INTRODUCTION

SCIENTIST + ENGINEER = PERCEPTIVE DESIGNER

Architectural experience relies on perception.

As a neuroscientist and chemist by education, I am interested in mental and physical human reaction to spatial stimuli. As an engineer, I wish to apply the information to create spaces that elicit certain emotions, thought processes, or bodily symptoms.

The following work presents my endeavor to understand and influence human perception—and ultimately human experience—through spatial manipulation.

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STUDIO

CONCEIVING SPACE
1. VOID SEDUCTION
CONCEPT

PROJECT

Architecture provides experience not only through the design of individual spaces but also through circulation. A spatial transition was created between threshold X and threshold Y in a room connecting an alleyway to a gallery.

PARTI

The concept of seduction via unattainability was manifested in a hypercube structure at whose center lies a void—the epitome of the unattainable.

>>> Conceptual model § Bristol paper

CIRCULATION STUDY

The void was designed to be experienced from different angles to maximize the tantalizing effect of its unattainability.
Planes (pink) were added to eliminate gaps in space and enhance the visual focus on the void.

(Top) Perspective
(Left) Plan and cross section through the void
VOID SEDUCTION

EXPERIENCE

Seduction of the void

Void of seductive unattainability
2. // (PARALLEL) COHABITATION

STUDIO || Harvard Career Discovery Program
Instructor: Kevin Murray
June - July 2015
ANALYSIS

PROJECT

While architecture is a medium for circulation, it also has to include consideration for programs, boundaries, thresholds, and envelopes. These factors were taken into account to promote a harmonious cohabitation between two groups of clients in Cambridge, MA.

CLIENTS

<table>
<thead>
<tr>
<th>CLIENT</th>
<th>ZERO</th>
<th>FIRE ESCAPE COUPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The Grand Budapest Hotel”</td>
<td>“Rear Window”</td>
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CHARACTER

- Private
- Observant
- Nimble and acrobatic
- Loves Agatha & M. Gustave
- Aloof to prying eyes
- Sleeps on the fire escape

NEEDS

- Easy access
- Sense of security
- Athletically engaging spaces
- Accommodation of guests
- Open spaces
- Multipurpose spaces

INTERACT.

The fire escape couple, who are rather exhibitionists, would not mind being observed by Zero. Zero, on the other hand, would prefer to keep his everyday life private.

SITE

Proximity of NE and SW buildings
- Protection of privacy

Height of SE and SW buildings
- Provision of sunlight

Parking lot in the back
- Car entrance

PROGRAMS

Zero
- Living room for added privacy
- Bedroom and kitchen most private to accommodate his lover, Agatha, a pastry chef
- Guest room for M. Gustave

Fire Escape Couple
- Multifunctional except for bathroom and kitchen

PARALLEL COHABITATION | 06
CONCEPT

SPATIAL LOGIC

To accommodate the clients with opposite characteristics, the idea of parallel cohabitation emerged; the two would share the same footprint but one would inhabit the negative space of the other. Elevational separation was used to achieve the effect. The program requirements of Zero dictated the overall footprint. The interior walls were removed from the couple’s space to cater to their penchant for open and multifunctional space.

VERTICAL CIRCULATION ANALYSIS

Zero’s space was laid out vertically with careful consideration to the height of the couple’s kitchen and bathroom which were to be placed on the same level as Zero’s living room and bathroom (1 and 2). Couple’s space was laid out to provide a different circulation experience from Zero’s.
ELEVATION + PLANS

Section A-A
(Sans louvers)

Plan B-B

Plan C-C

Plan D-D

Plan E-E

>>> Lead on Bristol paper

>>> Lead on Bristol paper

- Fire Escape Couple
- Zero
- Both Residents
EXPLODED AXONOMETRIC + MODEL

(Sans top envelope)

Top floors (Couple), mid floors (Zero + Couple), and the bottom floor (Zero)

>>> Foamcore, Bristol paper, basswood strips

>>> Lead on Bristol paper
LOUVER DESIGN

HORIZONTAL VS. VERTICAL

Vertical louvers were selected over horizontal ones to allow more sunlight into the structure.

ANGLE

Various tilt angles were analyzed (01-05) to decide which option affords the greatest privacy. Variation 05 proved to be the least visually exposed. The arrangement was duplicated on the other sides to produce a concentric diamond pattern in roof-plan view.

>>> Pen and lead on vellum and Bristol Paper

(Top) Changing transparency depending on the viewing angle
(Bottom) Elevation views: east, north, west, and south

>>> Foamcore, Bristol paper, basswood strips
Zero, Zero’s guest, and the Fire Escape Couple share a moment in which they encounter each other and become aware of their cohabitation.

Interior windows provide Zero with a chance to observe the couple’s activities.

The sunlight filtered through the glass provides light for Zero and Zero’s guest.

The couple’s bathroom was tucked underneath the main ramp to solve the problem of required privacy without introducing an interior wall.

The utilization of surface was maximized for the couple’s space.
ANALYSIS

PROJECT

This project explored architecture as a medium for collection at two scales and temporalities:

01. a permanent archival collection of films within the scale of an institution
02. a temporary collection of urbanites at the scale of an urban site

The archive theater, slated to be located in Somerville, MA, had to provide both a definitive identity and multiple readings of place and operation.

SITE ANALYSIS

Surrounding land use
- TOD, residential, commercial (dark gray, gray, white)

Traffic congestion
- Gateway to Boston

Pedestrian traffic
- More robust to the west

Topography
- Upward slope toward the NE

Nearby building heights
- East buildings generally taller

Absence of a major public space

>>> Paper relief of the site || Bristol paper

SPEED ANALYSIS

The perception of the site were noted at two different speeds of walking and driving.

PROGRAM ANALYSIS

User | Program | Requirement
--- | --- | ---
Outdoor public | Outdoor theater | Accommodate 200
Arbitrary | Outdoor public market | 1500 - 3000 SF
Indoor public | Cafe | 1000 - 1500 SF
Public lobby | Indoor theater | 7000 SF
Archive visitors | Gallery | 2000 - 5000 SF
Film vault | 2000 SF
Workshops/Seminar rooms | 2200 SF
Administrative offices | Conservation department/lab | 600 SF
Archive staff | 800 SF
Total | Approx. 26,500 SF
ARCHIVE THEATER || 14

MASSING

MASSING MODELS

01  Subdued + Topographic
02  Focal space + Varying profile
03  Presence + Quartered
04  + Accessibility + Identity

Final Model

>>> Foamcore, Bristol paper

SPATIAL LOGIC

ORGANIZATION

PROGRAMS

Large perforations:
Patio umbrellas for the cafe
Temporality through shades

Small perforations:
Modulated lighting

No perforation:
In case of inclement weather

Highest traversable point:
View of the Boston skyline

Conservation dept./lab

Workshops/Seminar rooms

Administrative offices

Film vault

Conservation dept/lab

Outdoor theater

Outdoor public market

Public lobby

Film bookshop and library

Indoor theater

Gallery

CIRCULATION

Paths as promenades

Paths as promenades

Paths as promenades

Paths as promenades
MASSING MODEL

01 View from above
02 Looking from the southwest corner
03 Looking from the northeast corner
04 Central staircase area on the second floor

SECTION MODEL

01 Plan view
02 Elevation view
03 Corner view
04 Looking from the outdoor seating area
05 Shade patterns under the roof
ENGINEERING

FORMULATING SPACE
As a civil engineering design project, a hypothetical sports facility was proposed to be located near Lake Michigan on Northwestern campus. An important requirement for the project was the inclusion of an indoor football field. Being the structural engineer of my team, I designed the structure as a steel building with a cable-stayed roof to effectively accommodate the long-span requirement of 387’.
CONSTRUCTION

MATERIALIZING SPACE
PROFESSIONAL EXPERIENCE

As a highway engineer for the Illinois Department of Transportation, I assisted a resident engineer in the supervision of the construction of a concrete bridge carrying I-57 over Langan Creek near Chebanse, IL.

GENERAL PLAN + ELEVATION

The existing structure built in 1951 was replaced with a 216’ concrete bridge of three-continuous-span superstructure supported by integral abutments on H-piles.

>>> Structure No. 098-0245  
Plan by Wight & Co.

CONSTRUCTION PROCESS

H-piles and seal coats  
Abutments, piers, and riprap  
Steel beams  
Deck and parapets  
Sleeper slabs  
Approach slabs  
HMA pavement resurfacing  
Earthwork and seeding  
Road striping and miscellaneous

>>> Marking metal stud locations on beams  
Photo by Andre Sargent

>>> Completed bridge viewed from the south  
Photos by Andre Sargent
Fourteen other students from Northwestern and I built five houses for the victims of the 2007 Peru earthquake with the help of NU Habitat for Humanity, local high-school students from Lima, and the mayor of Chincha, Peru.
PERSONAL

PLAYING WITH SPACE
RISE FROM THE ASHES

Mar 2014 || Collaborative

MULTIMEDIA INSTALLATION

As part of Great Fires, a performance hosted by White Elephants in Bridgeport, Chicago, the project chronicled the evolution of Chicago's architecture and cityscape since 1871, the year of the Great Chicago Fire. Various video clips and images were projected onto foamcore structures emulating a cityscape.

>>> Project by Judy Suh
Project mapping by Liviu Pasare
Model making by Hyerin Lee
Foamcore, projector

SPATIAL ILLUSION

Jan 2010 || Individual

>>> IKEA catalog chair || Lead on paper
REAL AND IMAGINARY

Individual

>>> Brooklyn Bridge
Pen and markers
Oct 2015

>>> Salzburg
Pen and watercolor
Sep 2014

>>> Mechanical Heart
Pen and lead
Jun 2014

>>> Hachi and Lady Justice
Pen and Photoshop
Oct 2014
Triggered by climate change, rising sea level increases the need for land reclamation. However, the resultant soil can be problematic due to its susceptibility to liquefaction during earthquakes. The problem is exacerbated by the fact that coastal areas, which are major targets for land reclamation, are often exposed to earthquakes due to a large overlap between coastlines and fault lines. Liquefaction poses a risk not only in terms of the immediate danger from tilting, sliding, and fracturing of structures but also in terms of the health deterioration of the residents living in slanted buildings.

People perceive spatial orientation through visual and non-visual cues. The mechanism for detecting the latter relies on the vestibular system, viscera, somatosensory system, and the position of the long axis of the body. The certainty with which people make judgments about their orientation can also affect their final perception.

Sensory conflict theory predicts that feelings of nausea might result when there is a mismatch of information relating to orientation and movement supplied by the eyes, vestibular system, and proprioceptors. While motion sickness is the most widely-studied symptom of sensory conflict, it is not the only one. Even when the subject is stationary, if the perceived visual and proprioceptive information disagrees, the subject can experience disorientation.
The Great East Japan Earthquake of 2011 caused liquefaction in wide areas of Japan, including Mihama Ward of Chiba City. Residents, whose houses were subjected to large tilting, complained of health disturbances such as vertigo and nausea.

**CASE STUDY**

A typical two-story residential building in Utase is approximately 30’x30’. The following building morphology is suggested as a spatial solution to the health problems stemming from structural tilting. The building was designed for a family of 2-4 people.

**SPATIAL SOLUTIONS**

Assuming that the sensory conflict theory holds, the residents of Chiba City are experiencing sickness because the visual information from the rectangular framing of the houses, which gives the illusion of verticality, does not match the vestibular and proprioceptive information from the tilt. I propose two solutions to minimize the negative effect of the resulting sensory conflict.

**01 Elimination of local orientational cues**

The influence of the local frame of reference can be weakened by modifying the perpendicularity of planes. Placed in an unfamiliar environment, the inhabitant will have difficulty visually confirming the direction of gravity.

**02 Reorientation**

Provision of a global frame of reference, such as a view of the horizon, reestablishes the correct visual frame of reference.

**REFERENCES**