Playing on the Tracks
by
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thesis abstract
abstract

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background
The city hosts, participates in, and brings about new kinds of performances.

These performances are formal and informal, real and virtual, computational, kinetic, and musical. By being in the city, you are simultaneously an observer, participant and a living memory of these phenomena. You are changed by exposure to these events, and the physical fabric of the city is a continuously updating image of these events, past, present, and (sometimes) future.

The elevated train in Chicago is a unique symbol of the city; the downtown district is known as the 'loop' from the ring of elevated platforms that constitutes the hub of the rail network. Elevated train lines track through historic residential neighborhoods, industrial areas and the skyscrapers of downtown. The tracks and aerial stations are landmarks and major features of communities.

proposal
My proposal is for a public train station that allows people to be expressive in new ways; that allows people to play within the space, to be entertained, and to understand the city in a new way. By linking the public sphere of the train station with a more formal theatre space, I intend to draw connections between the (often) choreographed events taking place on stage and those events of the city occurring on the elevated platform of the train.

Thesis Supervisor
Wellington Reiter, Associate Professor of the Practice of Architecture
sequence of train usage, north and milwaukee

avenues of research
urban impact of elevated trains

The elevated tracks and trains are obtrusive, loud, and violent components of the city, which waste the space around them, and leave passengers exposed to extremes of weather. The proposal seeks to lessen the negative effects of these trains on the adjacent spaces and provide a more comfortable condition for the commuter. While the strategies will be developed for the downtown site, there exists the potential to extend them along rail lines.

mechanisms of travel

Travelers interact most with the machinery of trains and stations, in the form of gates, ticket machines, vending machines, and the train itself. The interfaces are familiar yet clunky. This project seeks to re-envision these older mechanisms in a larger, more flexible, mixed use space, where interactions are more fluid. Through the application of sensitive, reactive materials and technologies, our interactions with the basic necessities of travel can become less stressful and more evocative.

travelling architecture

The spatial experience moving through train stations is purely pragmatic; tunnels, stairs, and passageways are unmarked and roughly constructed, and have little connection to the structures and amenities around them. This proposal seeks to provide an architecture that communicates and reveals in a poetic way the motion and location of trains, other travellers, and the environment (both natural and manmade).
personal precedents / design aims
Throughout my career at MIT I have been keenly interested in the boundaries between materials scientists, computer scientists, interface designers, and traditional architects. In a number of projects in previous semesters I've examined materials and scenarios in which someone's actions affect the physical, formal properties of materials or spaces, and theorized about how those spaces could then effect behavior.

**responsive materials**
the 'angry ashtray,' a final project for John Maeda's introduction to computational design workshop, was a piece of material that responded simply and viscerally to basic stimulus -- heat. Eventually generalized to an multifunction architectural panel, this project planted the seed for the idea that technology could enable a poetic response from an otherwise inert building.

**responsive environments**
the final project of Frank Duffy's 'Workplace of the Future' was a similar technology designed to modulate the ceilings of standard office buildings, in order to facilitate more flexible, nomadic, and efficient work patterns.

**drawing tools**
finally, I am convinced that architects will continue to push the limits of the 'drawing', using animation, modelling, data gathering and synthesis, as well as other techniques. my use of the pros55ing programming language (developed by the Aesthetics and Computation Group at the Media Lab) to formulate crude graphical and mathematical models of how these technologies might work.
protoypical luminous plywood
reconfigurable public stage, new type of public participation, both active and passive (watcher, actor, and 'stager).

(The Artificial Landscape, p. 224)

the hybrid material juxtaposes a regular and familiar material with strange and alien characteristics, creating two totally different experiences in day or night.

(bugs, fish, floors, & ceilings, p 31)
closeup of site

maps and context 01
downtown context

physical context of downtown chicago

map of rail transport linkages
360 degree panorama from within site

panoramas 01
urban potential

the confluence of physical, urban, and cultural infrastructure creates an opportunity for an intervention that is both regional and local, that integrates the flows of students, artists, workers, and visitors to the city with movements of trains, buses, and automobiles. these flows already exist and interact, and this thesis investigates this increasing interaction as a generative force for new transport infrastructure, cultural spaces, and urban design.

the following pages describe and analyze some of the formal properties and characteristics of experience of an urban rail station. Despite the unique location of this station and site, the basic programmatic elements of the train station are the same as many others in the city, and these observations are useful in a wider context of urban rail travel in general.
the 'urban image' of the station

glimpse urban impressions of the structure, as landmark, beacon, and urban symbol
perception / orientation

the first category of experience is that of the building from a distance, either as a glimpse or as an extended view while approaching the building on streets or by train. The tectonics of the building operate at the urban scale, and must convey briefly, and abstractly the contents and state of the building, while retaining good relationships with the surrounding buildings, open spaces, streetscapes, etc.
waiting at a point along the stream

brief encounters with other travellers and the environment of the train station; also, the temporary meditation of the traveller.
meditation in transit

The transitory spaces of the building (either circulation spaces or waiting areas) exist at all levels of the building, and support different 'waiting' activities and durations. From simple warming booths to shops to small reading rooms or large film viewing rooms, these spaces are at the intermediate scale of the architectural design.
interact individual interactions with either the transport apparatus or other cultural activities
audience: all people are participants, and may interact momentarily or for extended periods with each other or the 'set'

**action / reaction**

the actual devices and machinery within the building, either for circulation (elevators, escalators, etc.) security, or commercial concerns, or for display and interaction (screens, kiosks, furniture, lights, etc.) These devices are the smallest component of the designs, but may have an effect on the larger, more architectural and urban components of the building.
concept sketch of exhibit / library space

tectonic strategy 01
overall building strategies

working at a small scale, several related but distinct strategies emerged. Named 'screen', 'plateau', and 'skin', the strategies were all variations on a solution to a basic architectural problem: wrapping volumes in multifunction surfaces that serve as inhabitable planes, protective shields, and communicative billboards or facades. The 'skin' metaphor, in which layers of membranes simultaneously separate and unify the volumes within it, was the most promising of the three. Ultimately, the ideas of the other two schemes trickled back into the 'skin' scheme as well.
skin model, view from southwest

tectonic strategy 02
sectional skin model, state street side, showing the relation of solids, voids, and layers of wrapping in longitudinal section
conceptual building sequence

tectonic strategy 03
heavy infrastructure
the existing elevated rail and the connections to existing subway stations are linked by a relatively heavy, public, permanent piece of urban 'landscape' for pedestrians.

This new ramp element provides vertical circulation distinct from the stairs and elevators of the existing train station, and is intended to provide the 'quickest' route from one train exit to the entrance, making it attractive for regular commuter use.

flexible space
the flexible, public, commercial, and institutional space is able to be inserted into, beneath, and around this infrastructure. A changeable mix of exhibition spaces, kiosks, shops, small restaurants, and study rooms is arrayed along the main spine.

at the base of the building, enough gaps between these uses remain, leaving a porous boundary between the sidewalk and the inner court, where larger uses are located.

responsive skin
the final element of the building system is a fabric like skin designed to provide a barrier between inner uses and the forces on the site. In addition to providing protection from the weather, these layers of skins interact with the forces on the site, including the sounds and vibrations of elevated trains and the activity of the people.

the interaction of the tectonic systems
existing dynamic signage in the loop

schematic program strategy
<table>
<thead>
<tr>
<th><strong>transfer</strong></th>
<th><strong>browse</strong></th>
<th><strong>study</strong></th>
<th><strong>live / work</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>description</strong></td>
<td>commuters making connections between transit modes as efficiently as possible. 1-5 minutes, concentrated during rush hours.</td>
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</tr>
<tr>
<td><strong>program</strong></td>
<td>ticket booth, machines storage bathrooms vertical circulation: escalators elevators stairs train platform waiting area for buses</td>
<td>kiosks and small shops storage bathrooms food prep display / eating area</td>
<td>theatre ticket sales waiting areas projection rooms seating area storage concessions gallery display area shops semi-public bathrooms</td>
</tr>
<tr>
<td><strong>requirements</strong></td>
<td>accessible 24 hours clean safe fast - direct routes</td>
<td>convenient secure from vandalism indoor / outdoor seating shopping non-direct paths</td>
<td>limited hours sound and light controlled secure advertised public destination</td>
</tr>
</tbody>
</table>
schematic model 01
module / pattern
the initial model studies explored the relation of solid forms with open floors, sheltered courtyard space, terraces, and ramps. The model was not sufficiently unified, and lacked a clear rationale for the distribution of solid spaces (blocks) amid the floors and ramps.
mapping through tectonics 01
mobile structure
these initial studies are attempts to describe, in an abstract way, how a building can be 'responsive' to internal stimulus from individual inhabitants of the building, as well as larger forces from trains, buses, and other pieces of mobile infrastructure.

Here a random pattern represents the motions of separate travellers. In reality these motions are not random at all, of course, and they have a critical relationship with the other entities in the space: the trains, the shops, showtimes, as well as the time of day, day of the week, etc.
// a basic layers model
int x;
int steps = 20;
int limit = 2000;
brelude up = true;
brelude up = false;
int current = 0;
int count = 0;

void setup(){
  size(300,300);
  x = color(255);
  colorMode(HSB);
  size(1000,1000);
  background(0);
  ellipseMode(CENTER, CENTER, CENTER);
}

void loop(){
draw(fill(current, 50));
  if (current < limit)
    if (up == true)
      current = current + 10;
    else
      current = current - 10;
  else
    current = current - 10;
  if (current == 20 & up == true)
    screenshot();
    count = count + 1;
}

void draw(int x, int y){
  for(int i = 0; i < steps; ++i)
    fill(int(255 * steps));
    ellipse(int(x), int(y), int(255 * steps), int(255 * steps));
}

code and image stills

mapping through tectonics 02
larger than life

the pattern coded into this sample models the reaction of a surface skin to a large scale change in the environment. The mass and noise of the train utterly and momentarily transforms the space, and the skin reacts by becoming more sound absorbent, opaque, and quieter, in essence 'protecting' the more sound sensitive spaces of the station, while signalling in a visual way the presence of the train.

In other experiments I explored how a single person might leave a semi permanent mark on the skin through a series of responsive pixelated panels. Without the resources or time to create actual experiments with people, these exercises were interesting but not all that useful.

In both of these experiments the coded pattern was a drastically simplified, cartoonish representation of reality; the problem was not only my programming skills, which were (and are) uneven, but the inability of some generalized algorithm to get at the nuances of people’s actual behavior.
folding surfaces
sound registering / blocking surface
this surface exists as a boundary between the train and the other uses, both in plan and section, and must work to buffer the extreme noise of the train. Internally, this surface may also work as a signal of incoming trains to inhabitants of the station.

overall building scheme
This drawing lays out diagrammatically the major elements of the proposal, while remaining flexible about particular formal relationships between the parts. The infrastructural ramp lies along State st., and the terraced green areals step down the middle of the building form. A vertical circulation core is at the corner of State and Van Buren, and a hierarchy of covering elements protects the common spaces of the building, unifies the language of the building, and wraps the gallery, working, and circulation linkage of the building.

public glass display
these surfaces cover the larger public spaces. they are designed to block the weather, as well as provide display surfaces for people both inside and outside the building. transparency and lightness are emphasized.

green space / terrace
planted areas, both at grade and terracing down from the level of the elevated platform. These steps are ‘responsive’ surfaces, changing over seasons and over a longer time frame, and provide a flexible path from the train station in summer months off people who have time to spare.

work / private glass skin
this is a more passive, opaque, and private skin designed to allow manipulation by end users to ventilate and light the more private galleries, working spaces, or offices within the building.

quiet / private spaces
these spaces are designed for use as galleries, classrooms, or offices for the library or surrounding school buildings.
plan and program
**ground level shops / cafes / kiosks**
extends out to double height space

**general circulation**
contains some gallery and commercial components, and is the location of much of the responsive surface

**green space**
either at grade or in terraces developed within the infrastructure

**closed space**
contains utilities, offices, etc. on second floor

**vertical circulation**

**gallery**
serves as main public link with the library, as well as a vantage point over the train tracks

**reading rooms**
closely linked with the library program
second schematic model
the second model rationalizes some of the smaller,
more scattered solid zones into larger, simpler zones.
Additionally, the internal terraced platforms are much
more integrated with the train platform, creating an al-
ternate way to descend from train level to ground level.
There is an exposed, exterior, 'fast' route and a more
interesting, flexible, private, and leisurely path through
the inside of the building.
building within site
conclusions / beginnings
Conclusion

Clearly, this thesis barely scratches the surface of the large architectural, urban design, and technological questions that it raises. I believe it is of utmost importance that architects be at the forefront of research into these complex urban interactions between people, institutions, and infrastructure.

I believe that architects, working with partners in related fields and pushing the limits of the technology available to them, have the capacity to create entirely new urban experiences in preexisting settings. This thesis endeavored to show one way to do this. The ultimate goal of the new station is to be more comfortable, efficient, useful, and potentially thought provoking.

The most promising part of the development of this thesis, and what might have differentiated it from a more traditional project, was the potential to develop a rigorous method for drawing and investigating real data, rather than assumed or invented behaviors and reactions. A simpler project with a similar public location and function may have allowed me to create prototypes and investigate truly ‘emergent’ design decisions. As it was, I struggled with the tools, and progress toward a satisfactory ‘project’ was slow. I am convinced, however, that this kind of research will bear fruit in the future.


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All illustrations by the author, unless otherwise noted.
Credits

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