials invite visitors from the streets, skyways, train platforms, and riverfront. Unlike the large atriums that often serve as indoor places of refuge, the interior landscape of the mediateque provides spaces of enticing comfort for a variety of people, activities, and weather.

9 AM

NOON

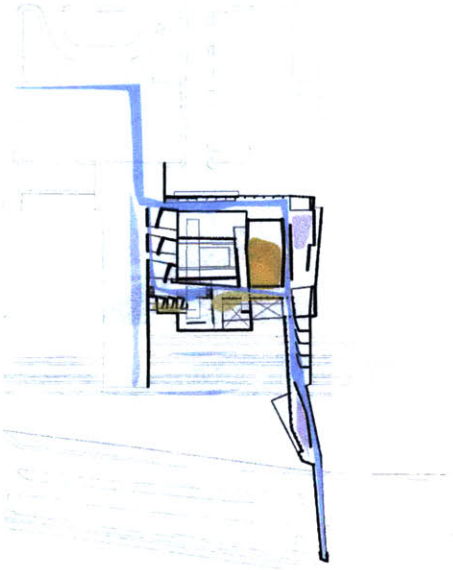
3 PM

TIMELINE OF RELATIVE INTENSITY OF PROGRAM ELEMENTS

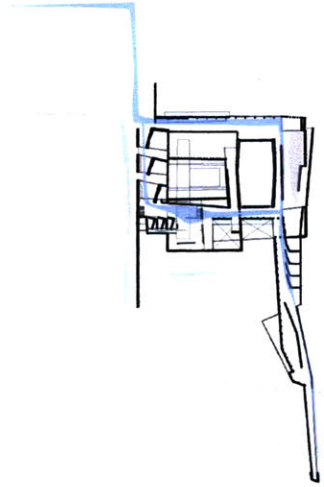


SPATIAL DISTRIBUTION OF OCCUPATION

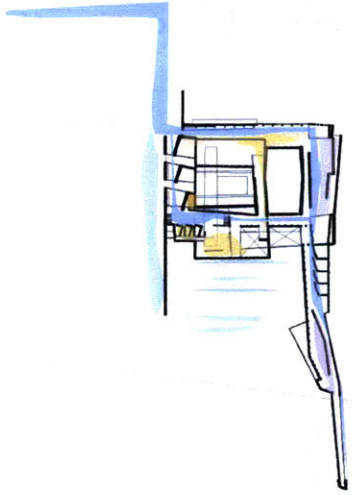
MIDNIGHT

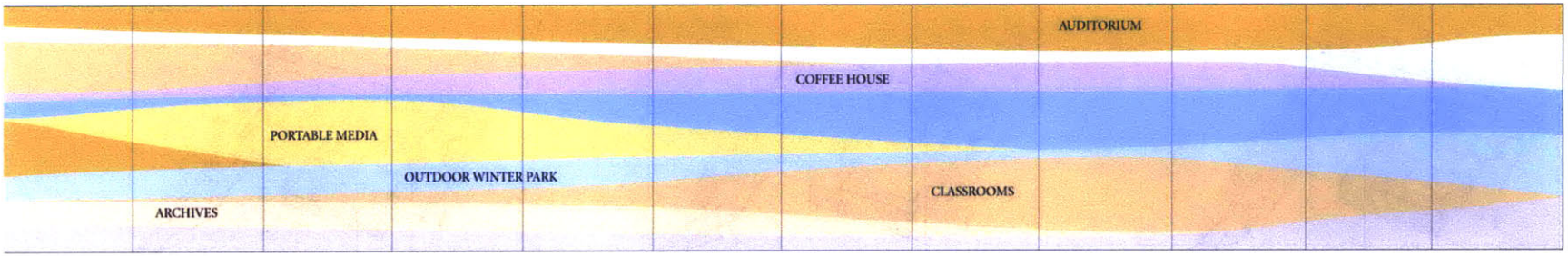


4AM

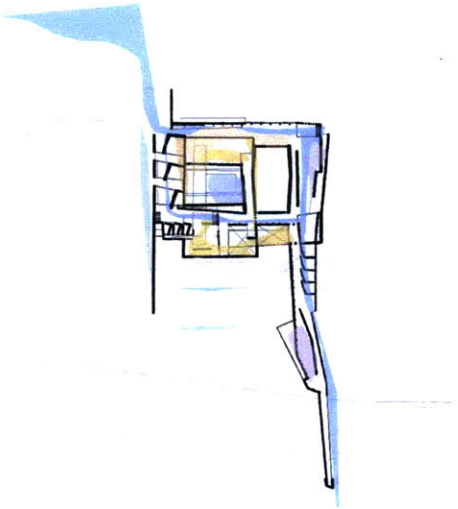


8AM

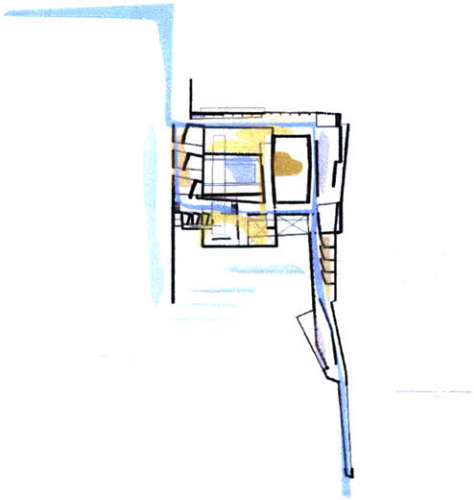



AUDITORIUM
COFFEE HOUSE
PORTABLE MEDIA
OUTDOOR WINTER PARK
CLASSROOMS
ARCHIVES
12PM
6PM
12AM

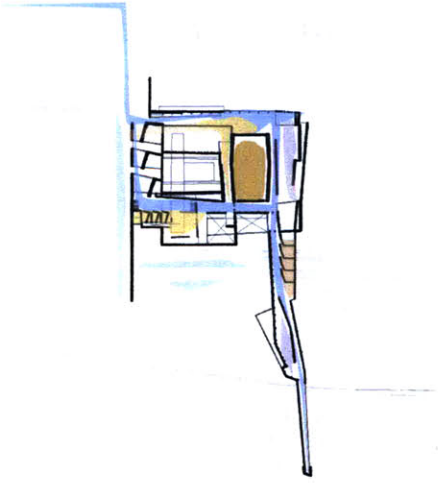
NOON



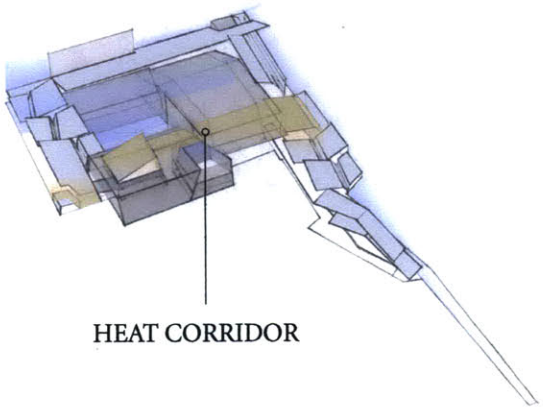
4PM

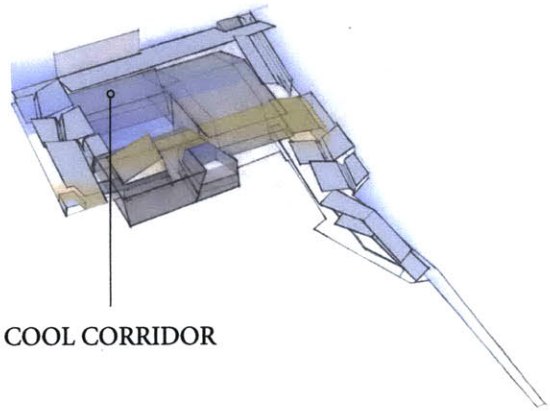


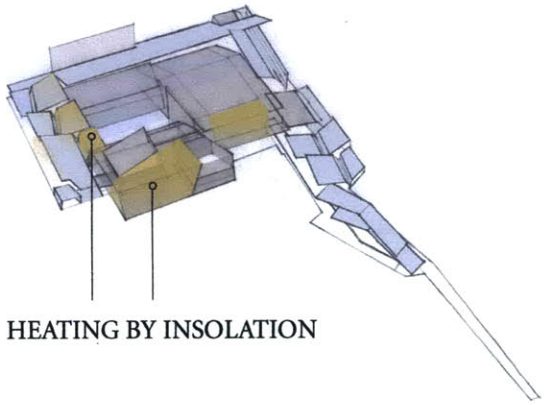
8PM



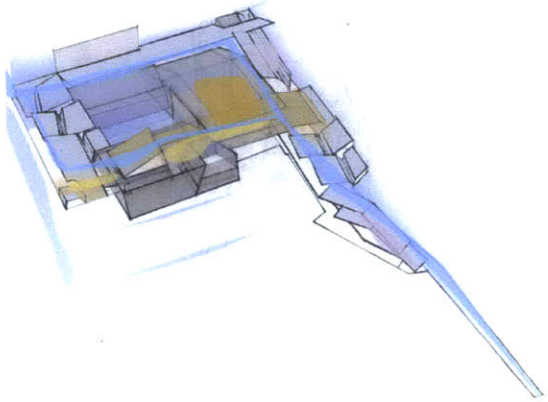
THERMAL DISTRIBUTION

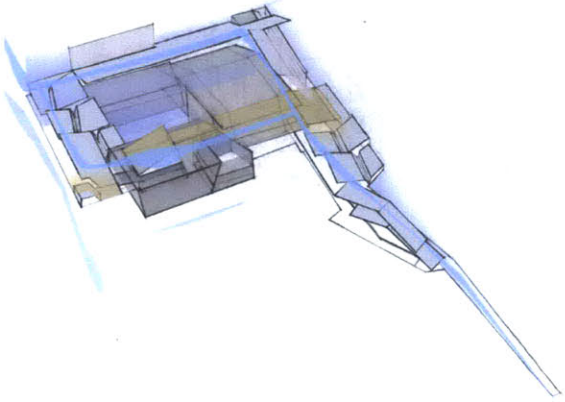


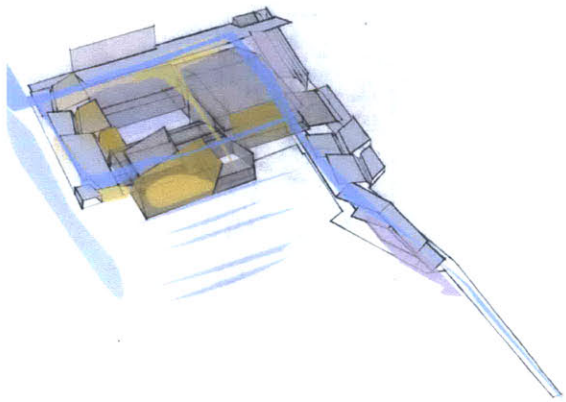


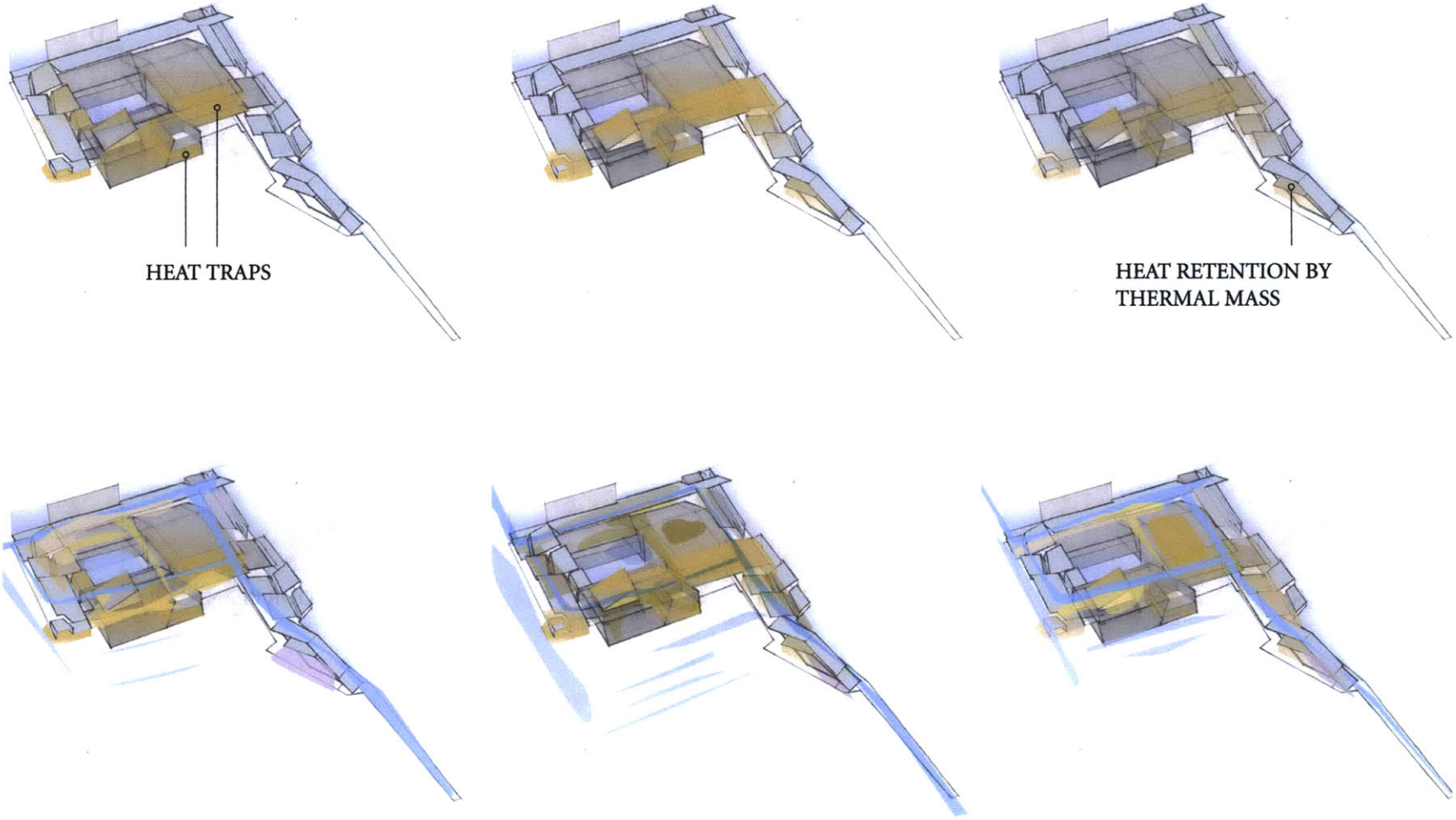


THERMAL QUALITIES AND PROGRAM

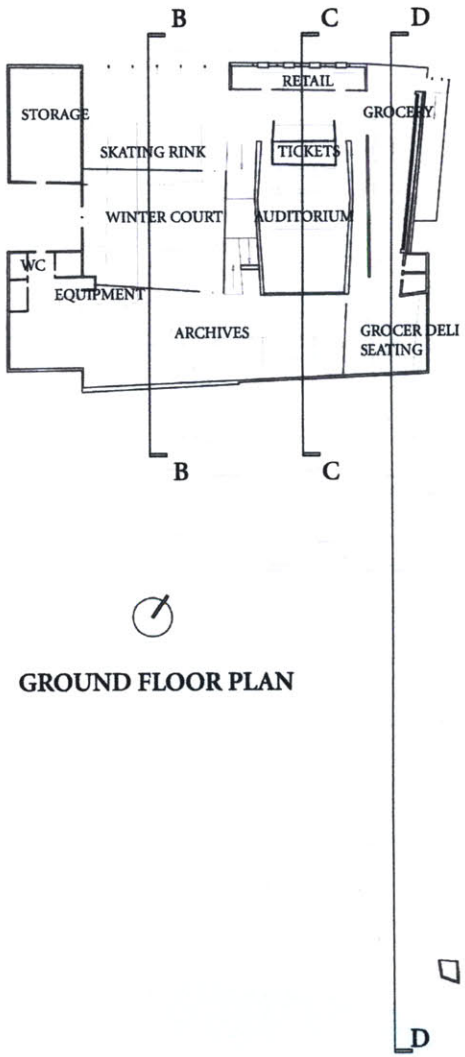




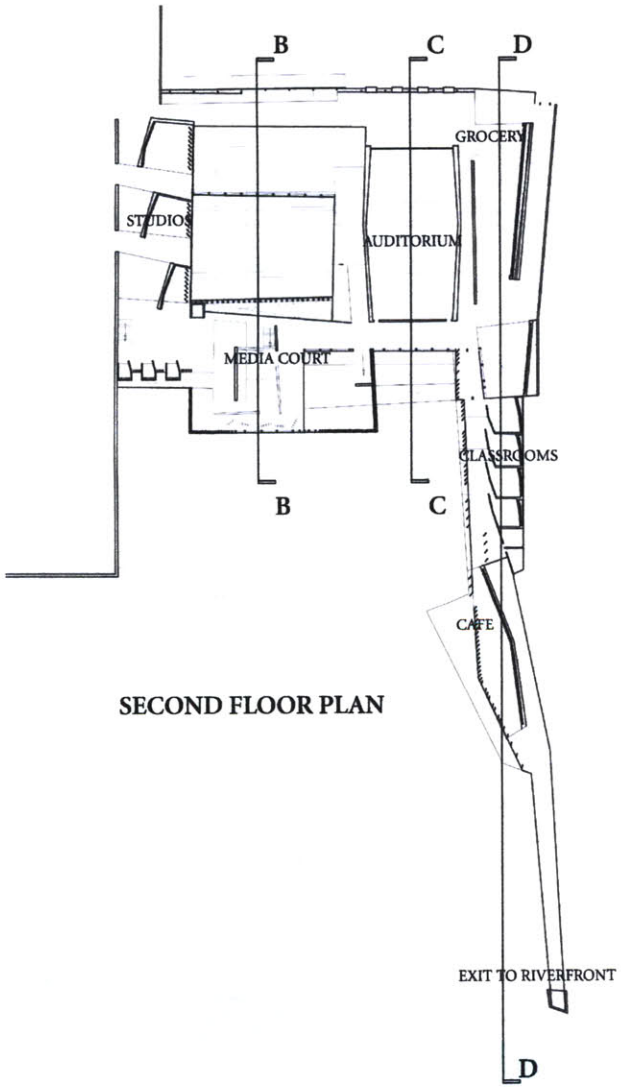



HEAT TRAPS
HEAT RETENTION BY
THERMAL MASS

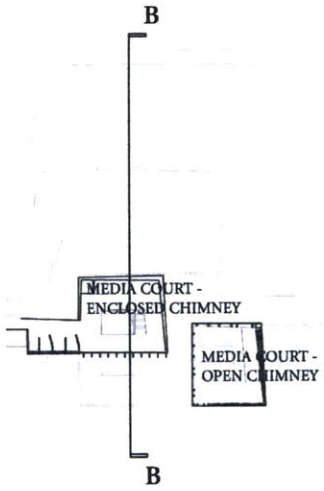
DRAWINGS



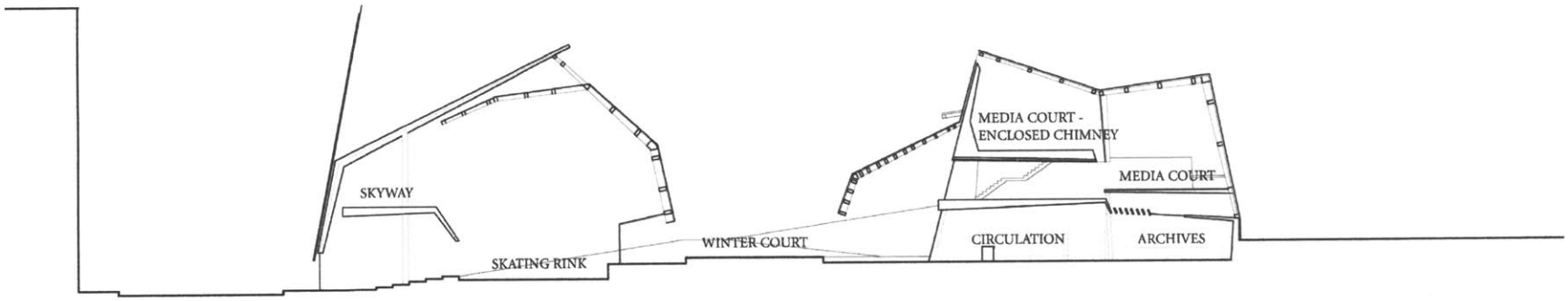
GROUND FLOOR PLAN



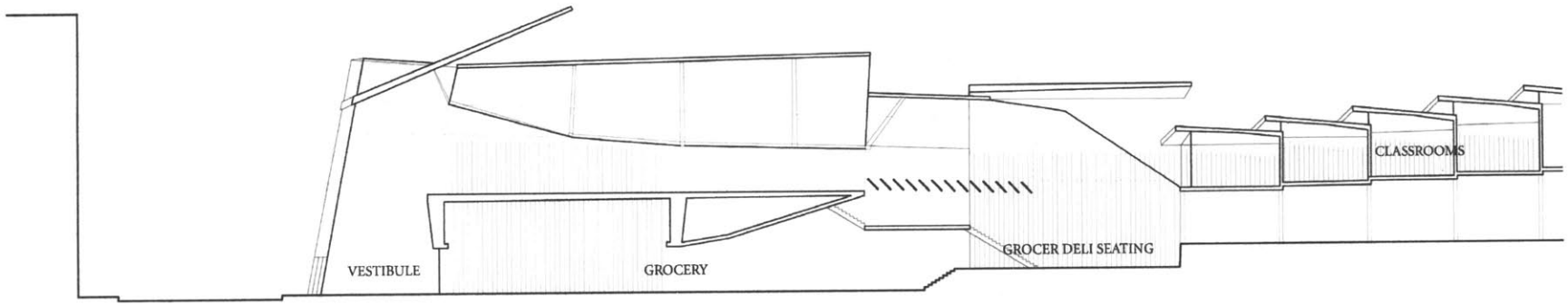
SECOND FLOOR PLAN



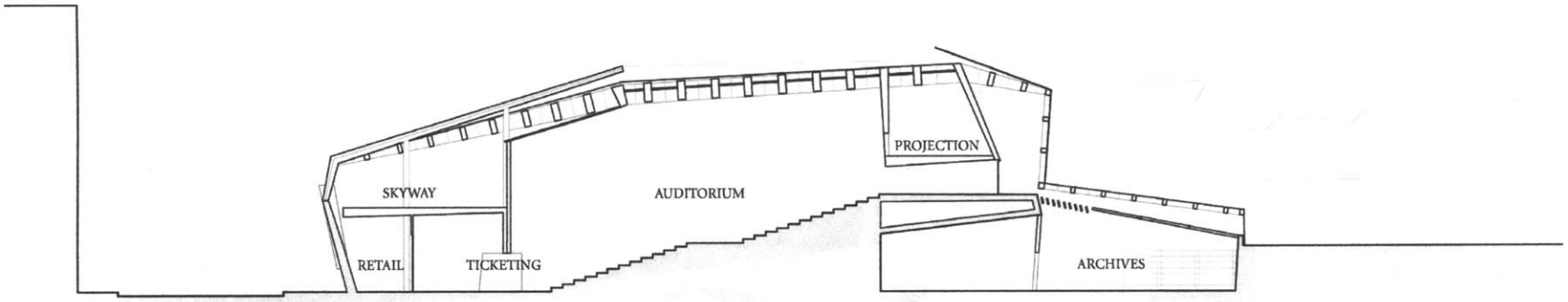
OCCUPIED THIRD FLOOR PLAN



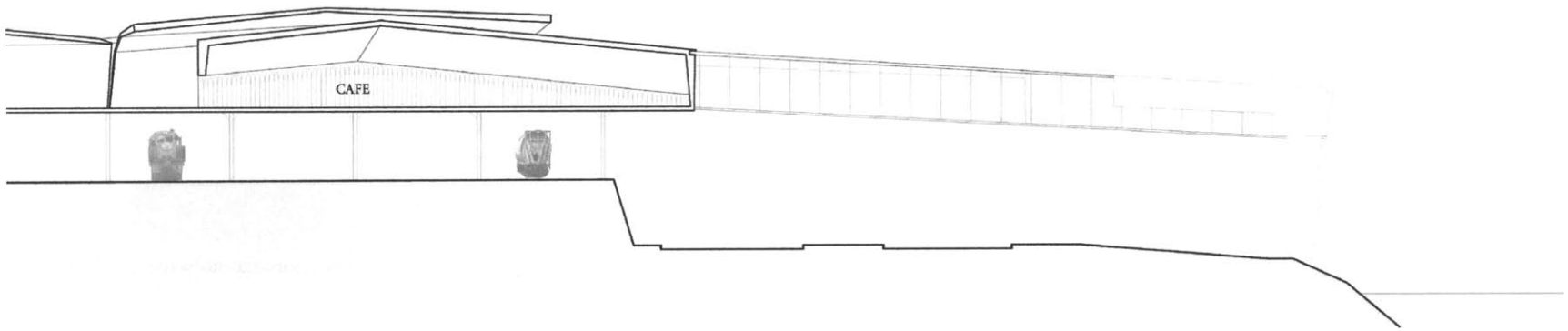
SECTION B



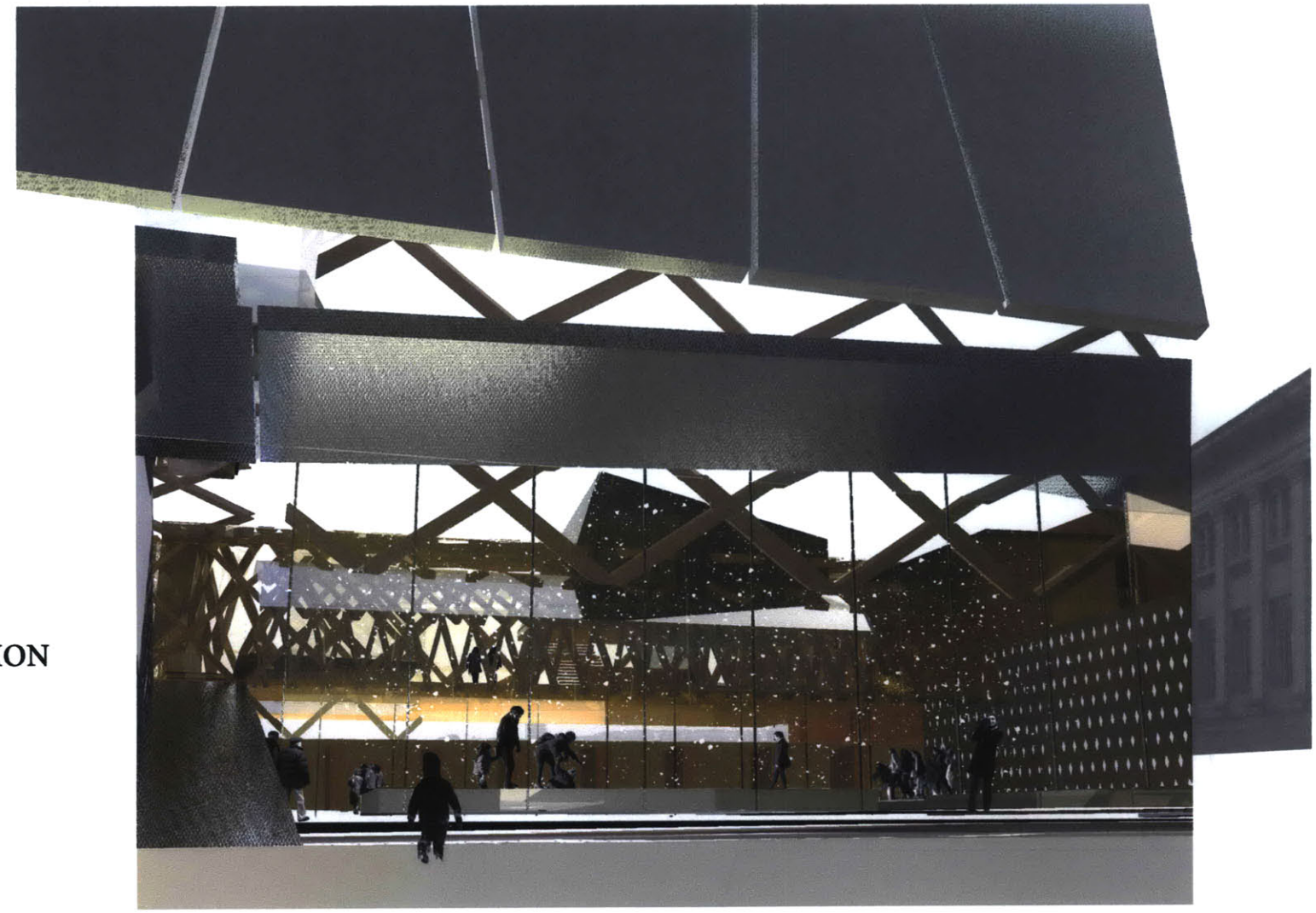
SECTION D


PROJECTION
SKYWAY
AUDITORIUM
RETAIL
TICKETING
ARCHIVES

SECTION C


CAFE

CONCLUSION



View through main entrance to skating rink, winter court, and media court.

A popular and exciting public space in St. Paul must be attractive in all seasons and throughout the day to all residents of the Twin Cities. An energy-efficient design responsive to the region's extreme climate makes the space comfortable, durable, cost-effective, and celebratory of its context. Relatively few Minnesota residents view central St. Paul as a destination for shopping, recreating, or living—a meaningful and noticeable indoor public space can rejuvenate social interaction and civic pride within downtown, attract visitors and homebuyers from the suburbs, and provide an example of best practice for other cities in the northern belt.

By acknowledging and using the climatic and urban context through using thermal qualities as the driver for design, an indoor public space will give visitors, even while they are working in the virtual worlds archived in the mediateque, renewed delight in their environment. By using micro-climates created through variations in form and material, the public space celebrates and complements the bitter chills, crystalline snowfalls, clear cold skies, and monochromatic palettes of Minnesota's winters, creating an inviting and equitable variety that will enhance residents' experience of their season and their community.

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INTERVIEWS

Griffin, Tim, manager of the St. Paul on the Mississippi Design Center, and Lucy Thompson, senior planner with the St. Paul Department of Planning and Economic Development. Interview by author, 22 July 2004, St. Paul. St. Paul on the Mississippi Design Center, St. Paul.

Latimer, George, professor of urban studies at Macalester College. Interview by author, 22 July 2004, St. Paul. Macalester College, St. Paul.

Lu, Weiming, president of the Lowertown Redevelopment Corporation. Interview by author, 21 July 2004, St. Paul. Lowertown Redevelopment Corporation, St. Paul.

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IMAGE CREDITS

All images by the author unless noted below. Listed by page number:

10 Félix-Hilaire Buhot. *Winter in* Paris. Etching, aquatint, soft-ground, drypoint, and roulette on greenish laid paper. 1879-80. Collection of Carol and James Goodfriend.

11 Alfred Stieglitz. *Icy Night*. Photogravure. 1898. Hood Museum of Art, Dartmouth College.

12 Childe Hassam. *Late Afternoon, New York: Winter*. Oil on canvas. 1900. The Brooklyn Museum.

Still from *Love Story*. Directed by Arthur Hiller. 99 Min. Paramount Pictures, 1970.

13 Lazlo Moholy-Nagy. *From the Radio Tower, Berlin*. Silver print. 1928. Gilman Paper Company Collection.

14 Still from *Edward Scissorhands*. Directed by Tim Burton. 105 Min. Twentieth Century Fox, 1990.

15 NICC Sapporo, Japan. Reproduced in Norman Pressman, *Northern Cityscape*.

16 Model of Land o' Lakes Headquarters, by Architectural Alliance, from *Aesthetics for the Cold* exhibition at Hallwalls, Buffalo, New York.

Model of Seagram Museum, by Barton Myers Associates, from *Aesthetics for the Cold* exhibition at Hallwalls, Buffalo, New York.

17 IDS Crystal Court. John S. Adams. *Minneapolis – St. Paul: People, Place, and Public Life*.

17 Eaton Centre Bergman + Hamann and Zeidler Roberts Partnership / Architects, Toronto. Reproduced in Norman Pressman, *Northern Cityscape*.

18 Plan of Eaton Centre Ibid.

19 Ralph Erskine, *An Ecological Arctic Town*. 1958.

Devonian Gardens. Norman Pressman, *Cities Designed for Winter.*

25 Sixth Street, 1922. Jerry Mathiason. *Twin Cities Then and Now.*

Sixth Street, 1996. Ibid.

27 Fourth Street, 1910. Ibid.

Fourth Street, 1996. Ibid.

31 Bern Arcade. Swiss National Tourist Office. Reproduced in Norman Pressman, *Northern Cityscape.*

37 Galtier Plaza. John S. Adams. *Minneapolis – St. Paul: People, Place, and Public Life.*

46 Paul Peel. *After The Bath.* Oil on canvas. 1891. Art Gallery of Ontario.

47 Andy Goldsworthy. 5 March 1988, Tewet Tarn, Cumbria.