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2003

RISK COMPLEX: Preparing the Body for New Hardware

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, June 2008.

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May 23rd, 2008

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ABSTRACT

Today's citizen navigates a vast society engaged in the explicit production of wealth and implicit creation of risks. Each transaction inherently increases both wealth and risk within the system. In 1986 Ulrich Beck proposed an explanation for this emerging post modern condition. His work, *Risk Society: Towards a New Modernity*, sketches the outlines of a society driven by the management and reduction of risk. Beck recognizes that a society will reach a point where efforts to increase wealth will be superseded by efforts to avoid risk. The organization of society will shift from the production and distribution of goods and services, to the redistribution and mitigation of risk. Through play activities the RISK COMPLEX will prepare citizens for the risk society.

The RISK COMPLEX seeks to provide a space that empowers the individual within the complicated web of risk connections. Visitors to the RISK COMPLEX learn about methods and technologies that allow them to monitor their individual risk. In the same way a child uses play to simulate danger and overcome it, the RISK COMPLEX uses play to empower individuals within the risk society. Sited on Coney Island the RISK COMPLEX taps into the historical playscape that includes the beach and boardwalk. The architecture links to the existing amusement infrastructure but seeks to carve out a separate matrix of simulated risks that individuals can engage.

RISK COMPLEX: Preparing the Body for New Hardware

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INTRODUCTION

"through the exponentially growing productive forces in the modernization process, hazards and potential threats have been unleashed to an extent previously unknown"

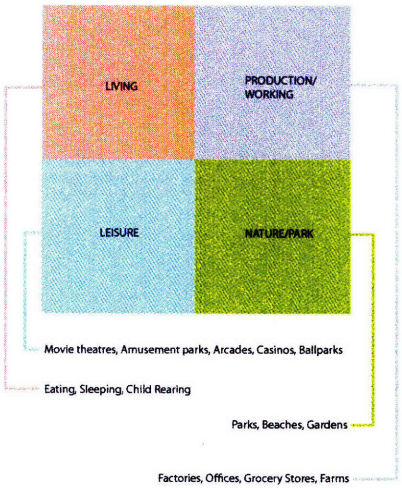
Ulrich Beck
Risk Society: Towards a New Modernity

Today's citizen navigates a vast society engaged in the explicit production of wealth and implicit creation of risks. Each transaction inherently increases both wealth and risk within the system. In 1986 Ulrich Beck proposed an explanation for the emerging post modern condition. His work, *Risk Society: Towards a New Modernity*, sketches the outlines of a society driven by the management and reduction of risk. Beck recognizes that at some point efforts to increase wealth will be superseded by efforts to avoid risk. The organization of society will shift from the production and distribution of goods and services, to the redistribution and mitigation of risk. In other words, the sociological milieu will become so risk laden that transactions will focus around individuals who seek to increase their security. Beck terms this new condition reflexive modernism and argues today's society has entered this post-modern state.

At the individual level consumption revolves around issues of health. Groups are defined by their new reflexive behaviors. Some refuse vaccination of their children suspecting a conspiratorial risk, others buy massive SUVs they perceive to protect their children, while others fret about medications, genetically engineered food, nuclear power or illegal immigrants carrying disease. All consumptive behavior centers around reactions to risks generated by the modern condition.

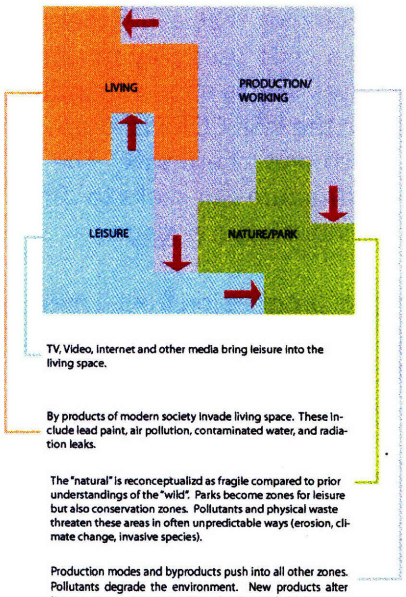
Beck, Ulrich
Risk society ; towards a new modernity
translated by Mark Ritter.
London ; Newbury Park, CA :
Sage Publications, c1992.

The MODERN PROMISE understands the world as a series of neatly divided zones.



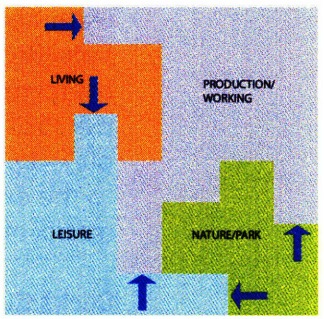
During MODERN BREAKDOWN we recognize that activity zones are not so easily separated. The byproducts of production inevitably penetrate other activity zones.

→ RISKS

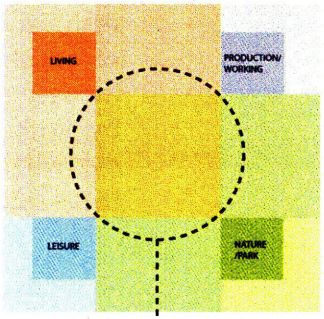


The RISK SOCIETY can either attempt to restore the zones defined by methods of production via mitigation efforts....

→ MITIGATION



... or concede zonal organization in favor of a heterogenous arrangement.



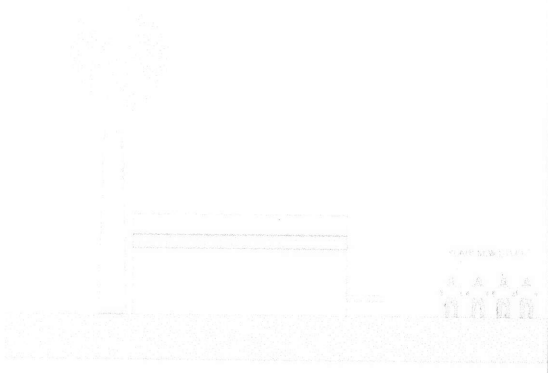
Overlapping region of risk and mitigation managed at the individual level.

The RISK COMPLEX seeks to provide a space that empowers the individual within this complicated web of risk connections. Visitors to the RISK COMPLEX learn about methods and technologies that allow them to monitor their individual risk. In the same way a child uses play to simulate danger and overcome it, the RISK COMPLEX uses play to empower individuals within the risk society. Sited on Coney Island the RISK COMPLEX taps into the historical playscape that includes the beach and boardwalk. The architecture links to the existing amusement infrastructure but seeks to carve out a separate matrix of simulated risks that individuals can engage.

Beck's theory presumes a historical progression from a premodern condition through the post-modern "risk society" condition. Viewed through the lens of risk, the modernization of the industrial age simply served to produce material goods that reduced people's exposure to risk. With the maturing of industrial processes workers and consumers began to recognize that the modern promise was not always kept. Called by many names (side effects, by products, externalities, etc) the risks associated with production become overwhelming. Society begins to reorient itself toward the mitigation of these side effects.

THE MODERN PROMISE

THE PRODUCTION OF MATERIAL GOODS WILL IMPROVE SOCIETY



ARCHITECTURAL DESIGN DRAWN FROM MODES OF PRODUCTION WILL IMPROVE LIVING AND WORKING

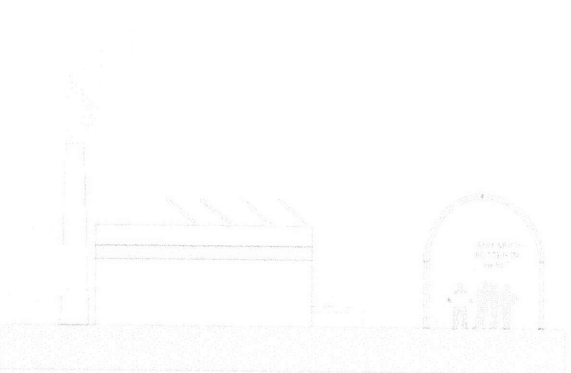
MODERN BREAKDOWN

THE BYBRODUCTS OF PRODUCTION CAUSE IRREPARABLE HARM TO SOCIETY

ARCHITECTURE BASED ON NON INDUSTRIAL MODES OF PRODUCTION WILL IMPROVE LIVES.

RISK SOCIETY

THE MITIGATION OF RISKY BYPRODUCTS IMPROVES SOCIETY



ARCHITECTURES THAT REFLECT MODES OF OBSERVATION, TESTING AND MONITORING WILL IMPROVE LIVES.

The characterization of risk can be separated into direct and pervasive risk. Generally direct risk is any risk that impacts the body directly and can be sensed directly. These might include weather, predators, starvation, fire, and flood. The modern promise intends to reduce the impact of these risks through technological means.

Pervasive risks are characterized by their inability to be sensed by the body. These risks require abstract reasoning, sensing and analysis to be understood. Many modern health risks fit this pattern including cardiovascular disease, and diabetes. Environmental concerns including air and water pollution, chemical toxins and global climate change are all pervasive risks.

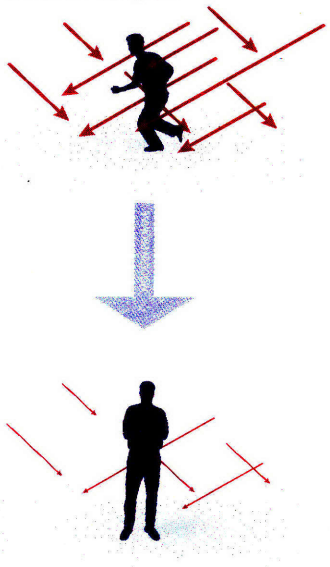
Through modernization direct risk has been reduced. Yet, this has spurred a growth in pervasive risks.

The MODERN PROMISE attempts to counteract direct risks.

Direct Risk

Defined by obvious physical impact. The risk is vector like, acting in clear paths and avoidance requires agility, quick reflexes and strength. The scale and force of direct risk is easily assessed, but often difficult to avoid.

Examples:
Exposure, Predators, Enemies, Starvation, Drought, etc.

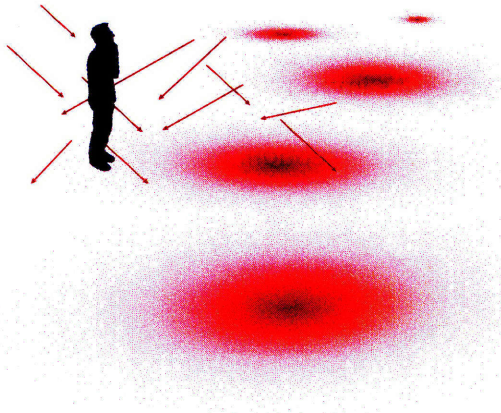


During MODERN BREAKDOWN production byproducts create pervasive risks.

Pervasive Risk

Defined by impacts felt over time and are difficult to diagnose, locate and identify. Avoidance requires diligence, attentiveness pattern recognition and specific knowledge. The risk is undefined, dispersed and exists at small and large scales.

Examples:
Air pollution, water pollution, tainted foods, global climate change.



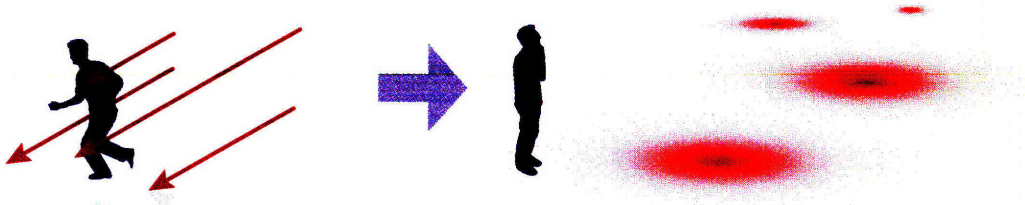
In the RISK SOCIETY we actively work to mitigate both direct and pervasive risks.

Mitigation

Requires persistent, educated, individuals to investigate, invent and produce methods to mitigate risks.

Examples:
Organic farmers, Green Architects, Environmental Scientists, Policy Makers.

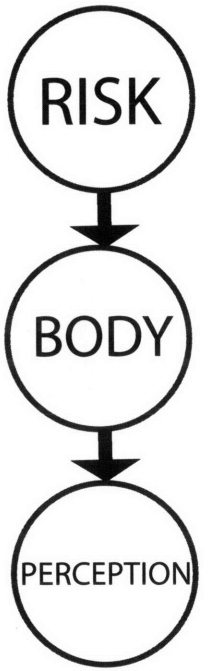
MODERNIZATION HAS CONVERTED DIRECT RISK TO PERVASIVE RISK



PROBLEM

In biological and evolutionary terms, the conversion of risk from direct to pervasive was almost instantaneous. It can be argued that people are inherently unable to perceive risk in anything but direct form. Any abstraction of risk drastically de-emphasizes it's importance, especially in reference to any residual direct risks in the environment. As a result, facts, figures and expert testimony do not impact risk perception.

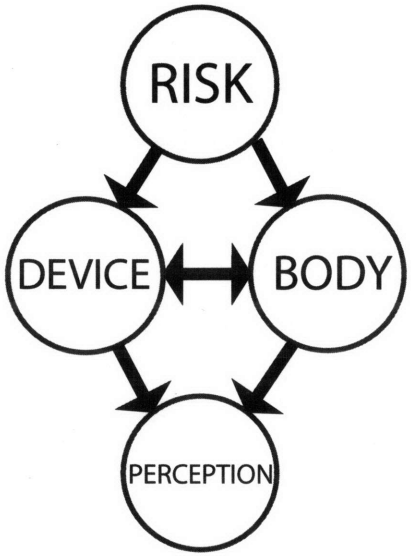
Our inherent risk perception path travels directly through the body where the senses register a risk or threat and signal the need to react.




Bar chart
Stacked line chart
Data A
Data B
Value
Sample analyses of CO
Spectrum
Trend removed
12 Mo. running average
Years
Regression
Data
1985
LIVE
CNN
DR. SANJAY GUPTA
SR. MEDICAL CORRESPONDENT
PAULA ZAHN
NOW

In order to close the gap between pervasive risk and the body's sensing abilities researchers have developed sense extending devices. Each of these examples provides the user with direct feedback in response to some abstract, pervasive risk factor.

In the risk society, devices will become increasingly important to the perception of risk. These devices will proliferate and be integrated into our daily lives.



The New York Times

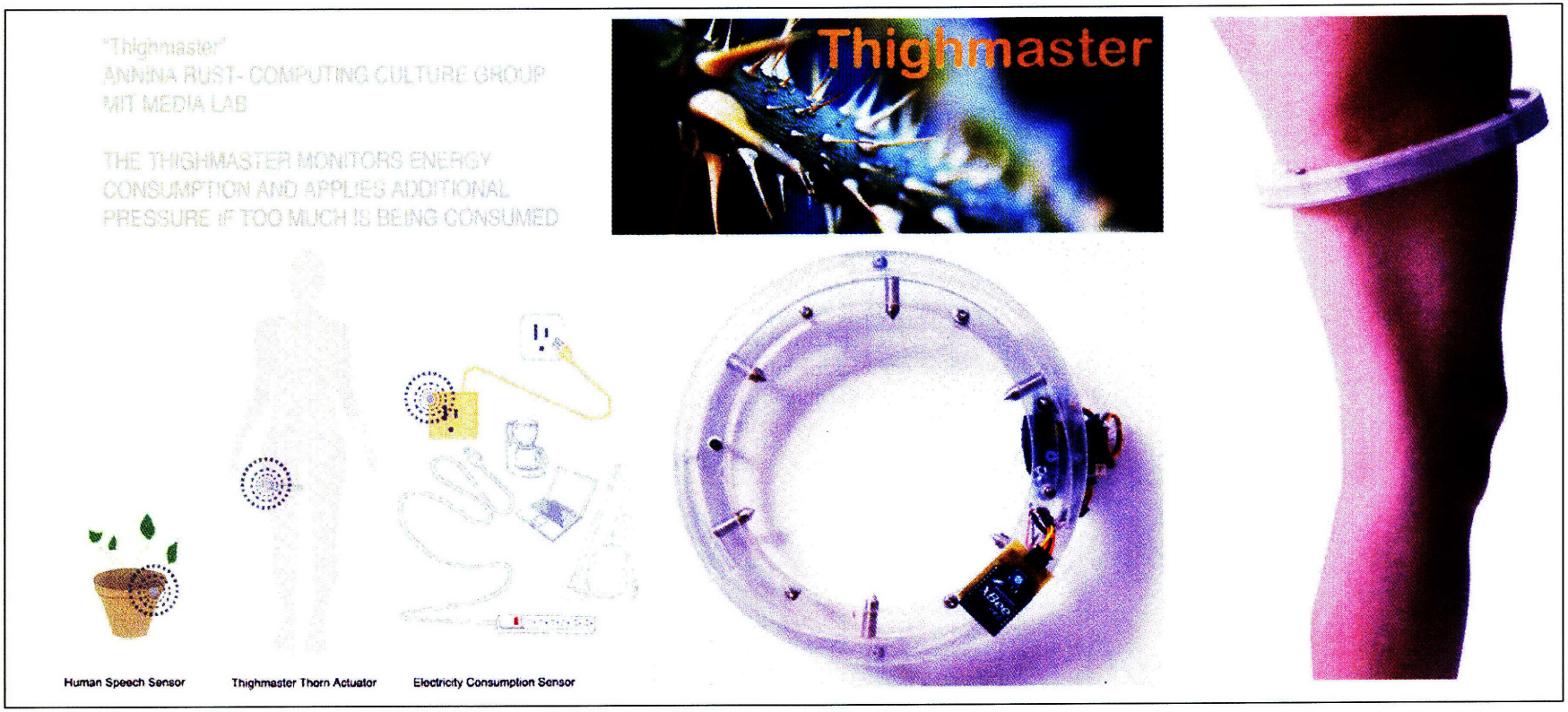
Freakonomics

Not-So-Free Ride

April 20, 2008

By STEPHEN J. DUBNER and STEVEN D. LEVITT

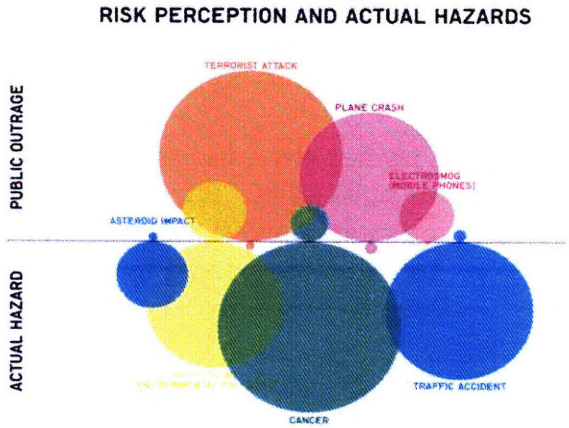
"Drivers who sign up for MyRate will install a small wireless **device** in their cars that transmits to Progressive not just how many miles they drive but also when those miles are driven and, to some extent, how they are driven: the device measures the car's speed every second, from which Progressive can derive acceleration and braking behavior. Which means that Progressive will not only be able to charge drivers for the actual miles they consume but will also better assess the true **risk** of each driver."

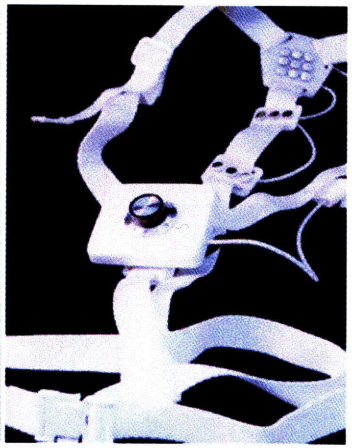


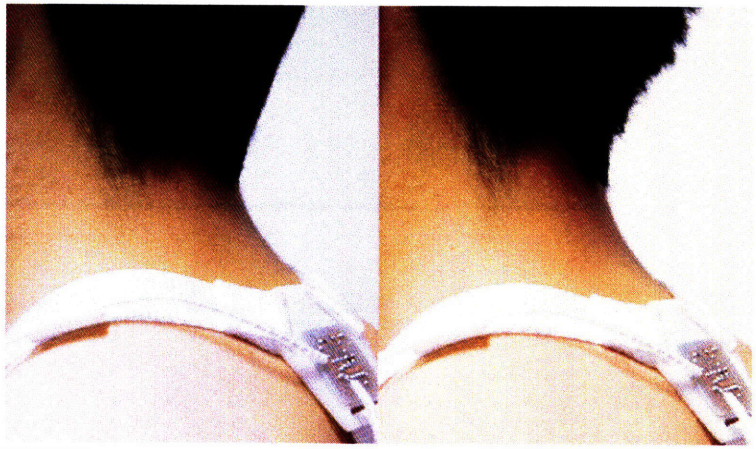
http://web.media.mit.edu/~rusti/thighmaster/

"we are just animals after all"
SUSANNA HERTRICH - THESIS Royal College of Art - London

HERTRICH PROPOSES A DEVICE THAT ELECTRICALLY STIMULATES THE BACK OF THE NECK IN ACCORDANCE WITH CERTAIN RISKS. SHE HOPES TO CLOSE THE GAP BETWEEN PERCEIVED AND ACTUAL HAZARDS.



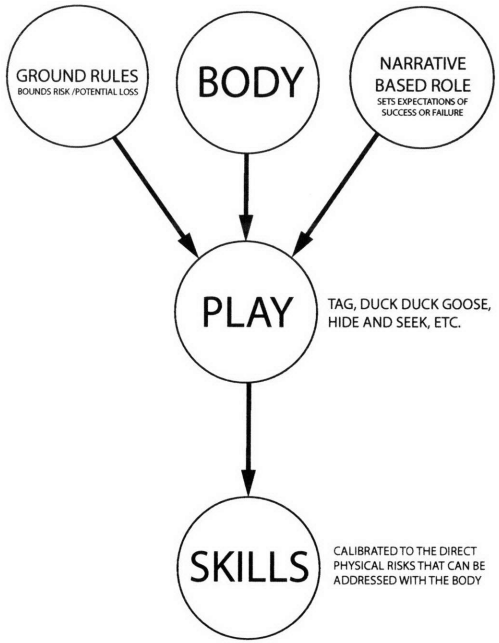




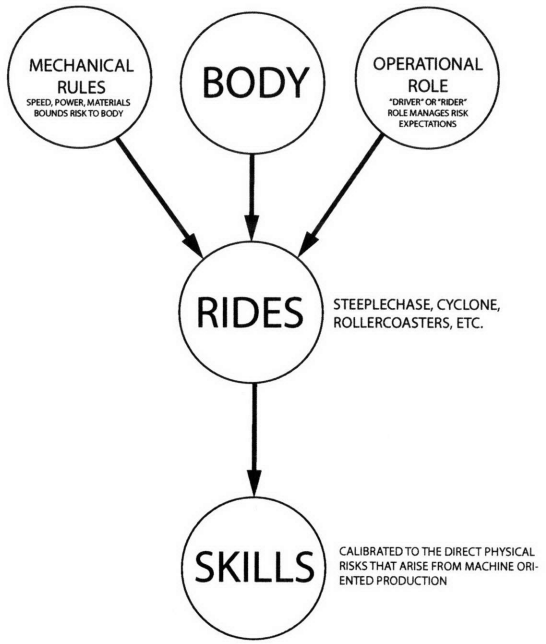
http://www.susannahertrich.com/html/humansanimals.html

Play has always served as a simulation of reality that enables players to build skills. Physical play addresses direct risks for humans and other animals. Through the modern era, amusement park play served to habituate people to the power of machines. The risk society will involve play with risk sensing devices.

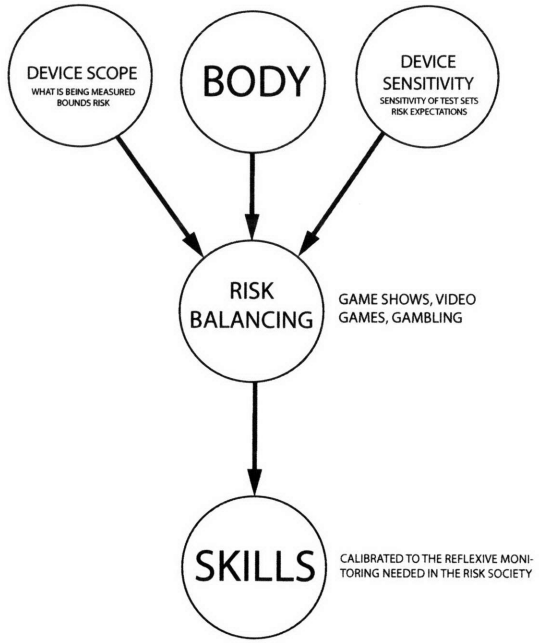
TRAINING FOR DIRECT RISKS



TRAINING FOR PRODUCTION



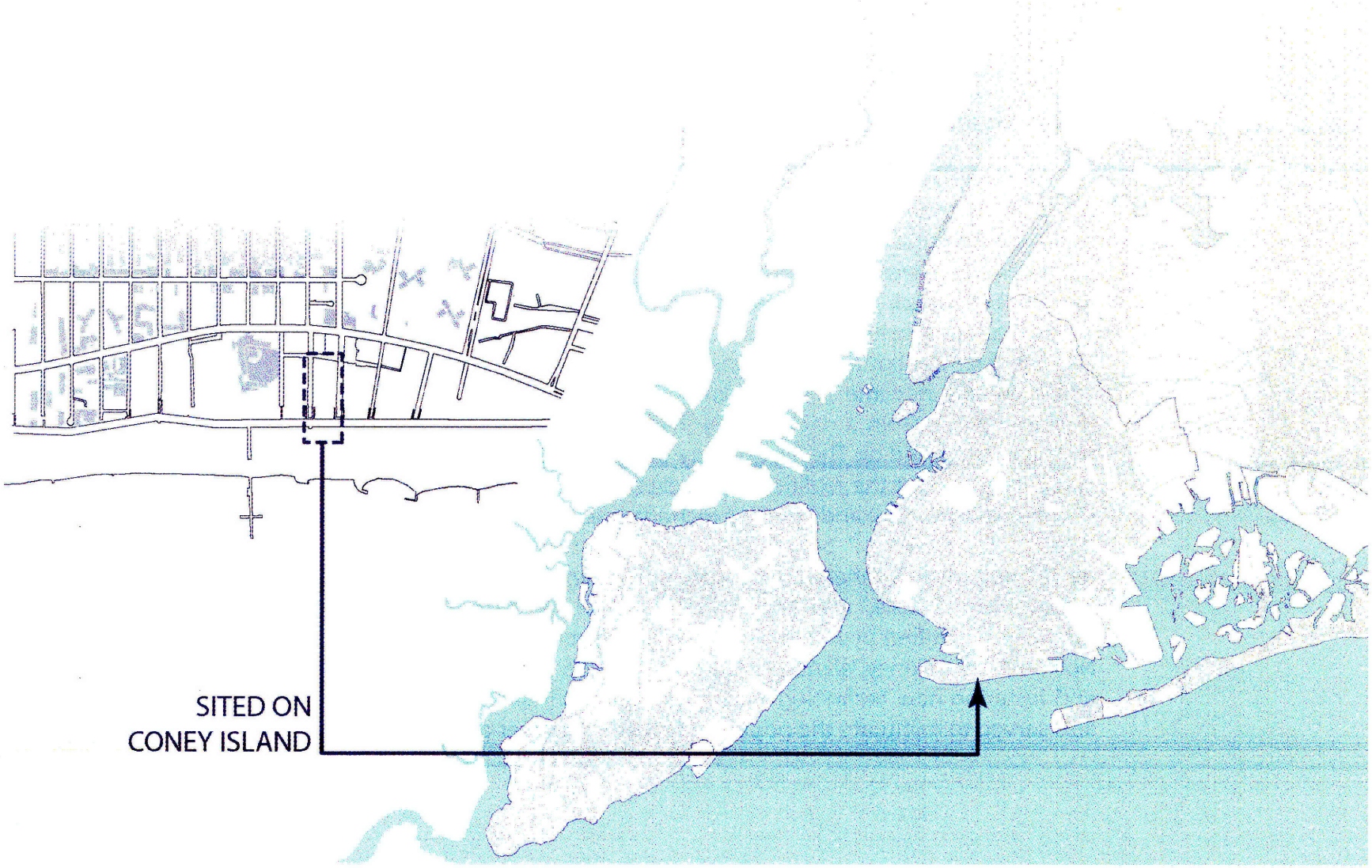
TRAINING FOR THE RISK SOCIETY



SITE CONTEXT

"The strategies and mechanisms that later shape Manhattan are tested in the laboratory of Coney Island before they finally leap toward the larger island. Coney Island is a fetal Manhattan."

Rem Koolhaas
Coney Island: The Technology of the Fantastic
from *Delirious New York*


SITED ON
CONEY ISLAND

Koolhaas finds Coney Island a breeding ground for technologies that would make urban living possible at increased densities. In *Coney Island: The Technology of the Fantastic he writes*, "The inordinate number of people assembling on the inadequate acreage, ostensibly seeking confrontation with the reality of the elements ... demands the systematic conversion of nature into a technical service." Koolhaas argues that a desire for sun, wind, sand and water combined with sheer human density produced new uses for technologies. These include electrical lighting, ventilation, air conditioning and elevators which would become the building blocks for Manhattan's new skyline. And, "within a decade they [had] invented and established an urbanism based on The Technology of the Fantastic: a permanent conspiracy against the realities of the external world" (Koolhaas, 61). Ever more productive and effective technologies propel this urbanism through the "modern" period creating the vast urban zones that most humans now inhabit. Concepts of efficiency, standardization, "economies of scale," and segmentation infect the heterogeneous urbanism identified by Koolhaas in turn of the century Coney Island. Not only does Coney Island serve as a urban laboratory, incubating and fostering new technologies and modes of living, but the island also served to habituate the populace to the new power of machines.

Koolhaas, Rem.
Delirious New York : a retroactive manifesto for Manhattan.
New York : Monacelli Press, 1994.

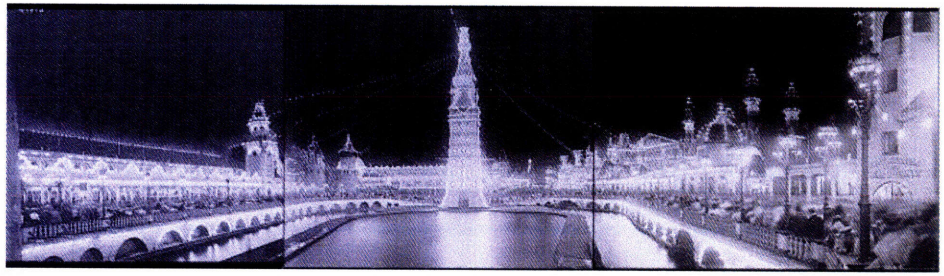


Image from
Library of Congress Digital Archive
http://hdl.loc.gov/loc.pnp/
det.4a05650

Image from
Library of Congress Digital Archive
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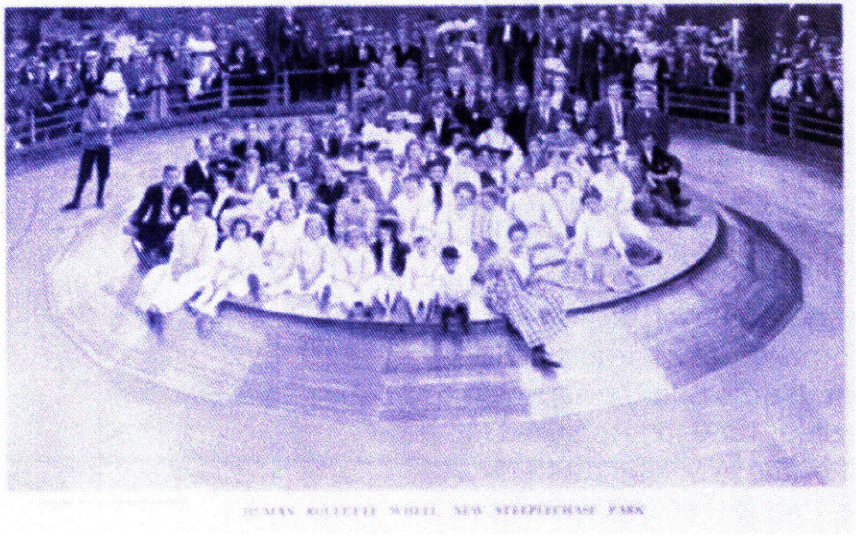
ppmsca.10795

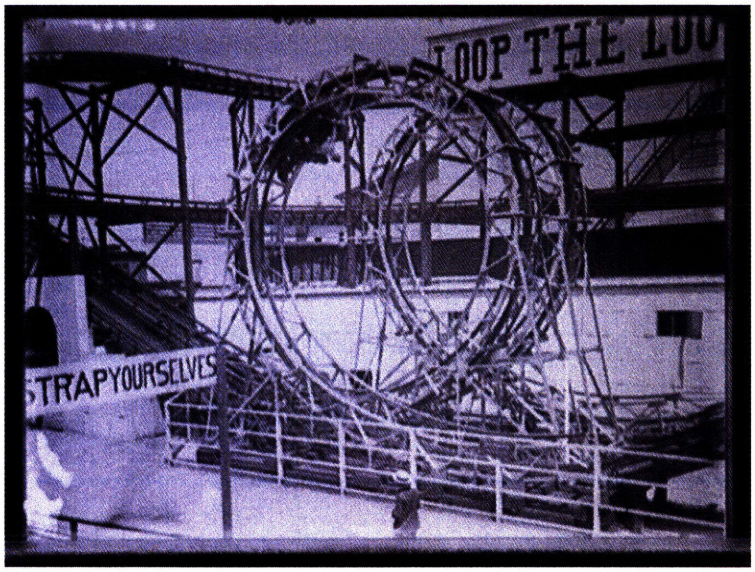
Coney Island's myriad amusements entertained and taught visitors about the developing relationships between the body and the machine.

The human roulette wheel and other amusements revealed the extent of centrifugal force that machines could produce. The Loop the Loop design was so misunderstood that it produced an extremely dangerous twelve times the force of gravity on riders. Many riders were seriously injured prompting the closing of the feature.

The Steeplechase amusement used mechanical horses that travelled around a metal track. Each of these amusements habituated the public to the power of machines in a developing industrial society.

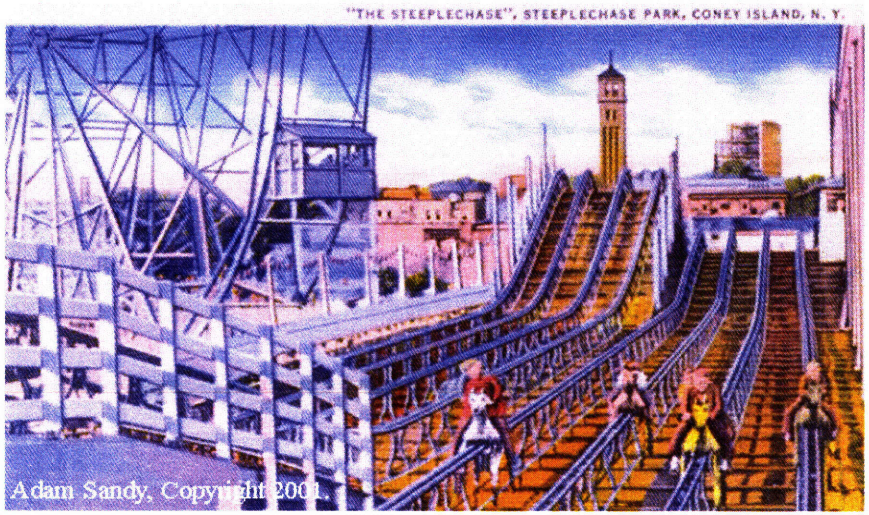
The RISK COMPLEX seeks to use this precedent, learning and habituation through play, to teach and empower people within the risk society.





Human Roulette Wheel, Steeplechase Park
Image from Library of Congress Digital Collection
http://hdl.loc.gov/loc.pnp/cph.3c15623

Loop the Loop
Image from Library of Congress Digital Collection
http://hdl.loc.gov/loc.pnp/det.4a05650



The Steeplechase
Image courtesy of history.amusement-parks.com
http://history.amusement-parks.com/Steeplechase/Steeple-chase%20Ride/steeplechaseride3.jpg

The millions of visitors who flooded to Coney Island on summer days packed the beaches, bath houses and amusements. The sheer density of the seething crowd drives Koolhaas' thesis.

Rem Koolhaas identified Coney Island as a zone of technological innovation that produced the driving forces for Manhattans skyline in. With the fires that consumed many amusements in the early 20th century, Coney Island suffered a slow decline. Though recognized for it's history, the decrepit run down state of the area suggests a new thinking is needed. Recent zoning changes (November, 2007) proposed by the NYC Department of Planning seek to spur development of several high rise towers surrounding a revamped amusement park on Coney Island.

New York City Department of City Planning
Coney Island Comprehensive Rezoning Plan

http://www.nyc.gov/html/dcp/html/coney_island/index.shtml

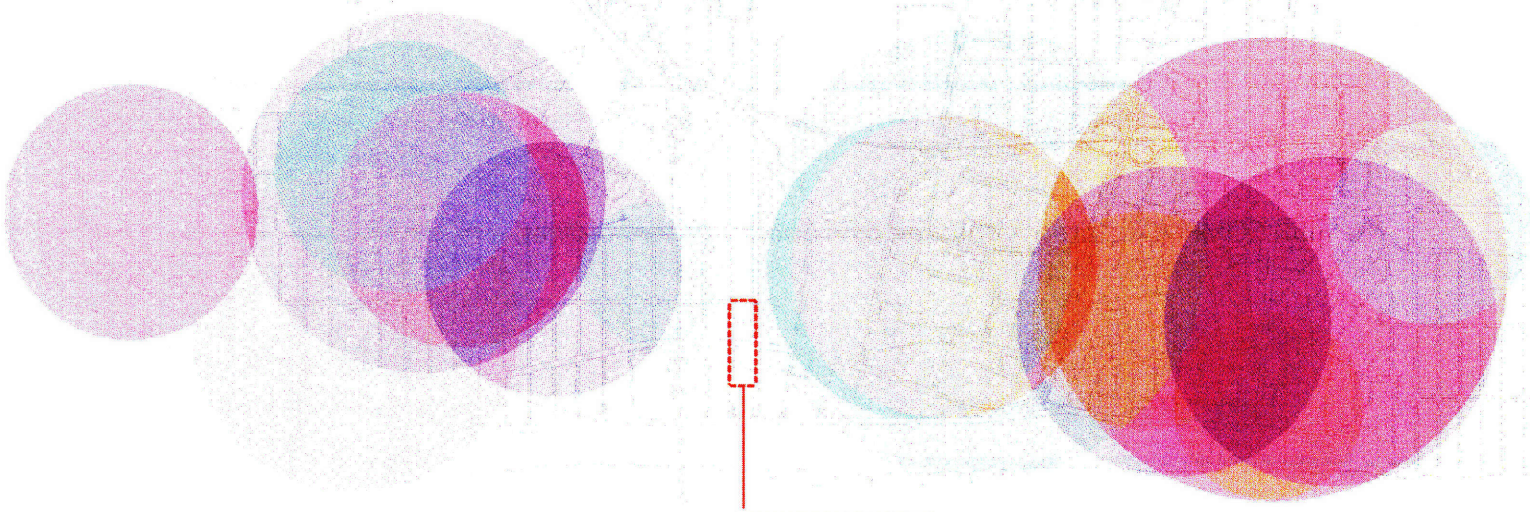
Image from
Library of Congress Digital Archive
http://hdl.loc.gov/loc.pnp/
fsa.8b00824

Image courtesy of history.
amusement-parks.com

http://history.amusement-
parks.com/ConeyBeach/
CrowdFromSky.jpg

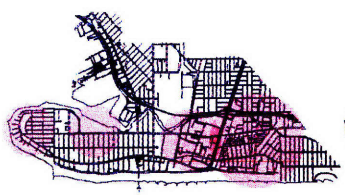
An analysis of risk on the site reveals a pocket devoid of the typical urban concerns. The analysis was gathered from census data from 2000.

The RISK COMPLEX benefits from being sited in a low risk environment. Learning via play requires a safe place.

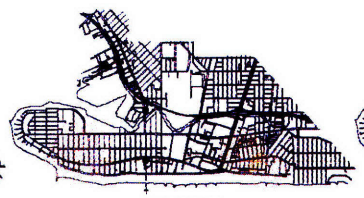


COMPOSITE RISK ZONES

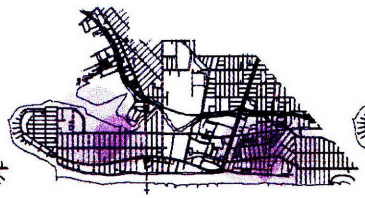
RISK COMPLEX SITE



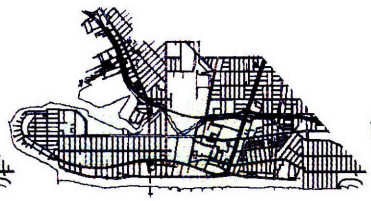
ACCIDENT/FIRE RISK
BASED ON BUILDING AGE AND HOUSING COSTS
LOW COST OLD BUILDINGS = HIGH RISK



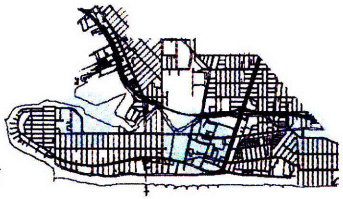
CRIME RISK
BASED ON HOMICIDE LOCATIONS FOR 2003,2004, AND 2005.



ECONOMIC RISK
SHOWING CENTER OF POOREST CENSUS BLOCKS



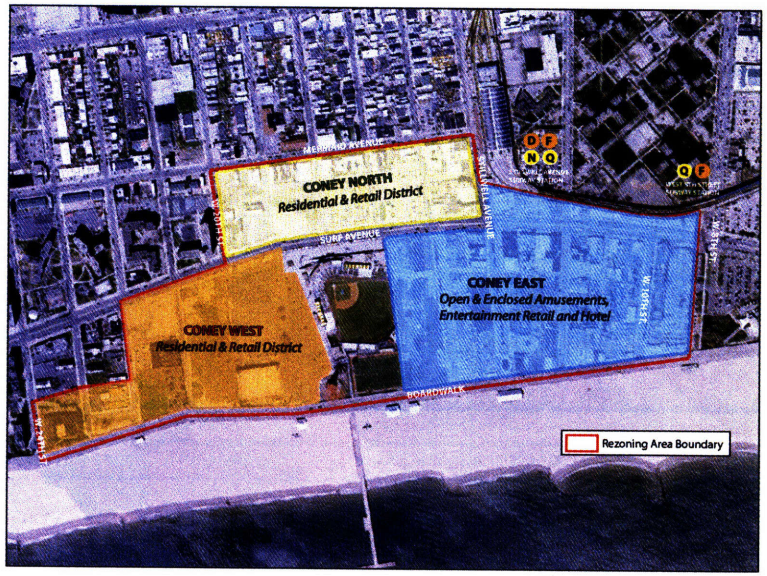
ENVIRONMENTAL RISK
BASED ON INDUSTRIAL LOCATIONS AND HOUSING AGE

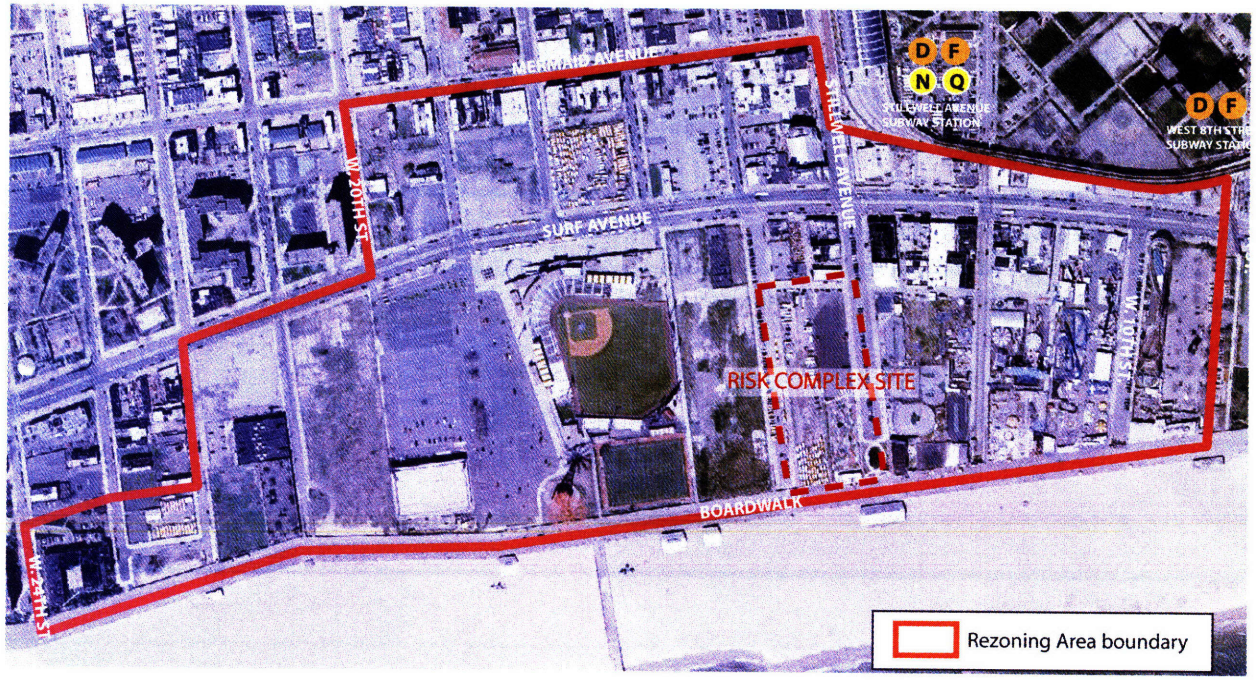


HEALTH RISK
BASED ON AGE AND CENSUS TRACTS RECEIVING MOST HEALTHCARE DOLLARS

The state and city plan $2.5 billion in investment in collaboration with private developers over the next ten years. The process will begin with a rezoning plan. An official entertainment district will be codified and developed in conjunction with new retail and residential development.

The RISK COMPLEX is sited within the new entertainment district.





Available from NYC Department of City Planning

Coney Island Comprehensive Rezoning Plan

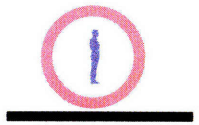
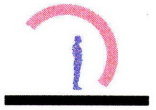
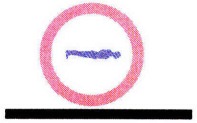
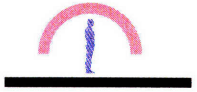
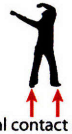
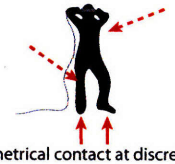
http://www.nyc.gov/html/dcp/html/coney_island/index.shtml

CLIENT

As the government assumes more responsibility for insuring people's health, knowledge of risk behavior becomes vital. This thesis presumes the State of New York has instituted a universal health care plan similar to Massachusetts'. Though a private insurance company could play the same role, the existing public investment in the redevelopment of Coney Island makes the State a logical client. The state would be able to improve their understanding of the insurance pool by owning the RISK COMPLEX.

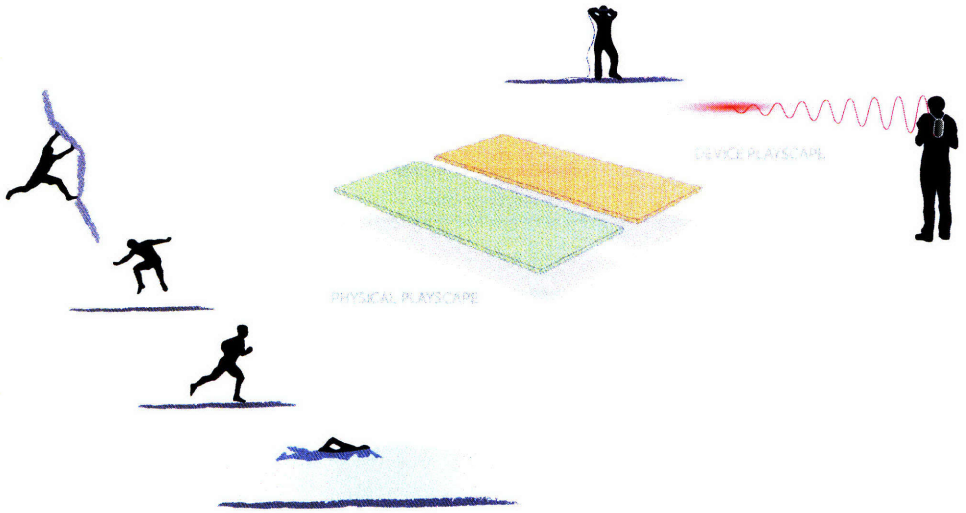
The risk complex will deploy the most advanced monitoring technologies to understand people's behavioral attitudes toward risk. At the same time an exciting amusement center will help revitalize the area.

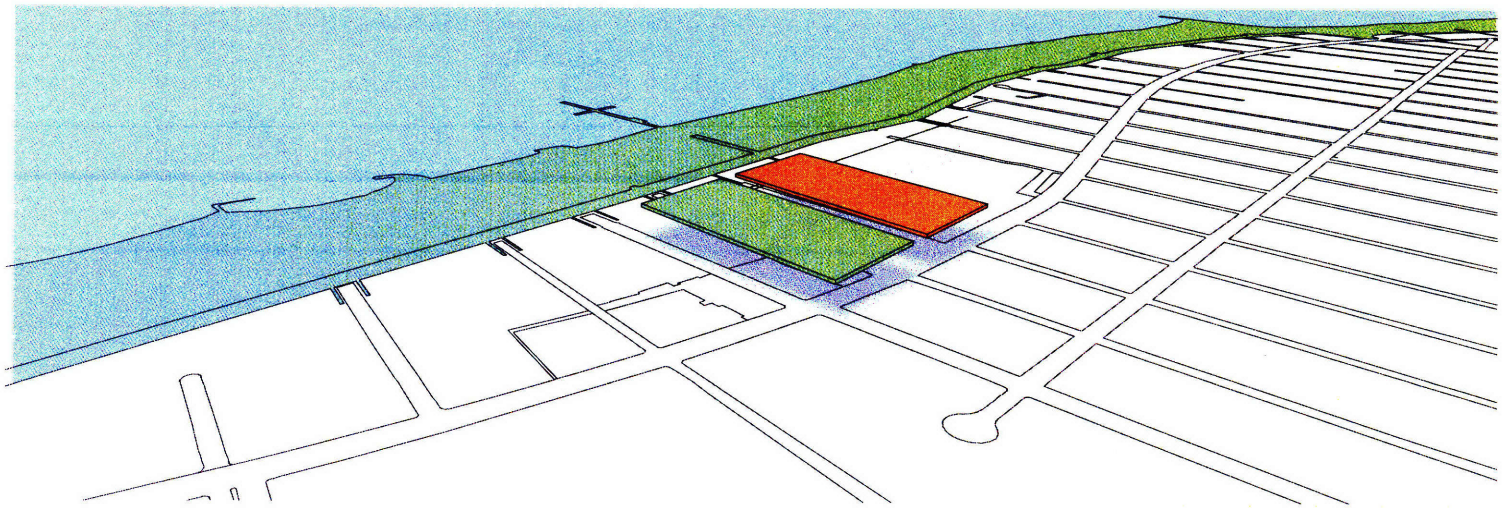
Play activities not only teach, but through monitoring devices, allow for a deeper understanding of risk behavior.

Jumping		 complete exposure	 weightless vertical orientation
Running		 frontal exposure	 asymetrical contact at discrete point vertical orientation
Climbing		 one sided exposure	 asymetrical contact at discrete points vertical orientation
Swimming		 complete exposure	 contact across body surface horizontal orientation
Multipurpose dance, game play, jogging, walking		 three sided exposure	 symetrical contact at discrete points vertical orientation
Virtual Reality Games		 complete simulated exposure	 symetrical contact at discrete points simulated contact vertical orientation

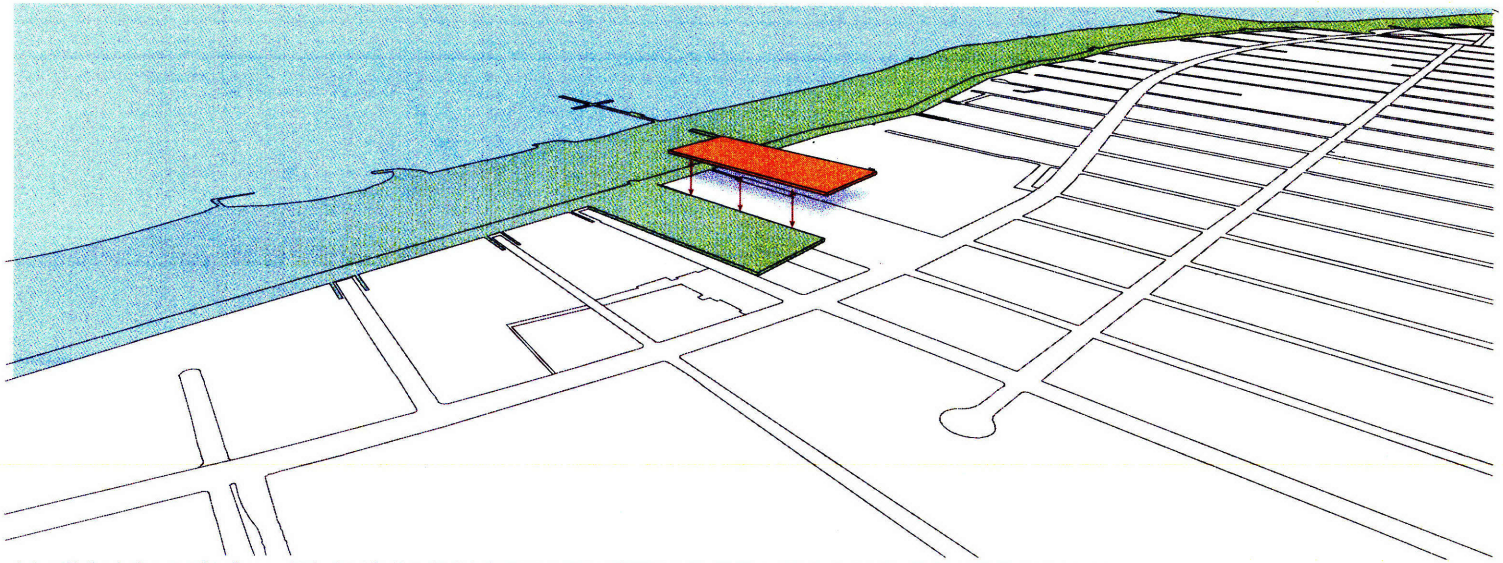
DESIGN SEQUENCE

The RISK COMPLEX seeks to build both the physical skills needed to counteract direct risk and the device oriented skills required to meet today's pervasive risks. This is resolved programmatically by two major spaces.

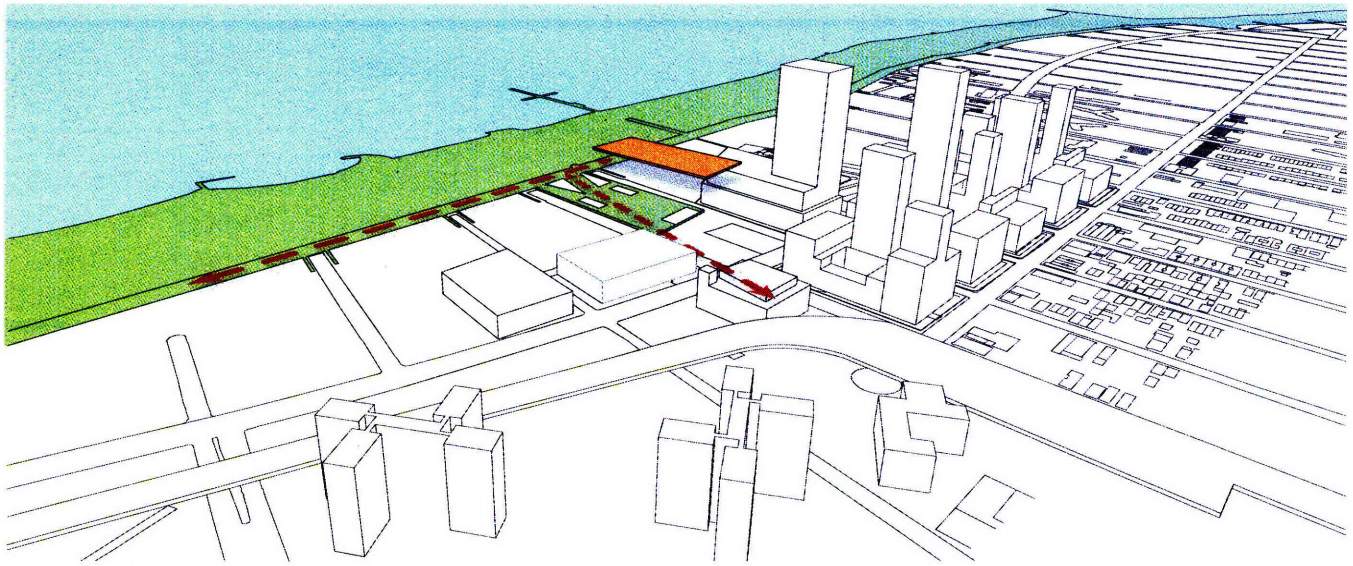




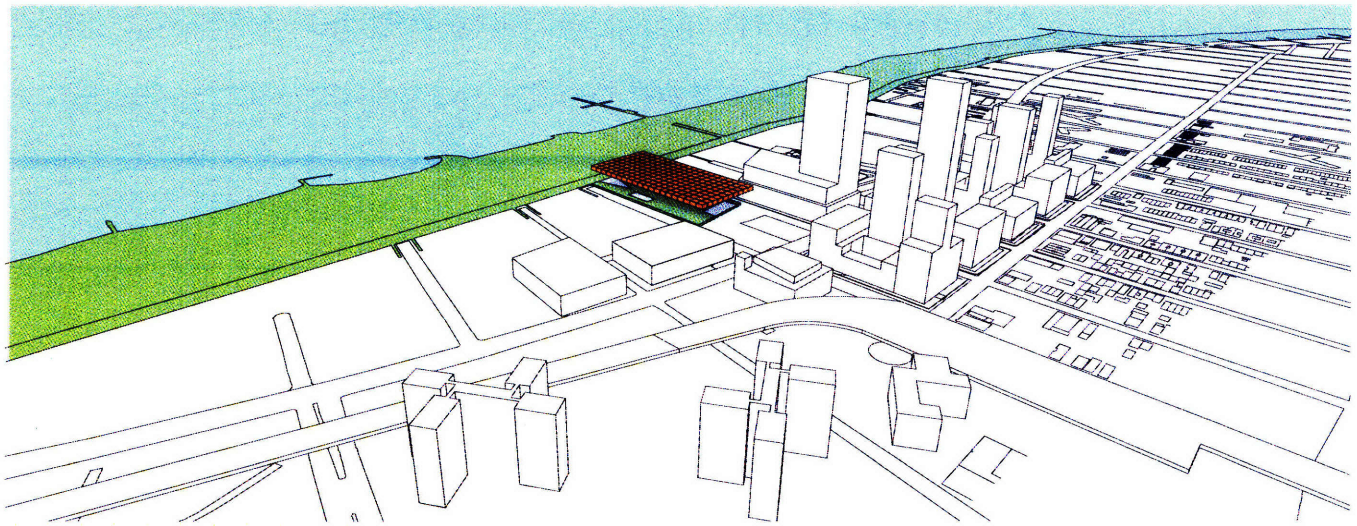
PLACE PHYSICAL AND DEVICE PLAYSCAPE ON SITE



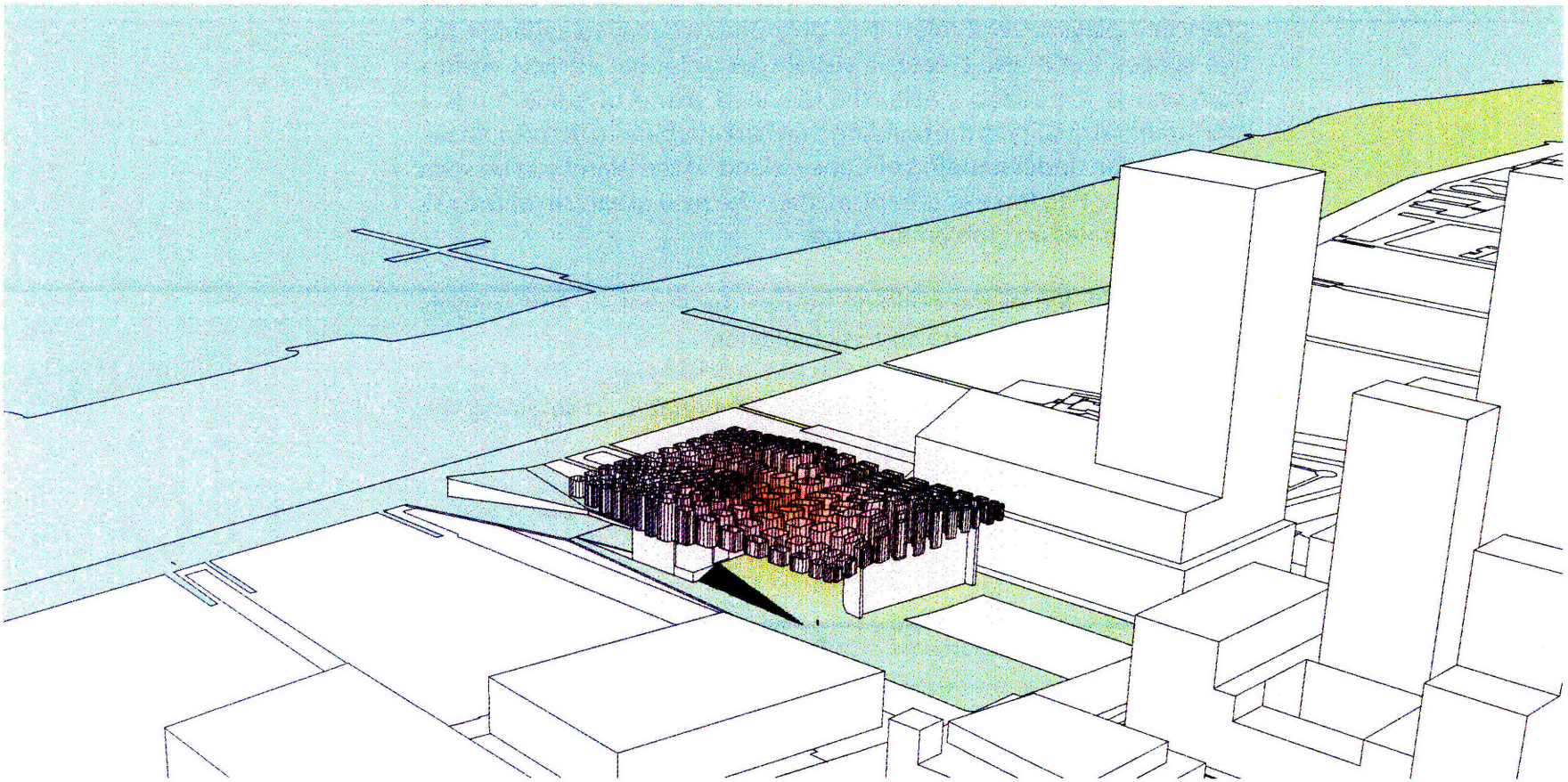
MATCH PHYSICAL PLAYSCAPE WITH EXISTING BEACH AND BOARDWALK



CONSIDER CIRCULATION FROM BOARDWALK AND SUBWAY FOOT TRAFFIC WHILE PLACING ELEMENTS



SUBDIVIDE DEVICE PLAYSCAPE



DEFORM SUBDIVISION TO ACCOMMODATE STRUCTURAL AND SPACE VARIATION NEEDS

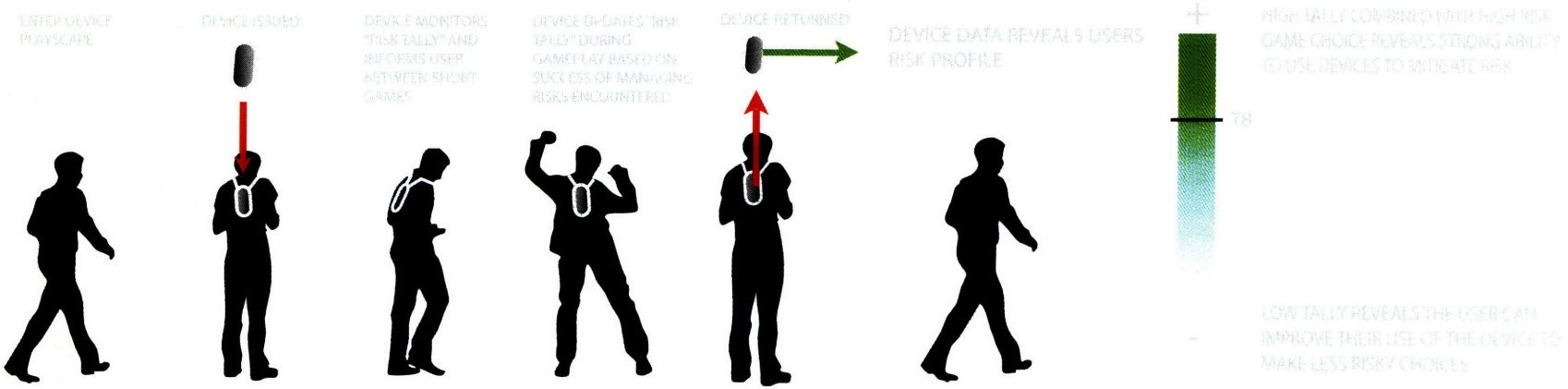
BUILDING ORGANIZATION

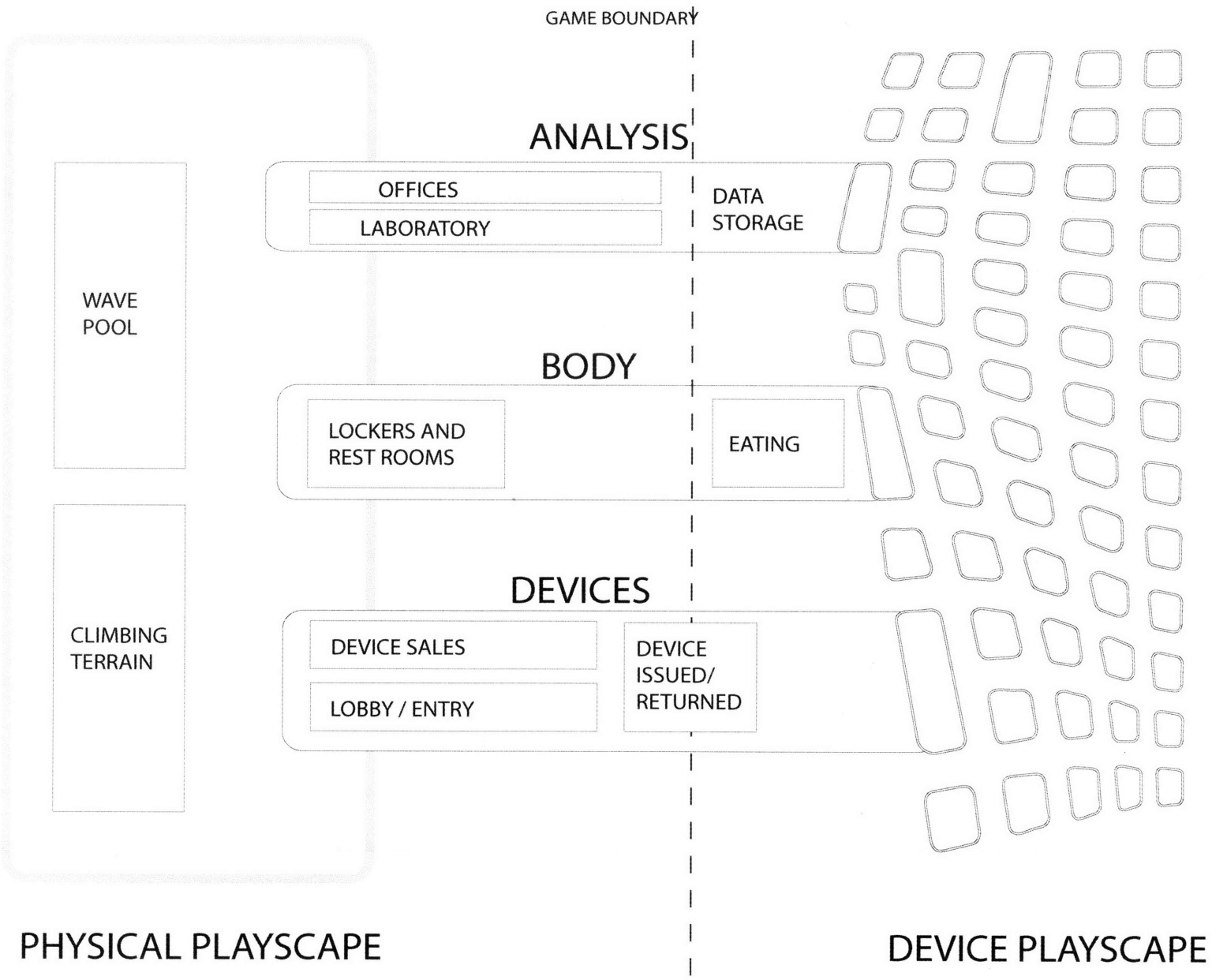
The physical playscape and device playscape are linked both conceptually and literally by three themes. The elevation of the device playscape plays several roles. Not only does it serve to separate the two spaces, but it also creates a visual spectacle that attracts visitors from across the island. Also, the elevated plane of 'pods' lends a monumental quality to the building that harkens back to Rem Koolhaas' semi-utopian understanding of Coney Island. If the island can be seen as a broadcasting force of urbanism, then the new urbanism of the risk society deserves an emblematic icon.

The ANALYSIS leg of the building houses the scientists and analysts who work to better understand risk behavior.

The BODY leg houses all program functions related to servicing the body.

DEVICES provides a circulatory connection to the device playscape.




GAME BOUNDARY
ANALYSIS
OFFICES
LABORATORY
DATA STORAGE
WAVE POOL
BODY
LOCKERS AND REST ROOMS
EATING
DEVICES
DEVICE SALES
LOBBY / ENTRY
DEVICE ISSUED/ RETURNED
CLIMBING TERRAIN
PHYSICAL PLAYSCAPE
DEVICE PLAYSCAPE

PHYSICAL PLAYSCAPE

	DIMENSIONS	CAPACITY
WAVE POOL	220' X 80' ~20,000 SF	400-500 people
CLIMBING TERRAIN/WALL	220' X 35' high	20-30 people
SUNBATHING/ARTIFICIAL BEACH	230' X 80' ~15,000 SF	800-900 people
OPEN PLAZA (CYCLING, BREAK-DANCING,KRUMPPING, SKATEBOARDING, JUGGLING, ETC.)	220' X 130'	800-900 people

BODY

CONCESSIONS	50' X 25'	400 hotdogs/hr
CHANGING FACILITIES	4' X 7'	50 units
PUBLIC TOILETS	3' X 7'	50 units
PUBLIC SHOWERS	3' X 7'	40 units
DESTINATION DINNING	50' X 25'	150-200 people

DEVICES

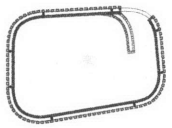
DEVICE SALES	70' X 100' ~7000SF
DEVICE DISTRIBUTION	60' X 100' ~6000SF

ANALYSIS

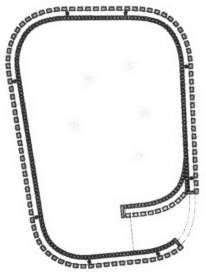
LABORATORY/POD ASSEMBLY	35' X 170' ~6000SF	
RESEARCH OFFICE SPACE	35' X 170' X 3 ~ 18,000 SF	40-50 researchers
DATA STORAGE GAME ADMINISTRATION	35' X 170' ~6000SF	

DEVICE PLAYSCAPE

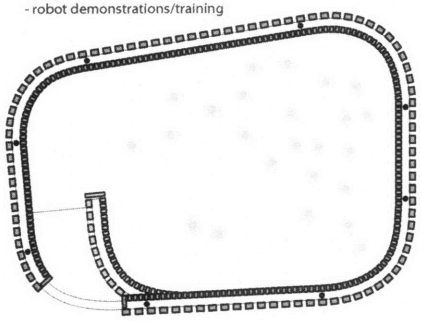
SINGLE USER PODS
- VR flight/space flight games
- Immersive environment games (Doom, Grand Theft Auto, etc).



SMALL GROUP PODS
FAMILY AND FRIENDS
2-5 people
- Group VR games (submarine/ship's crew)
- Eating
- Karaoke
- Wii type games (bodily interaction)



LARGE GROUP PODS
INSTITUTIONAL/EDUCATIONAL VISITORS
5-20 people
- Small performances
- educational presentations
- health training
- hologram games
- magic shows
- robot demonstrations/training

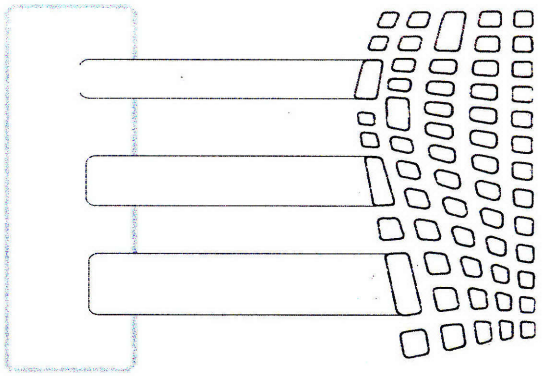


PHYSICAL PLAYSCAPE
TRAINING FOR DIRECT RISK

Direct Risk

Defined by obvious physical impact. The risk is vector like, acting in clear paths and avoidance requires agility, quick reflexes and strength. The scale and force of direct risk is easily assessed, but often difficult to avoid.

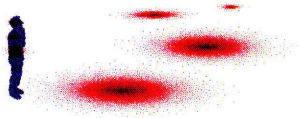
Examples:
Traffic, excess speed, violent crime, exposure, predation,



DEVICE PLAYSCAPE
TRAINING FOR PERVASIVE RISK

Pervasive Risk

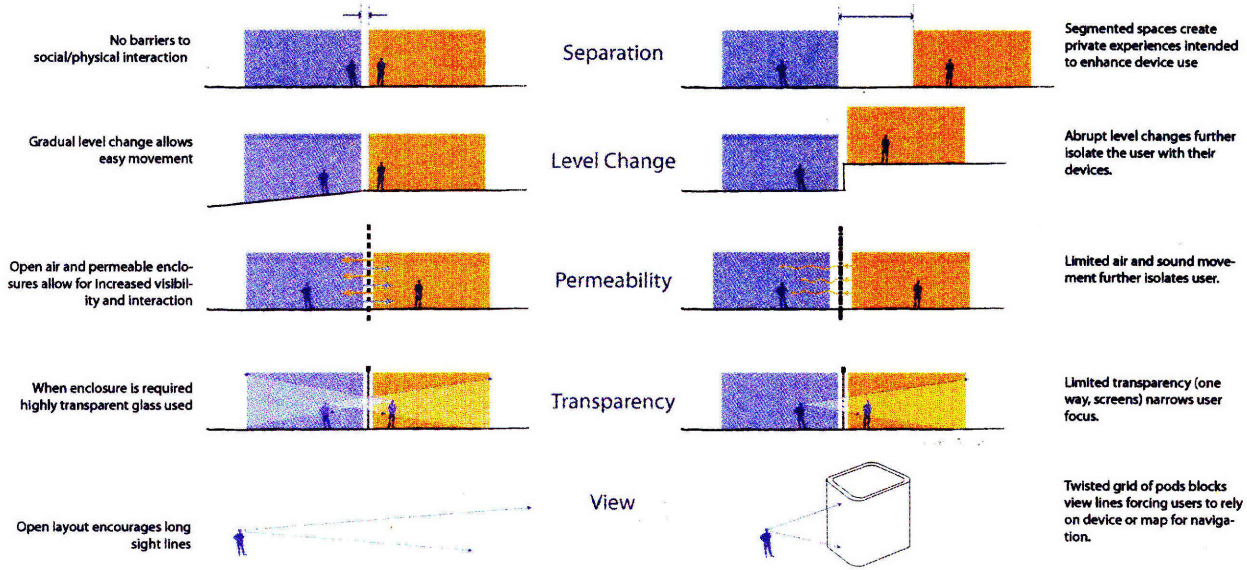
Defined by impacts felt over time and are difficult to diagnose, locate and identify. Avoidance requires diligence, attentiveness pattern recognition and specific knowledge. The risk is undefined, dispersed and exists at small and large scales.

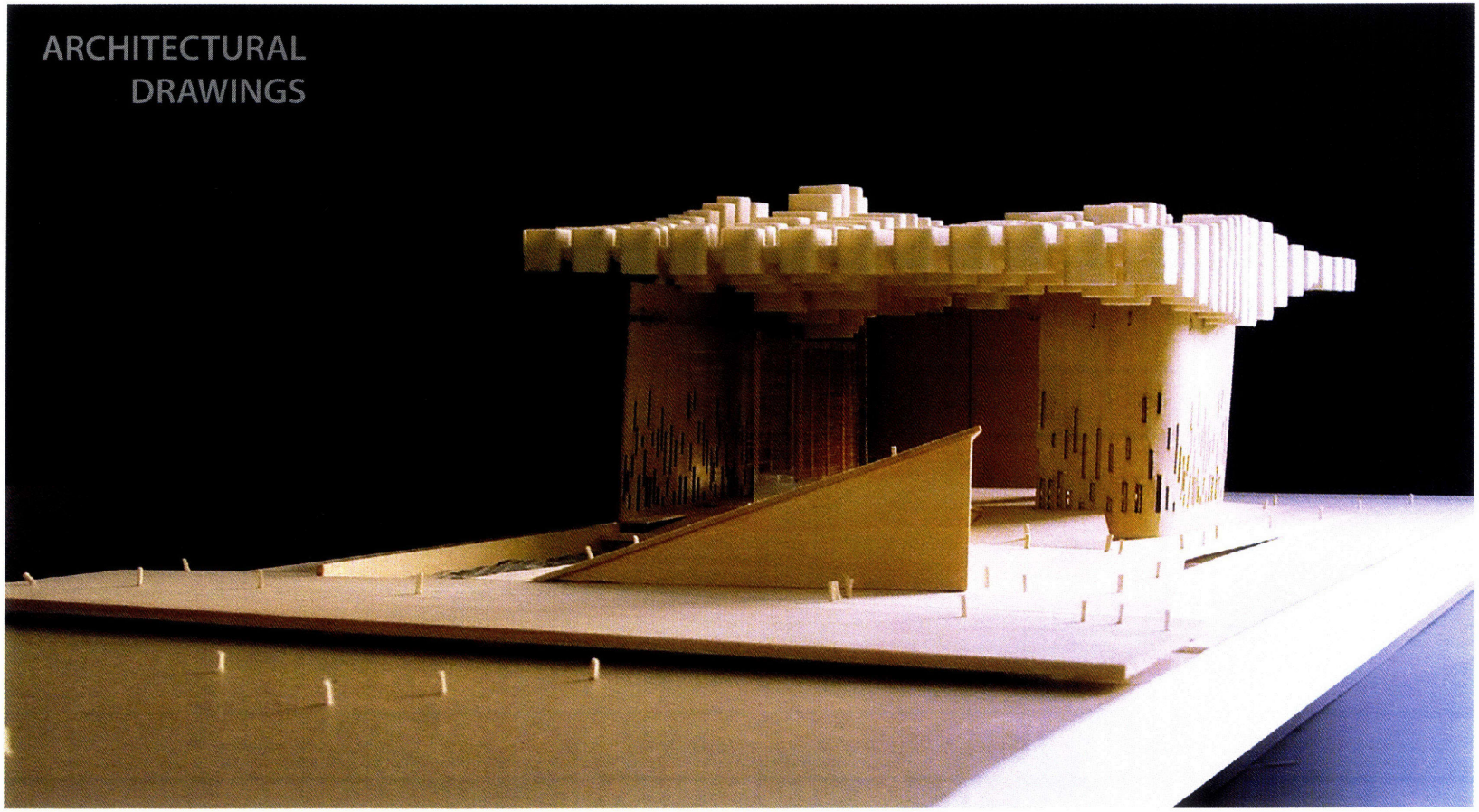


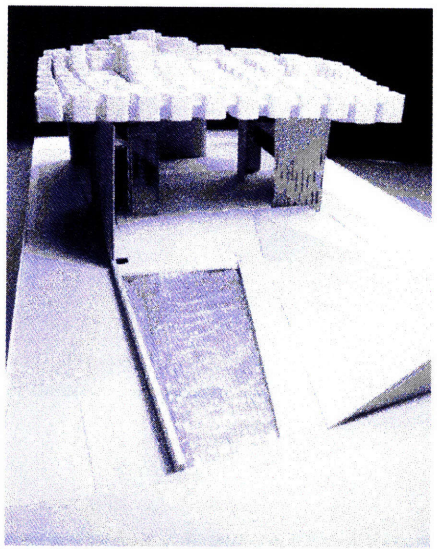
Examples:
Air pollution, water pollution, tainted foods.

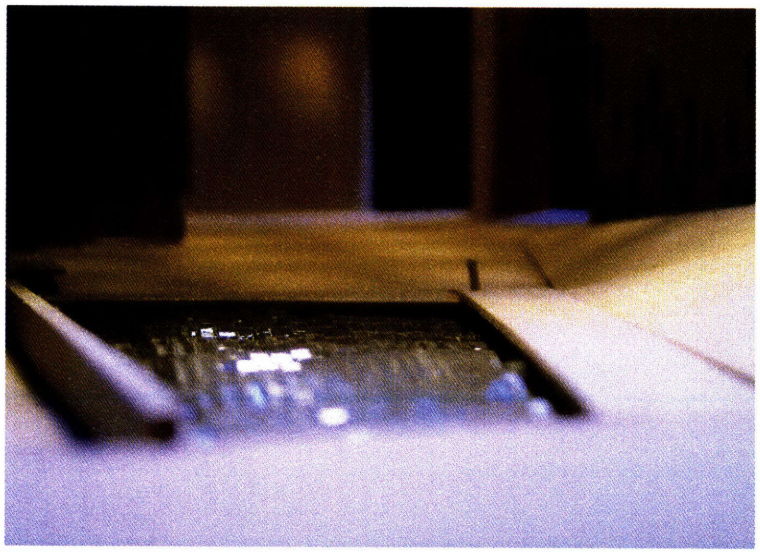
BODY MUST BE PREPARED TO ACT

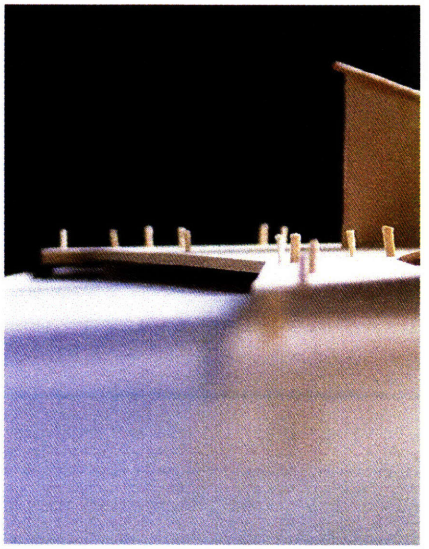
BODY MUST WORK WITH RISK SENSING DEVICE TO REACT

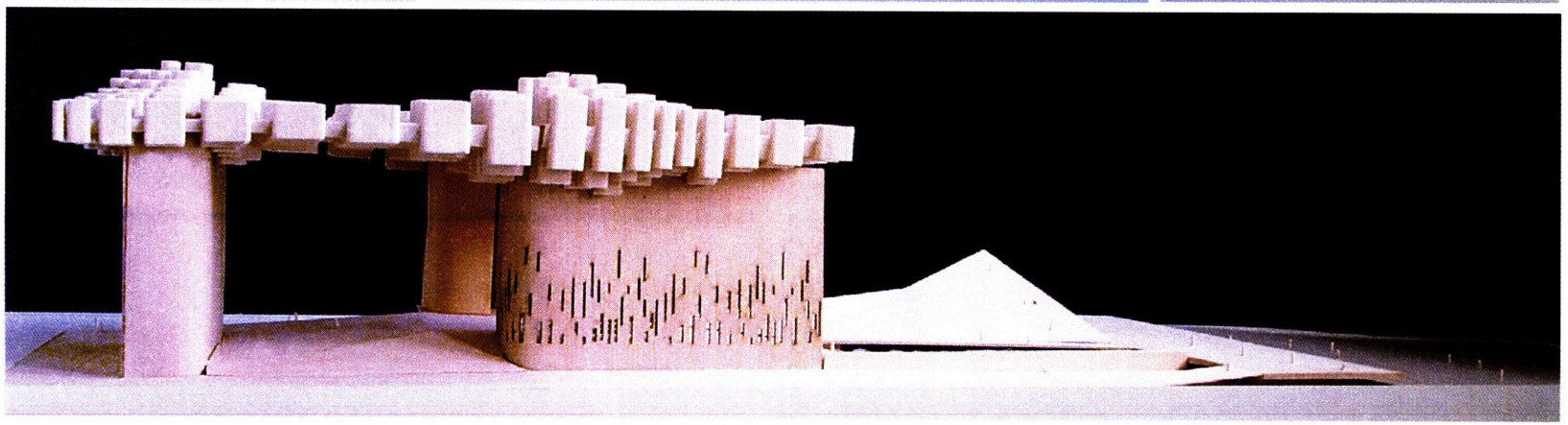



ARCHITECTURAL
DRAWINGS







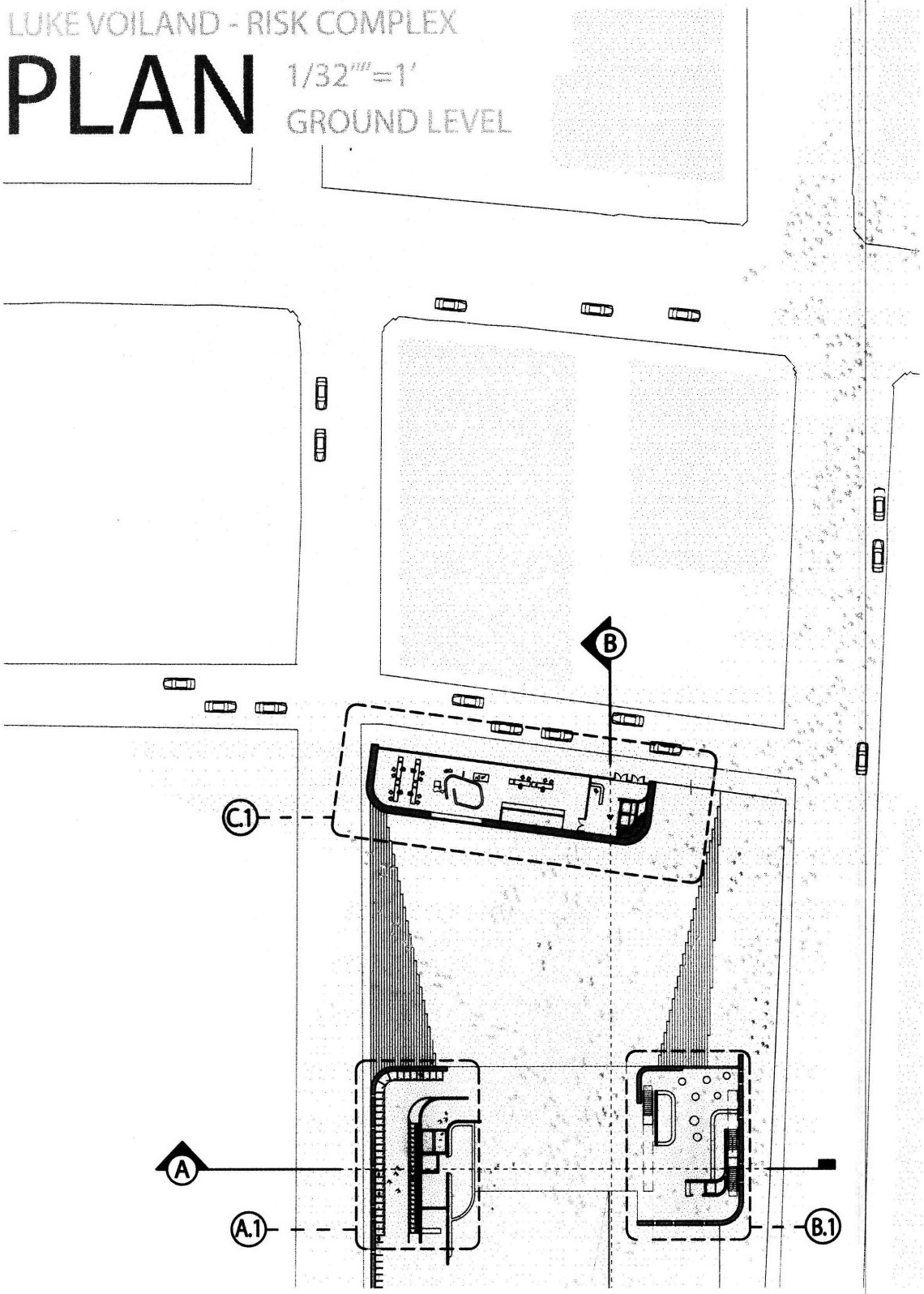


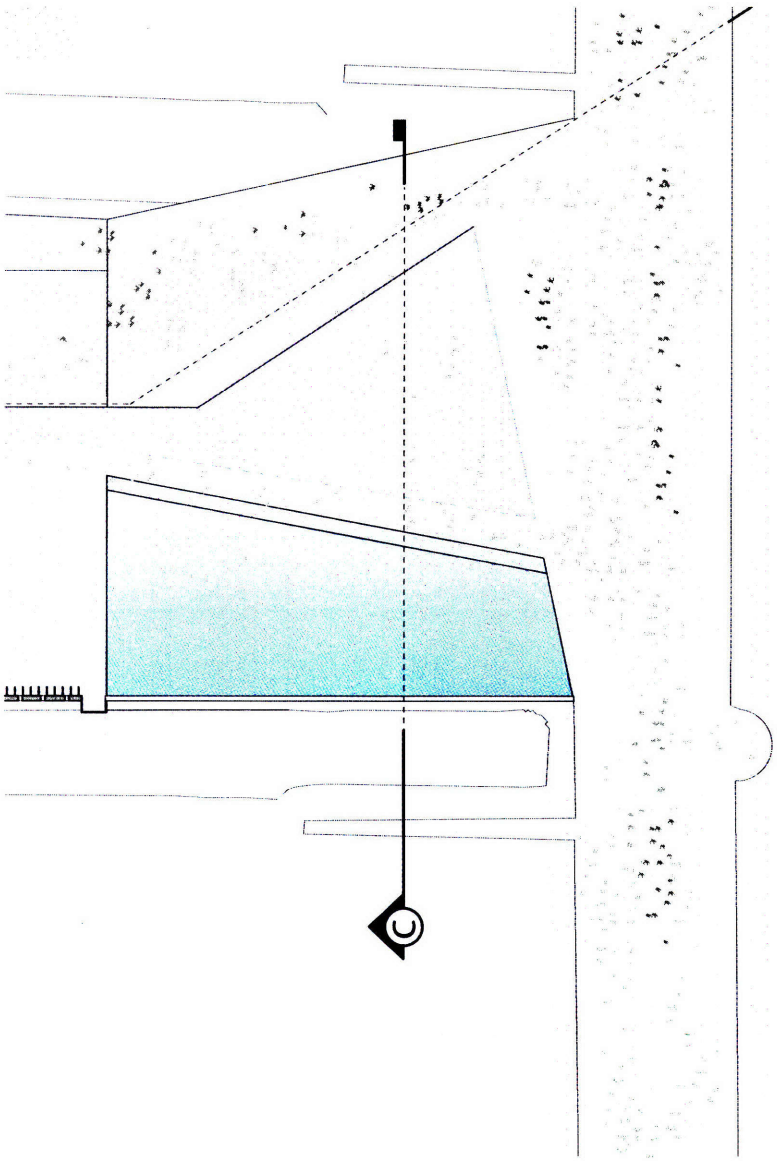
LUKE VOILAND - RISK COMPLEX

PLAN

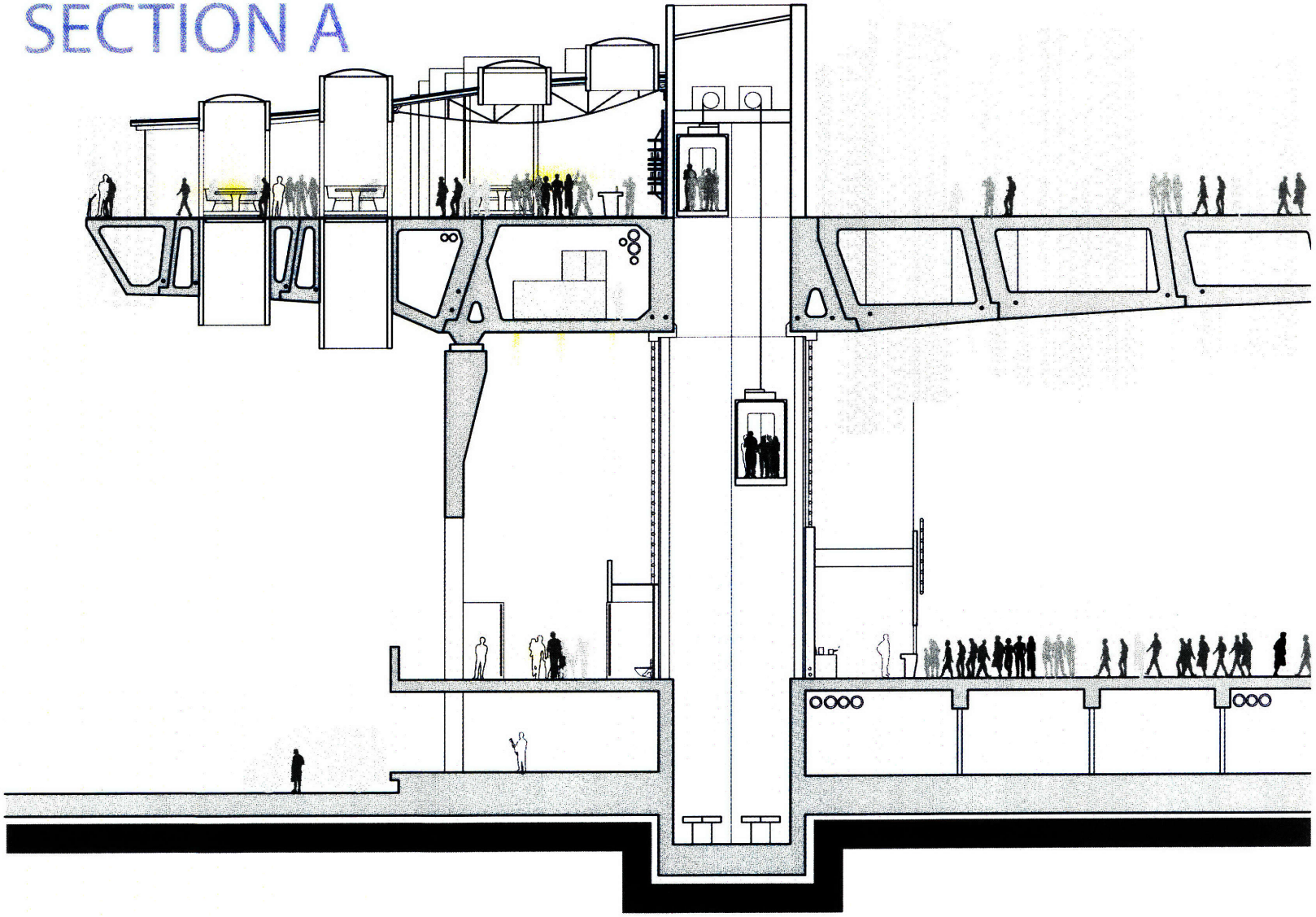
1/32""=1'

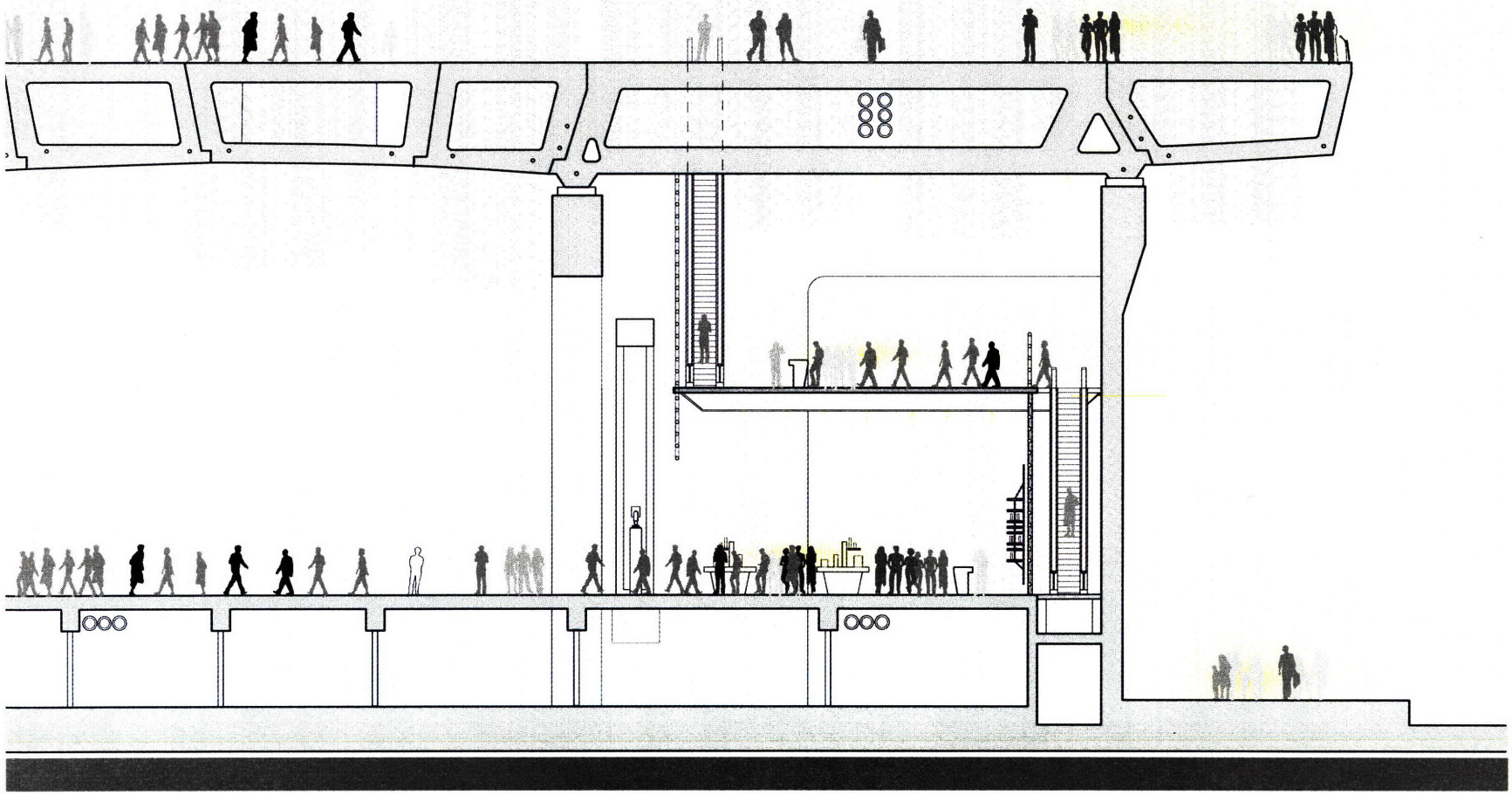
GROUND LEVEL



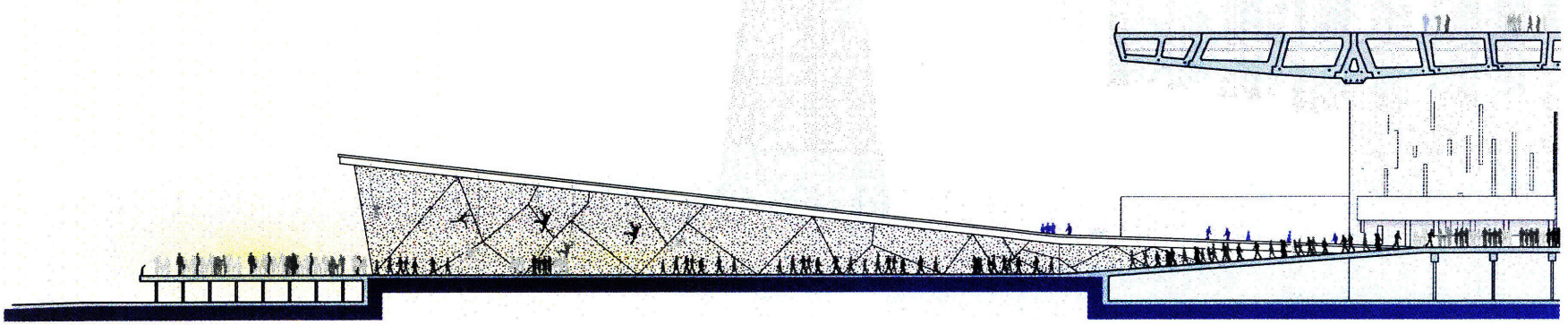


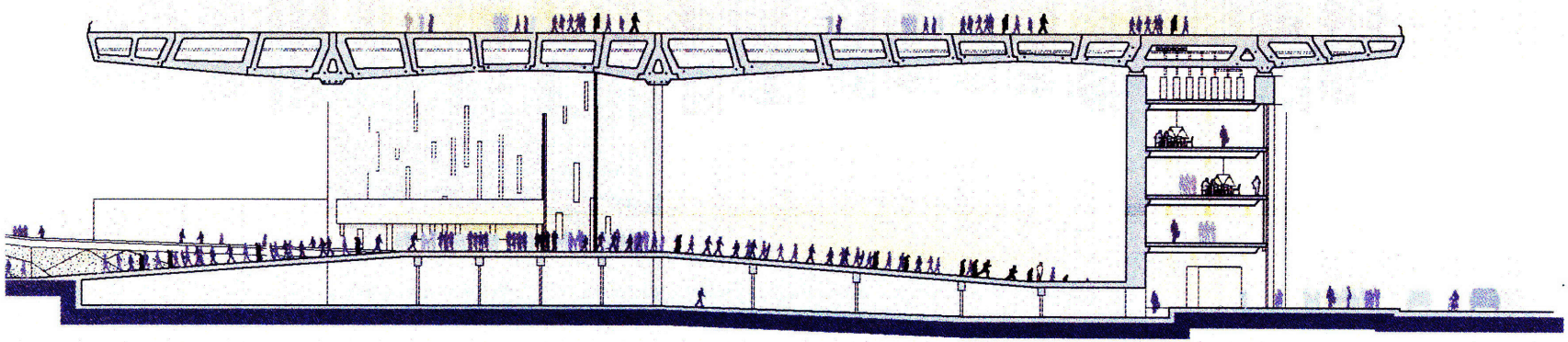
SECTION A



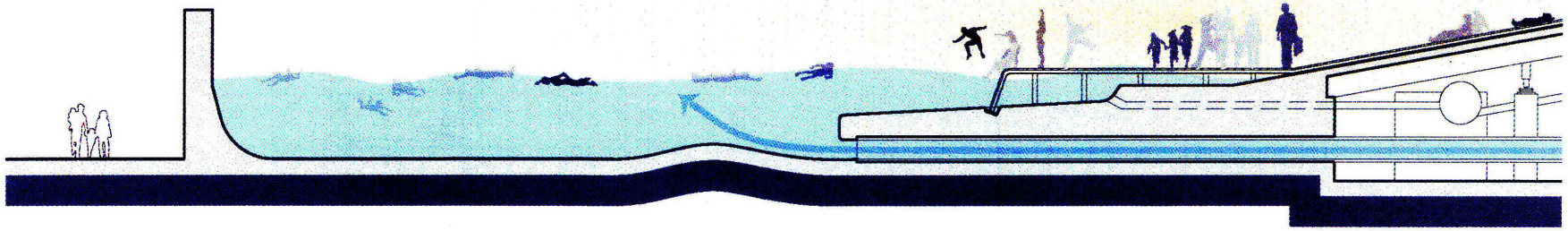


SECTION B 1/16"=1'

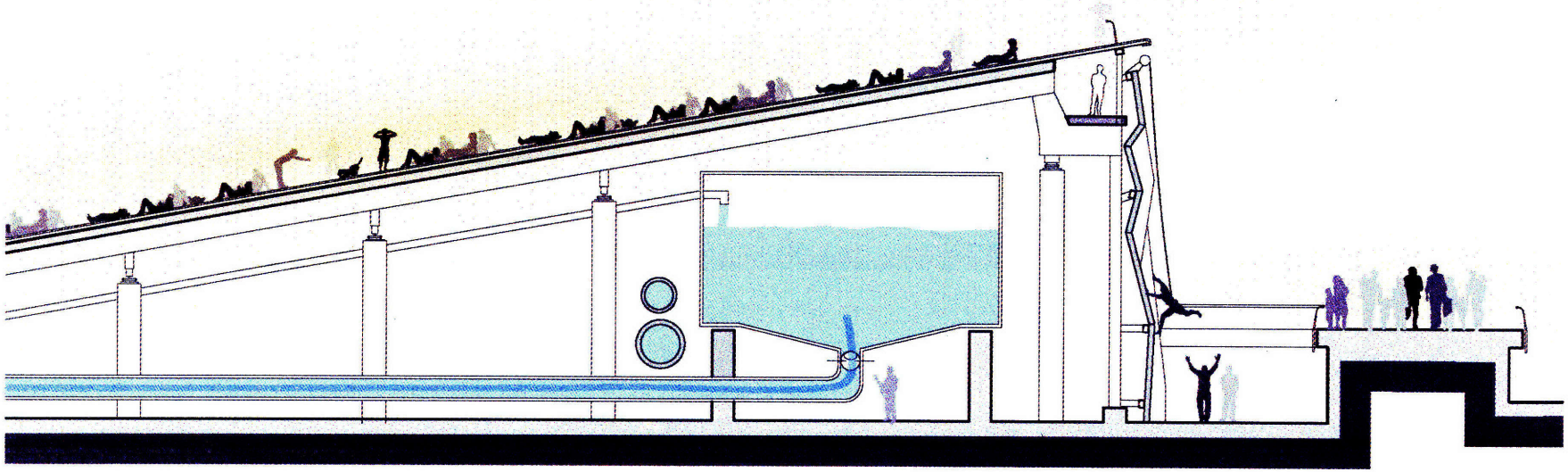


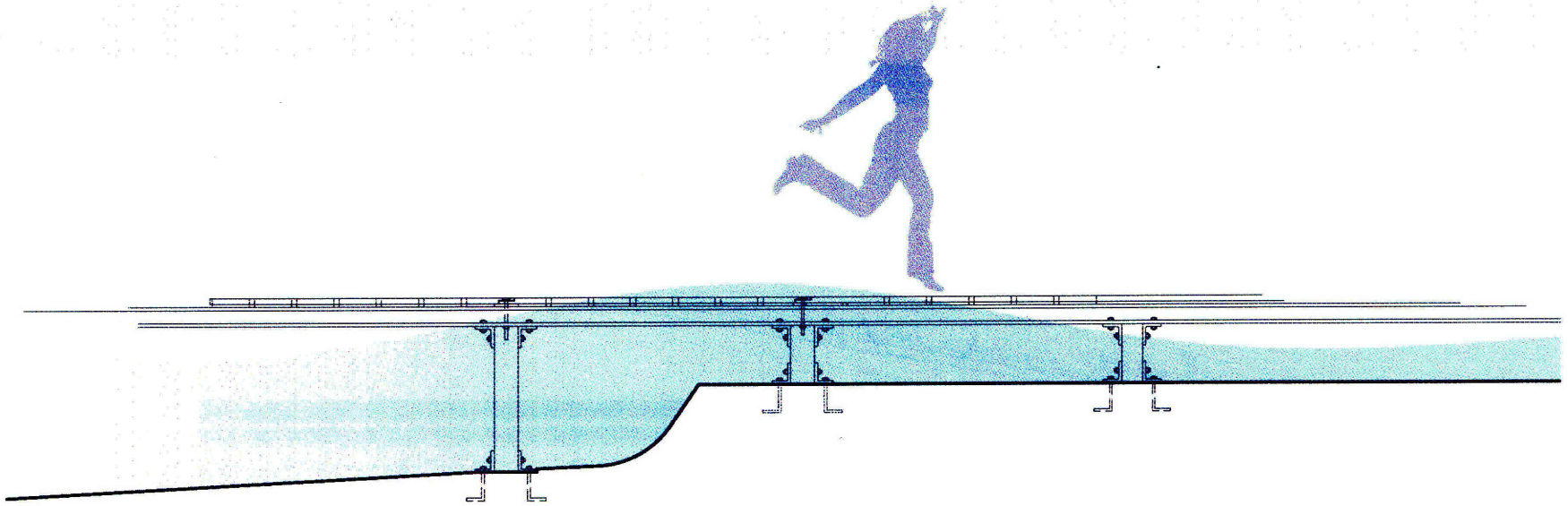


SECTION C

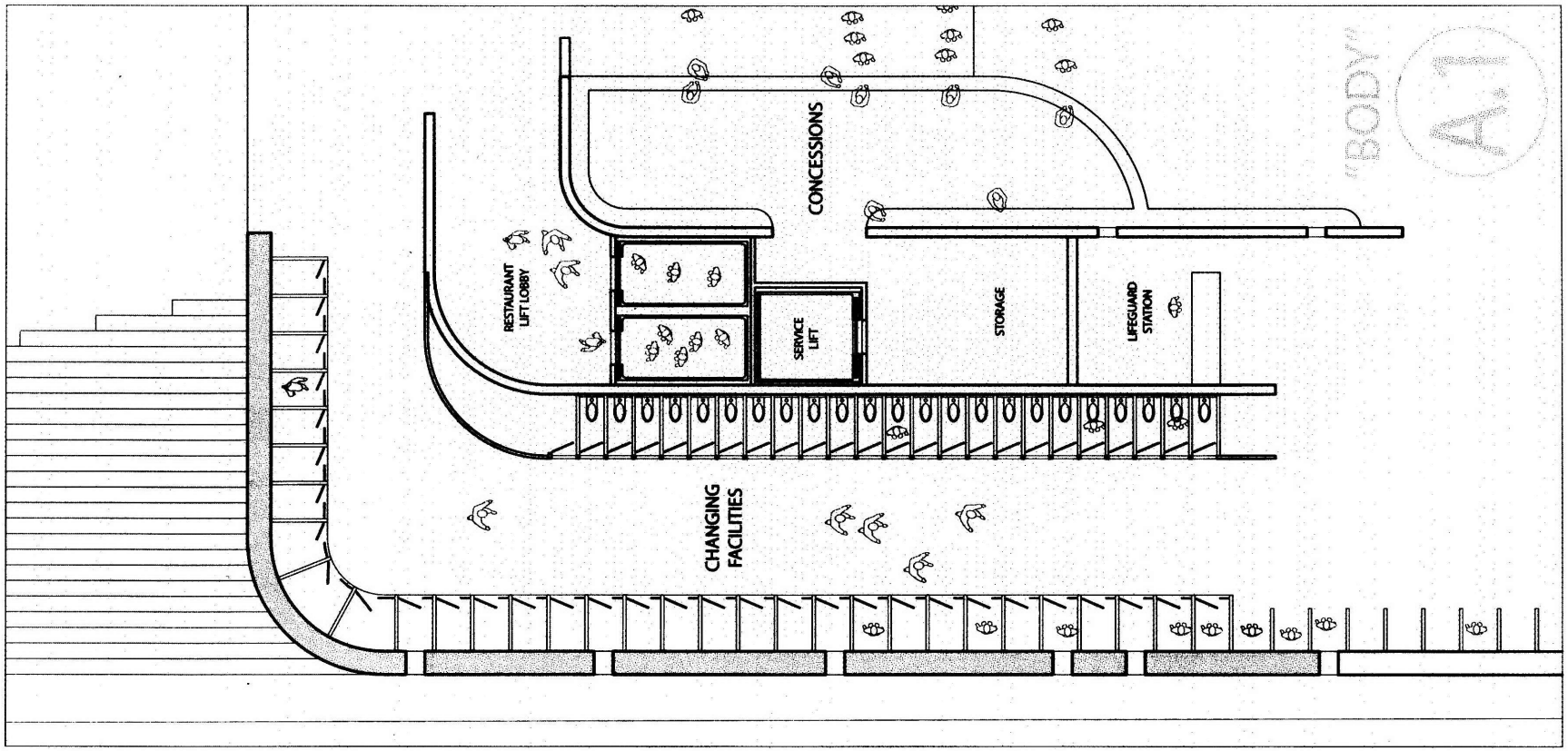


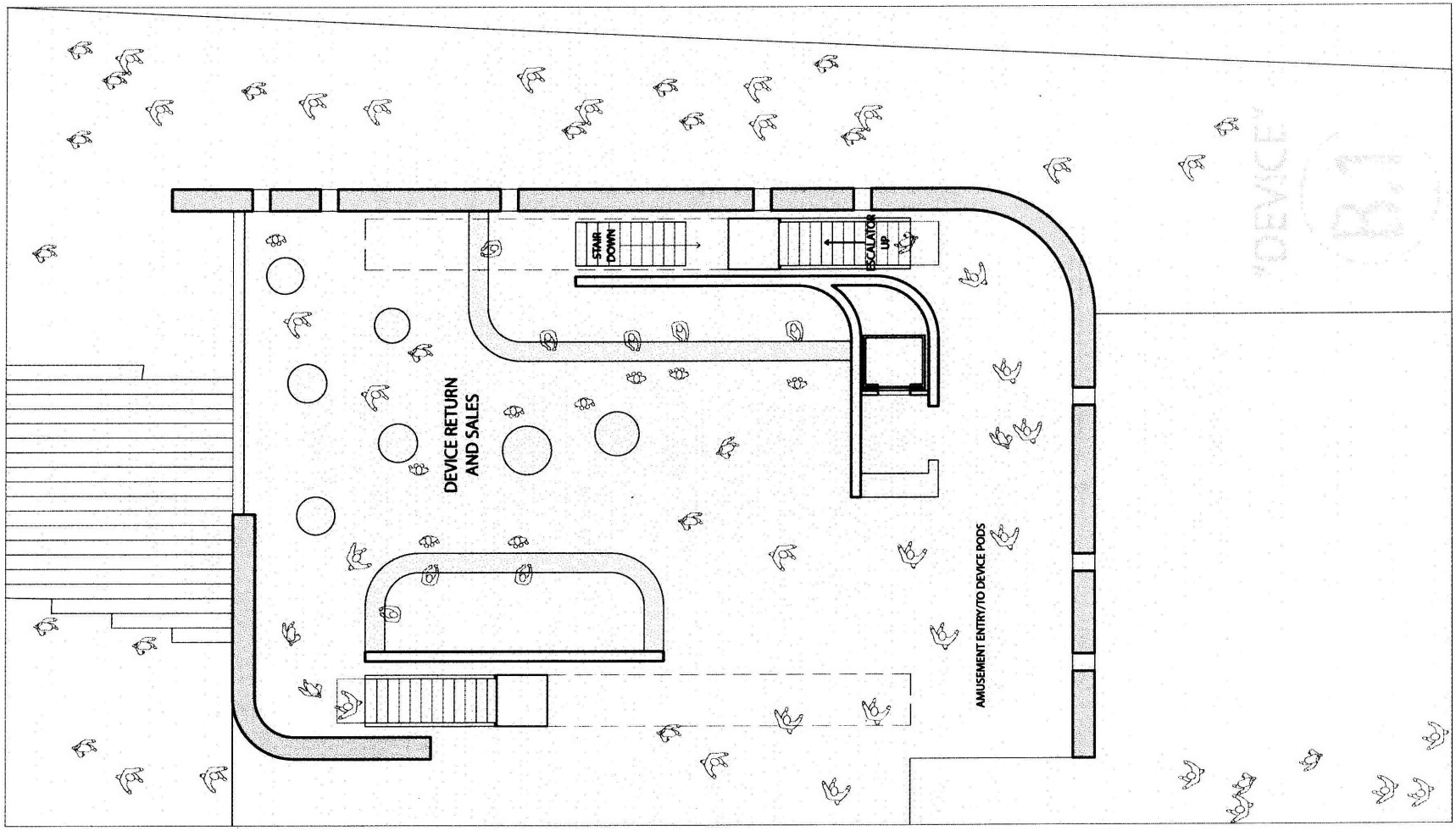
1/8"=1' WAVES GENERATED BY GRAVITY DRIVEN RECIRCULATING SYSTEM.

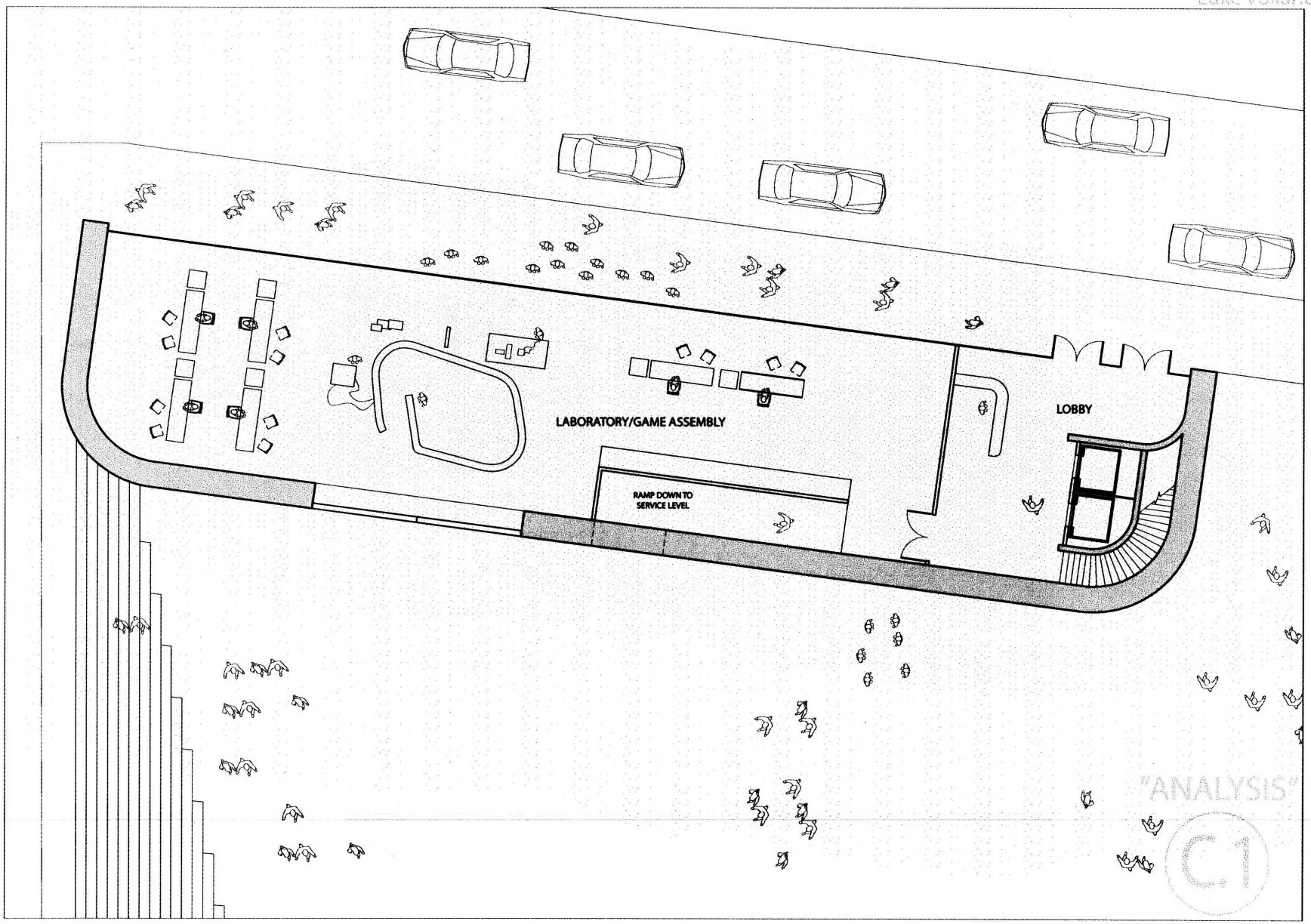


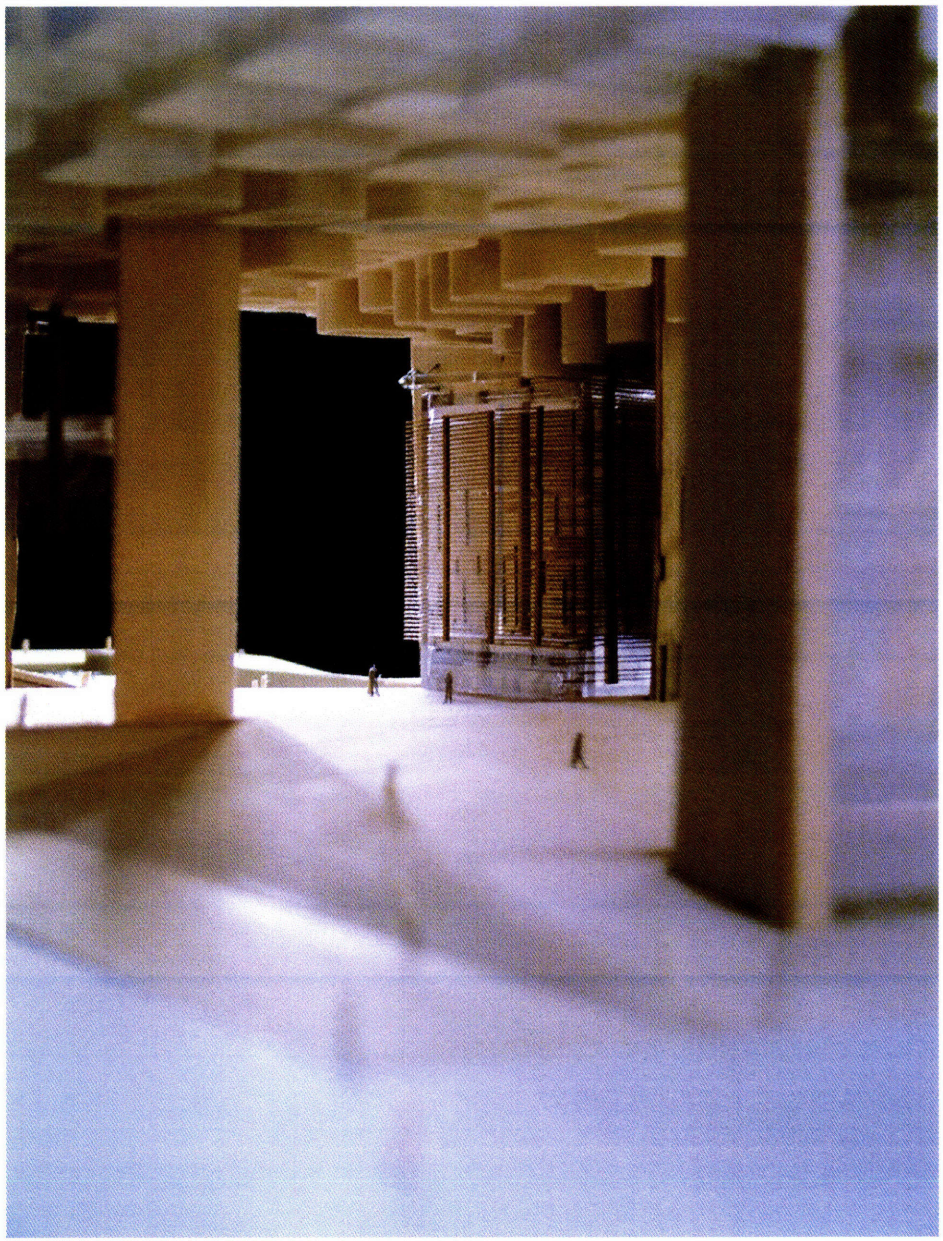


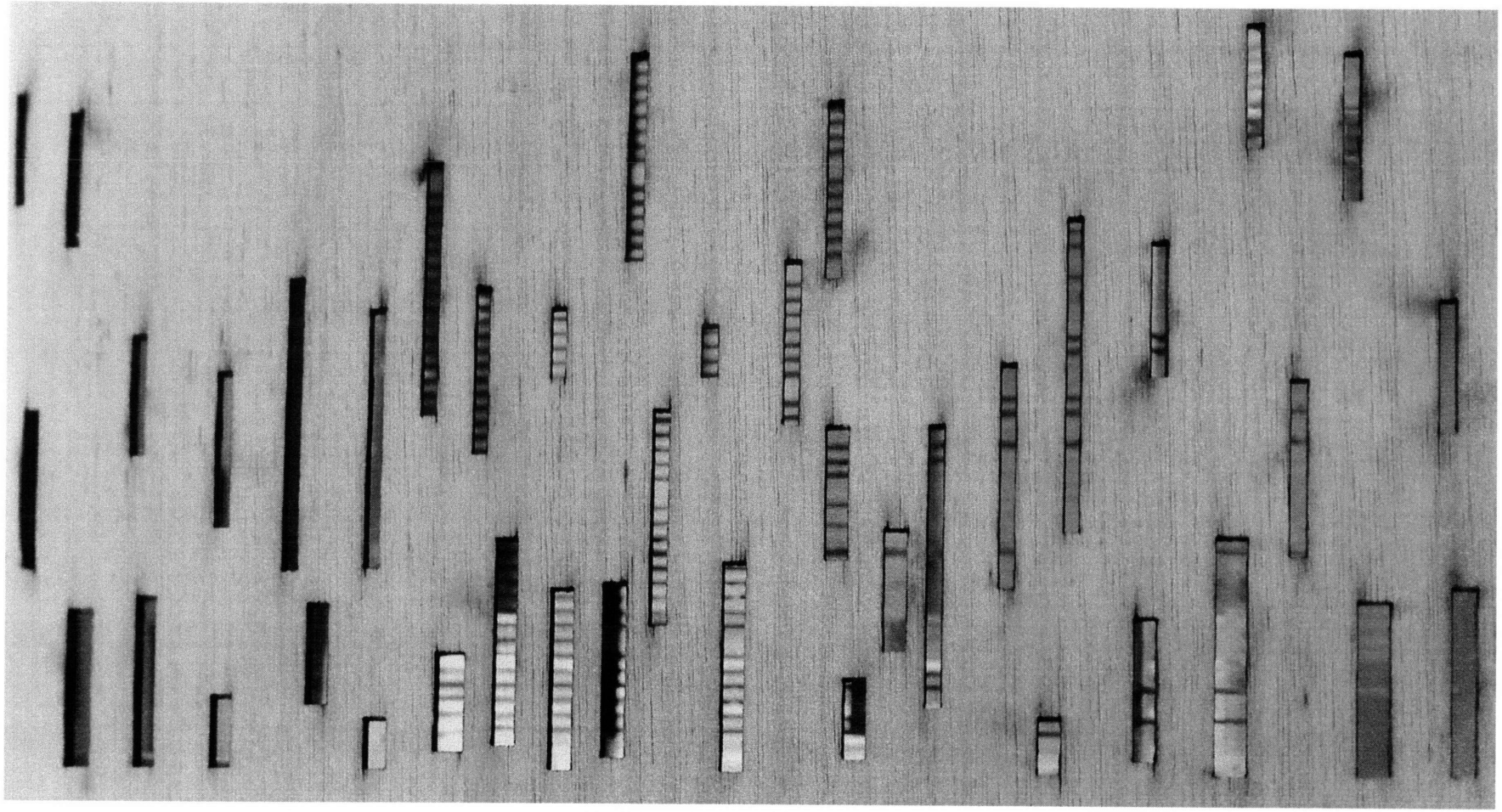
1"=1' STAINLESS STEEL FITTINGS ANCHOR DECK. WAVES FROM POOL PASS THROUGH DECKING TO CREATE DELIGHTFUL SURPRISE.

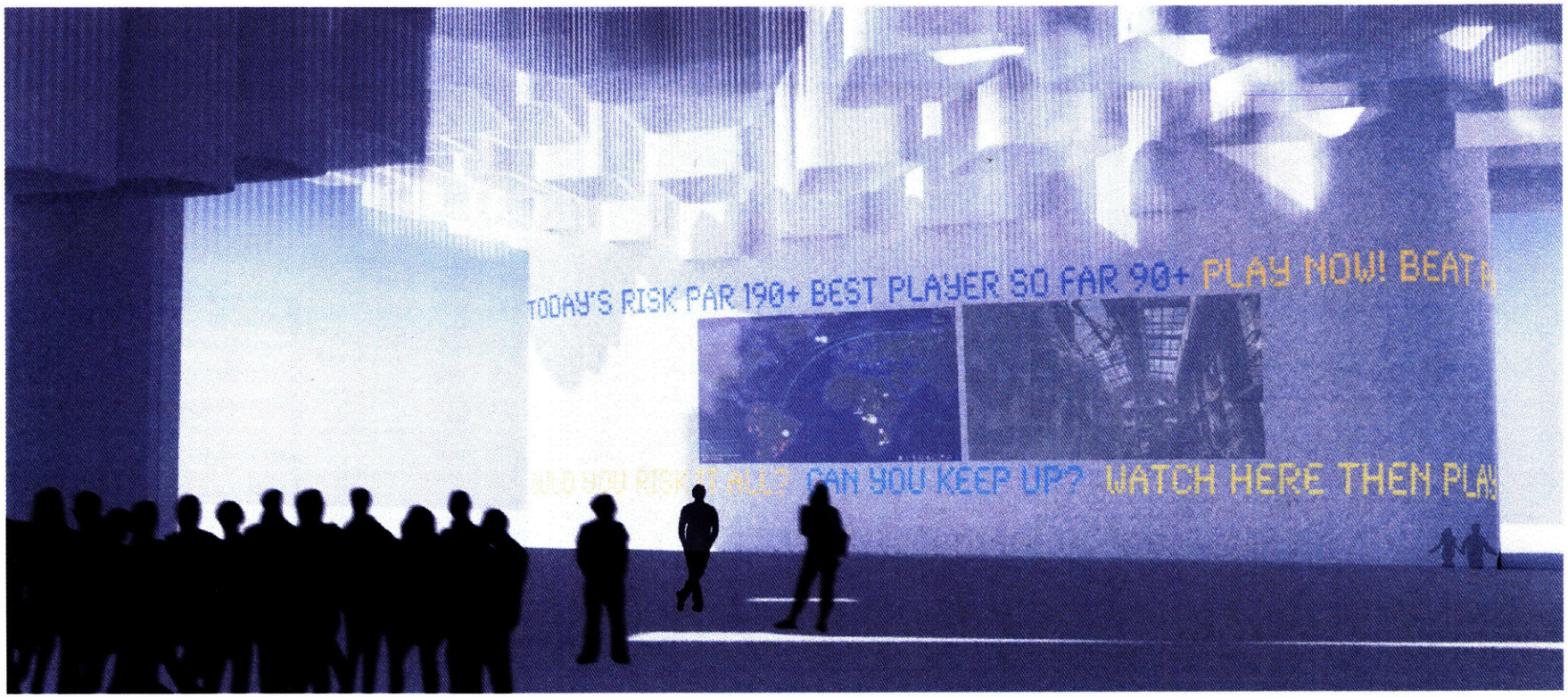

CONCESSIONS
RESTAURANT LIFT LOBBY
SERVICE LIFT
STORAGE
LIFEGUARD STATION
CHANGING FACILITIES
"BODY"

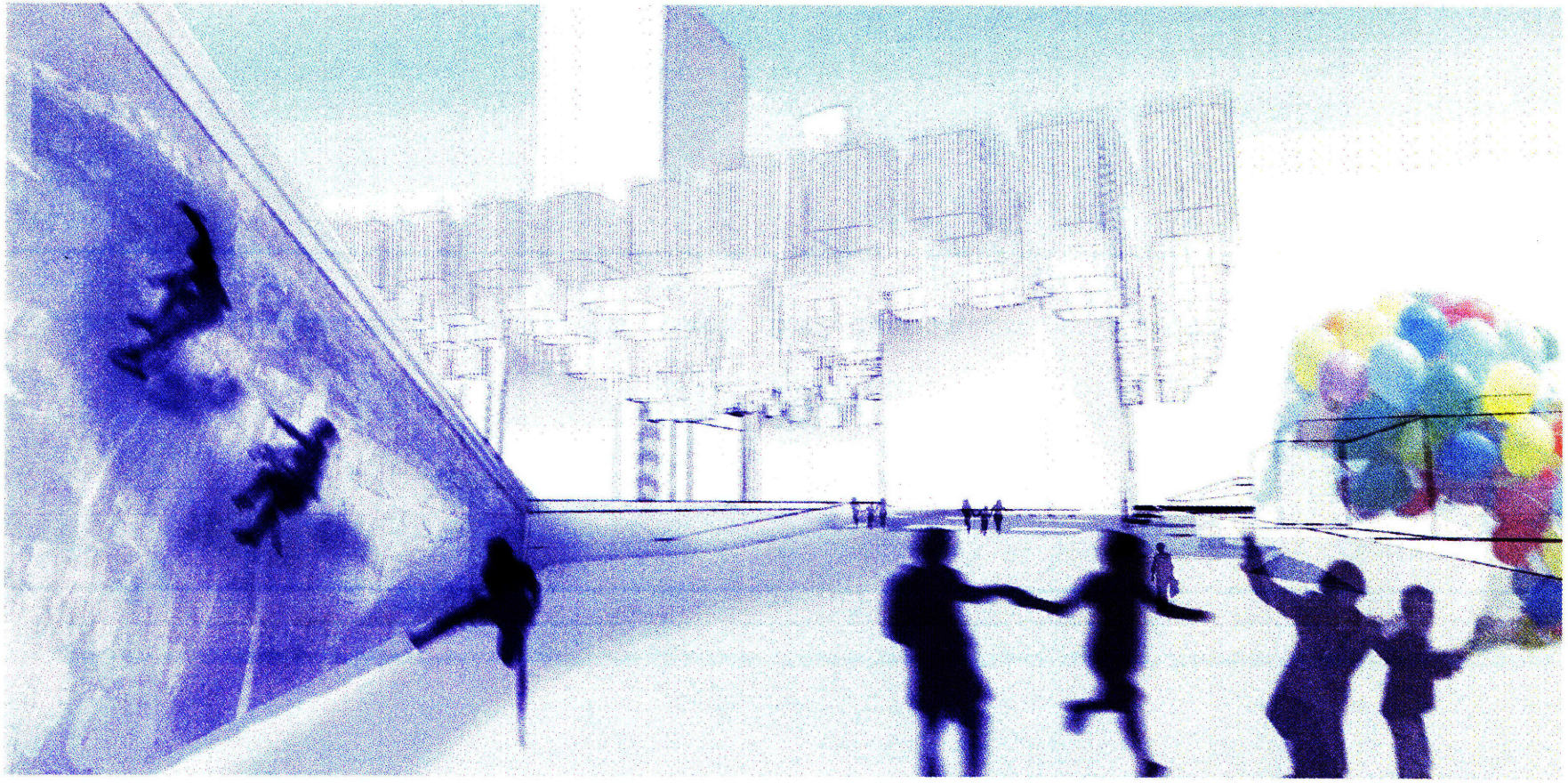

STAIR DOWN
ESCALATOR UP
DEVICE RETURN AND SALES
AMUSEMENT ENTRY/TO DEVICE PODS

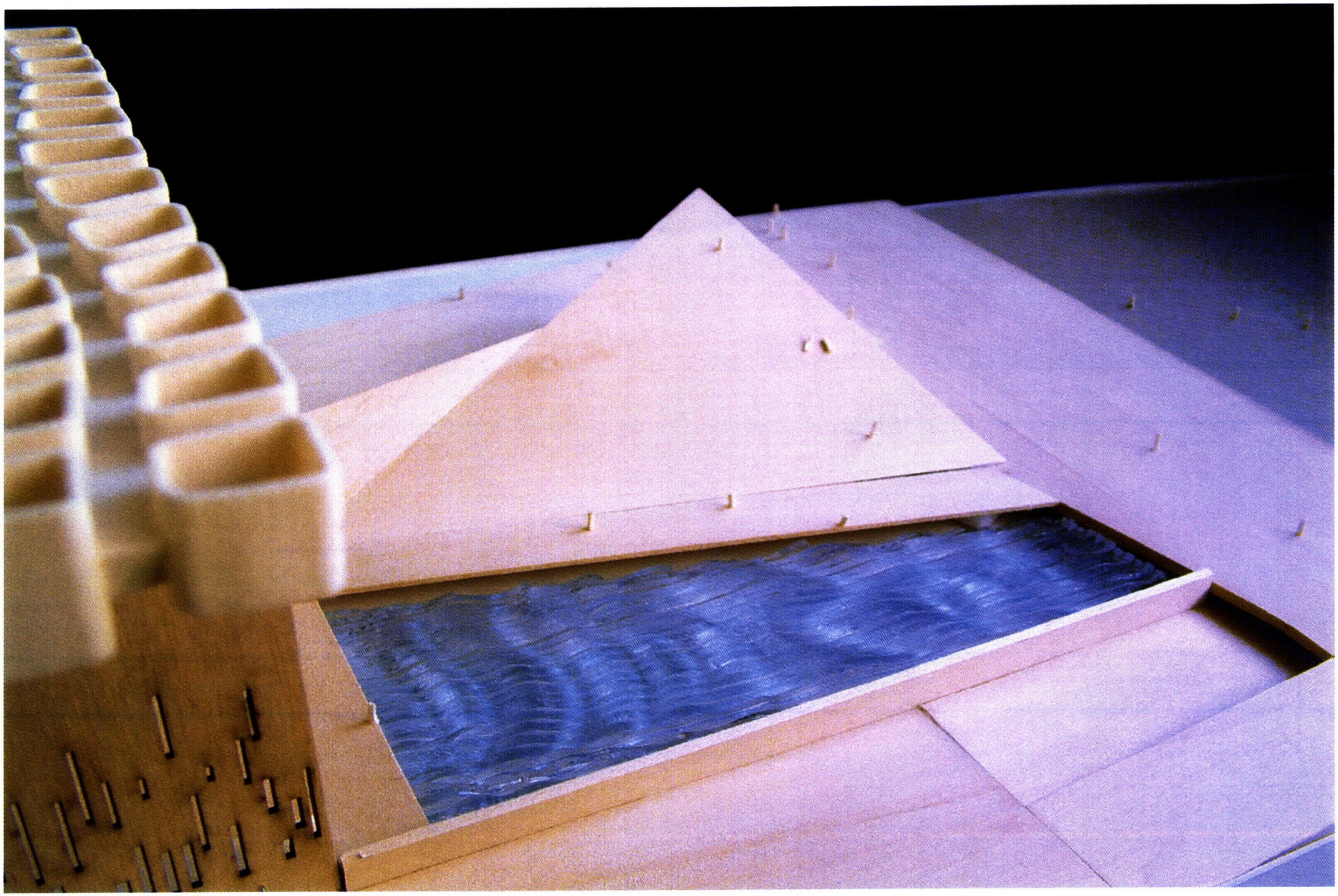

LABORATORY/GAME ASSEMBLY
RAMP DOWN TO SERVICE LEVEL
LOBBY

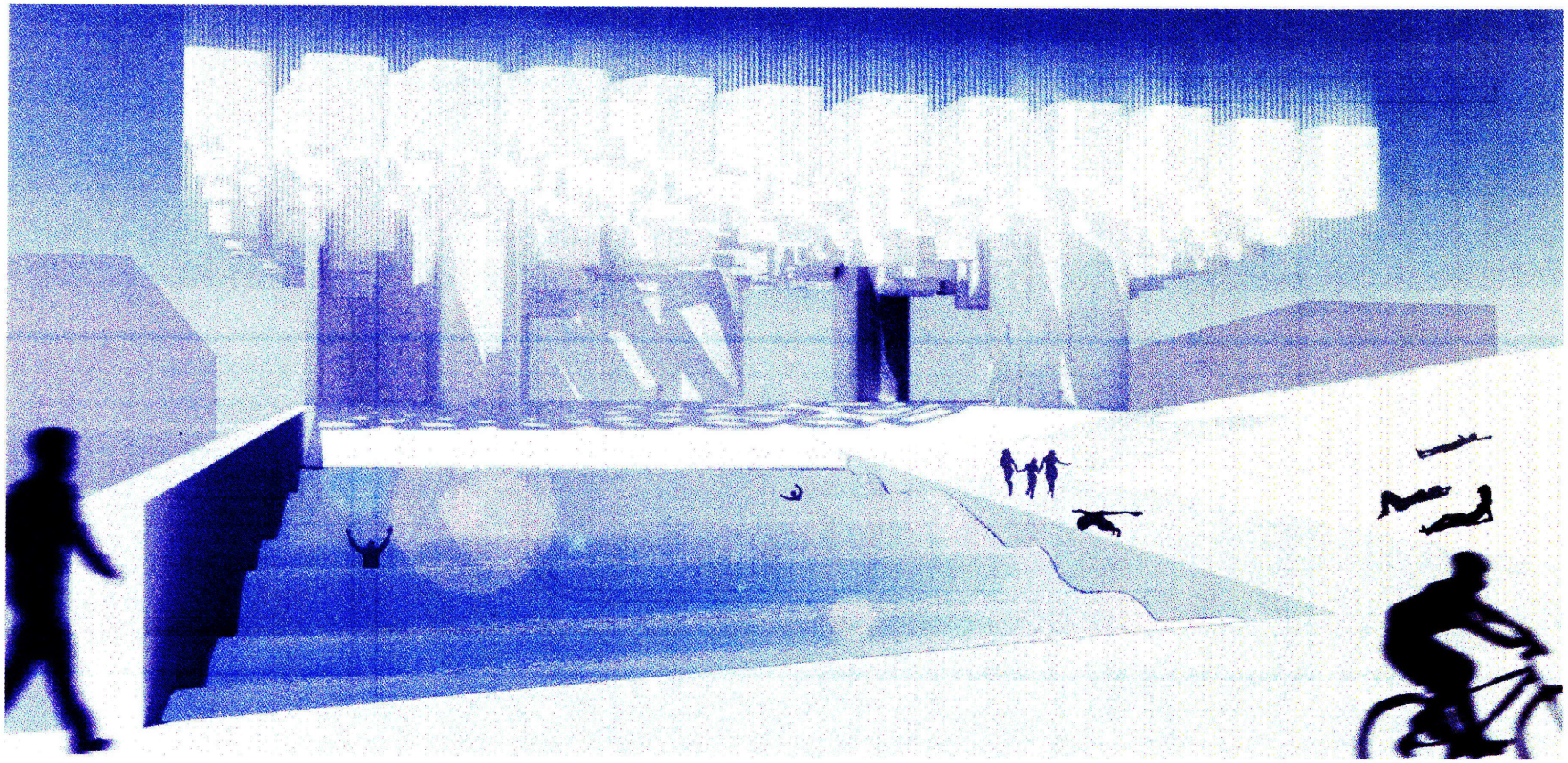


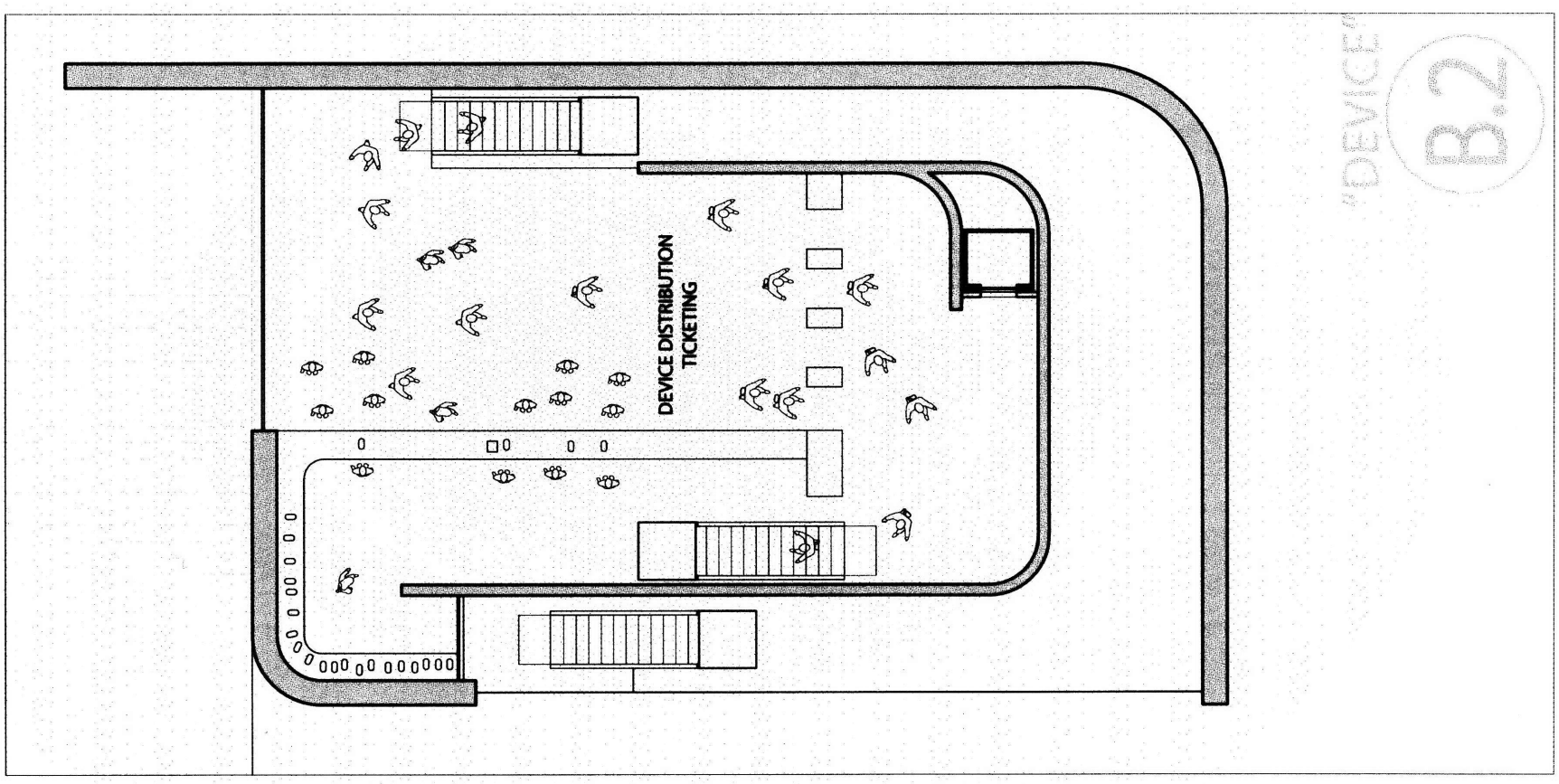


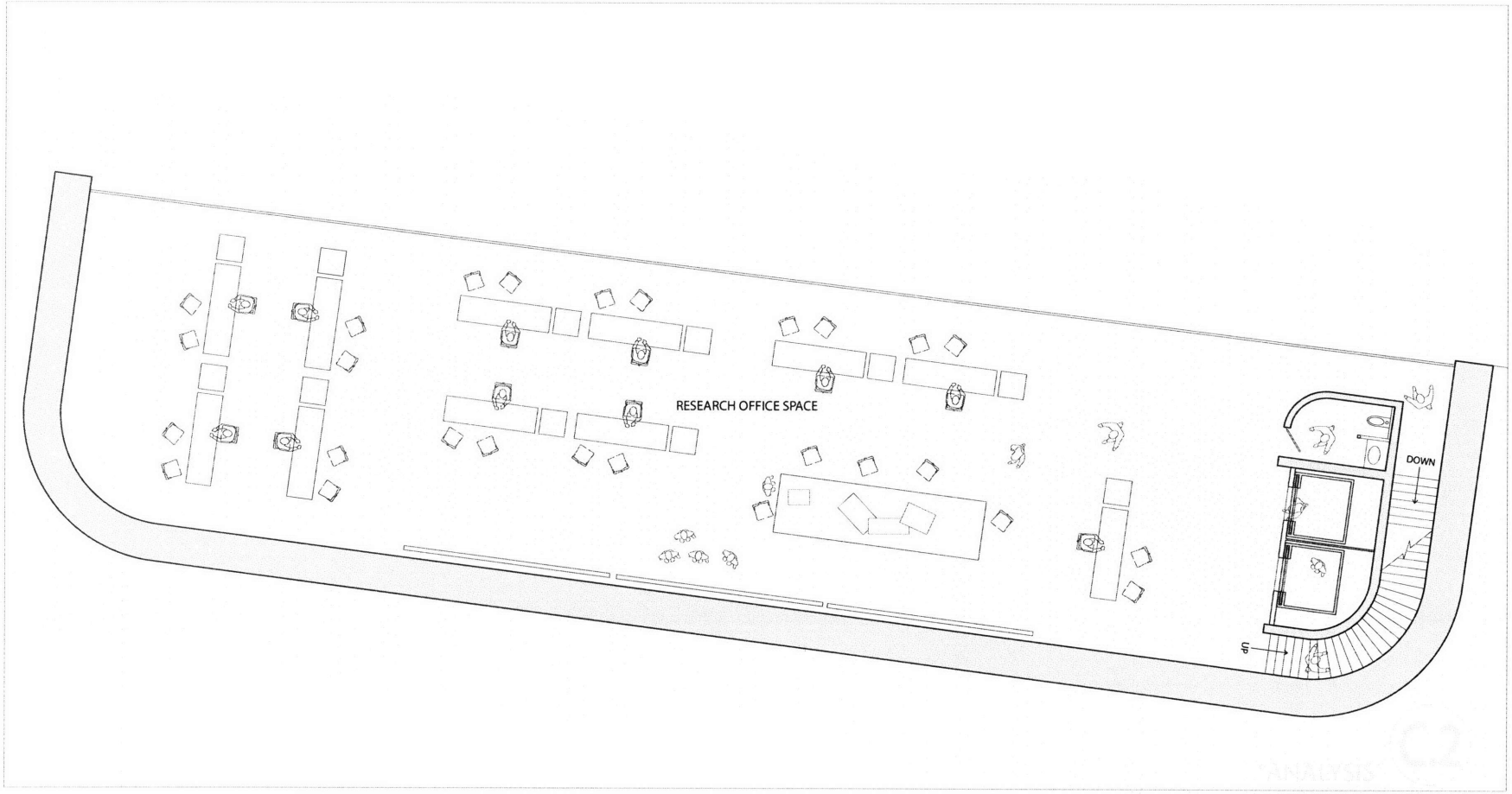

TODAY'S RISK PAR 190+ BEST PLAYER SO FAR 90+ PLAY NOW! BEAT
CAN YOU KEEP UP? WATCH HERE THEN PLA

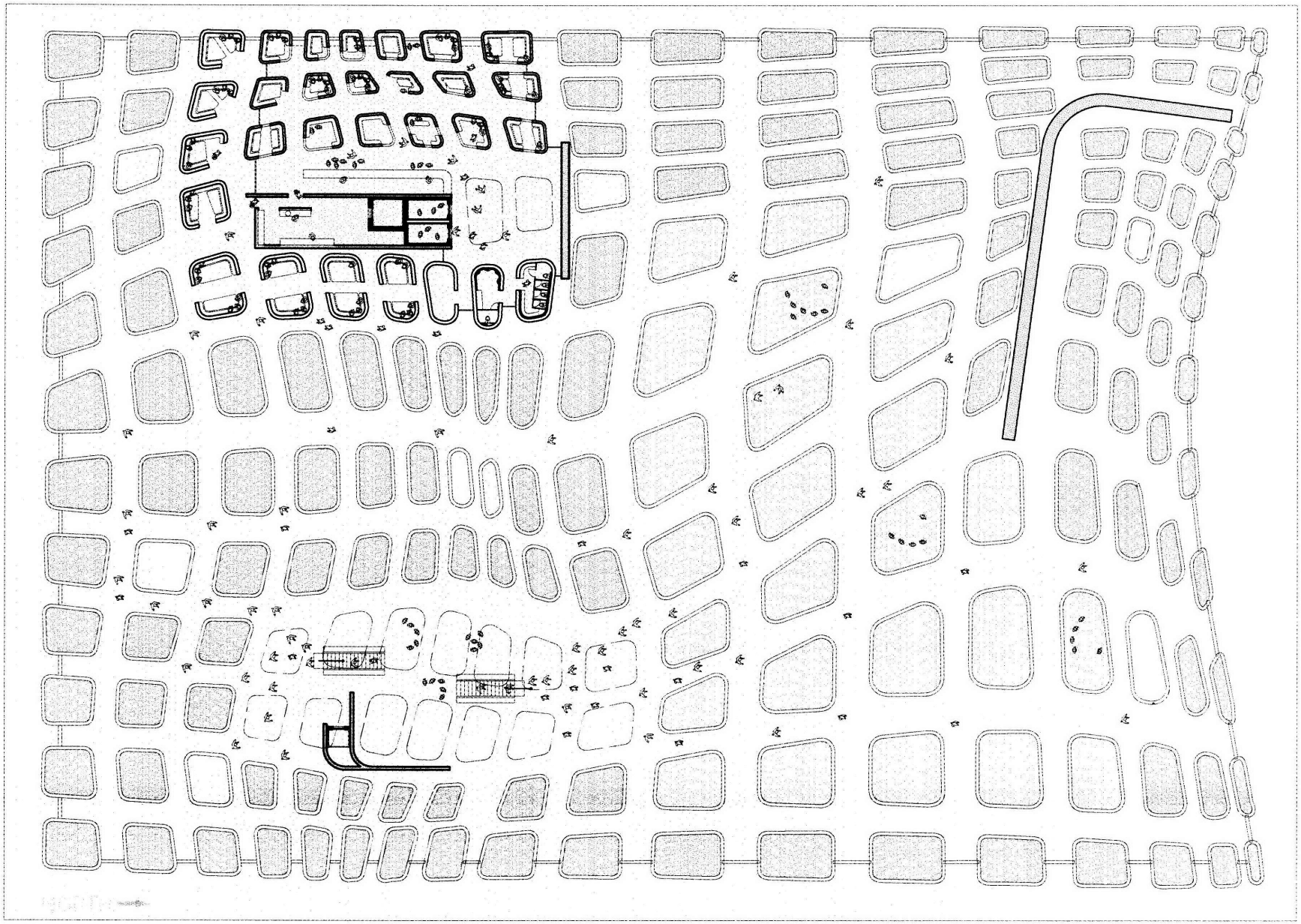


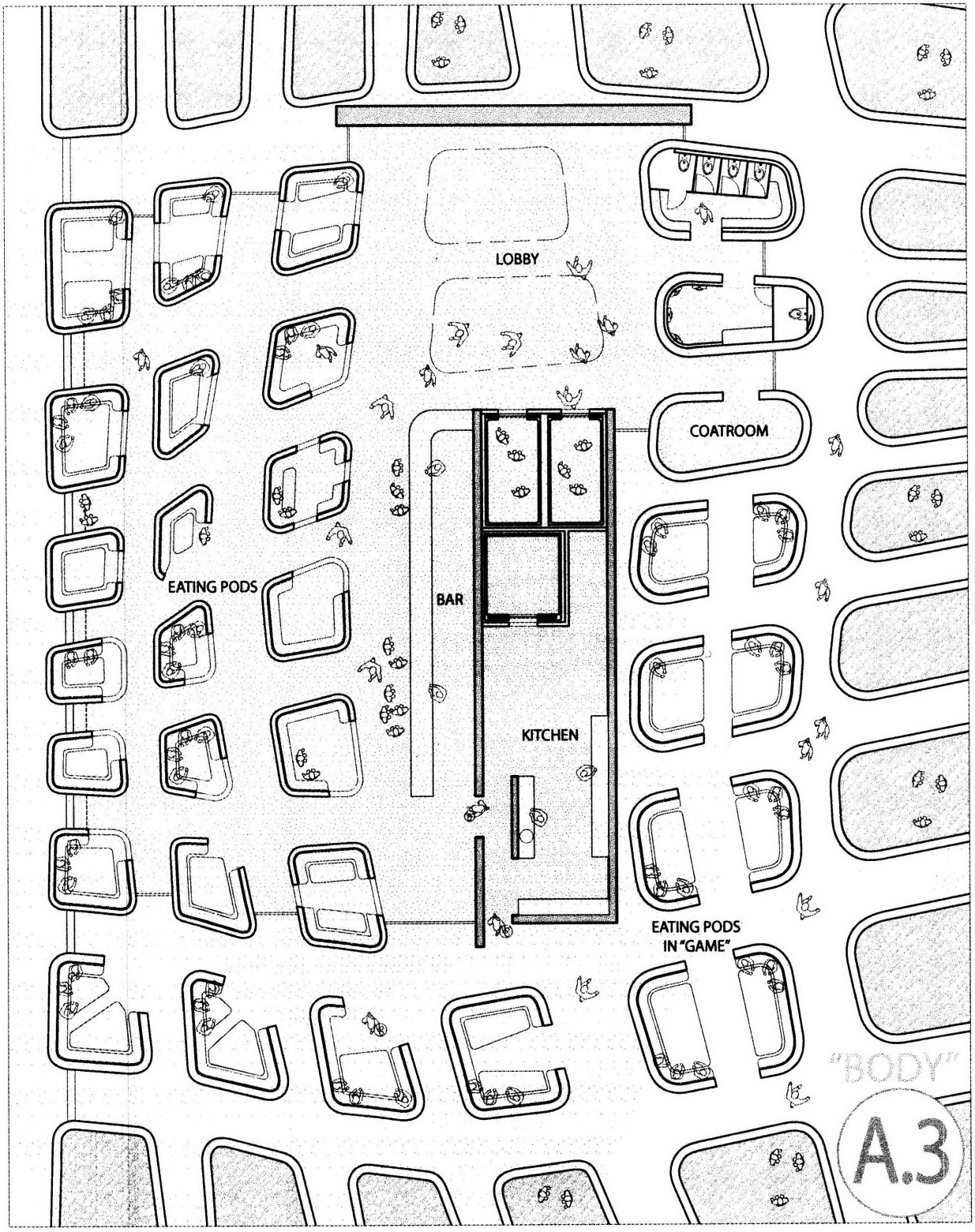


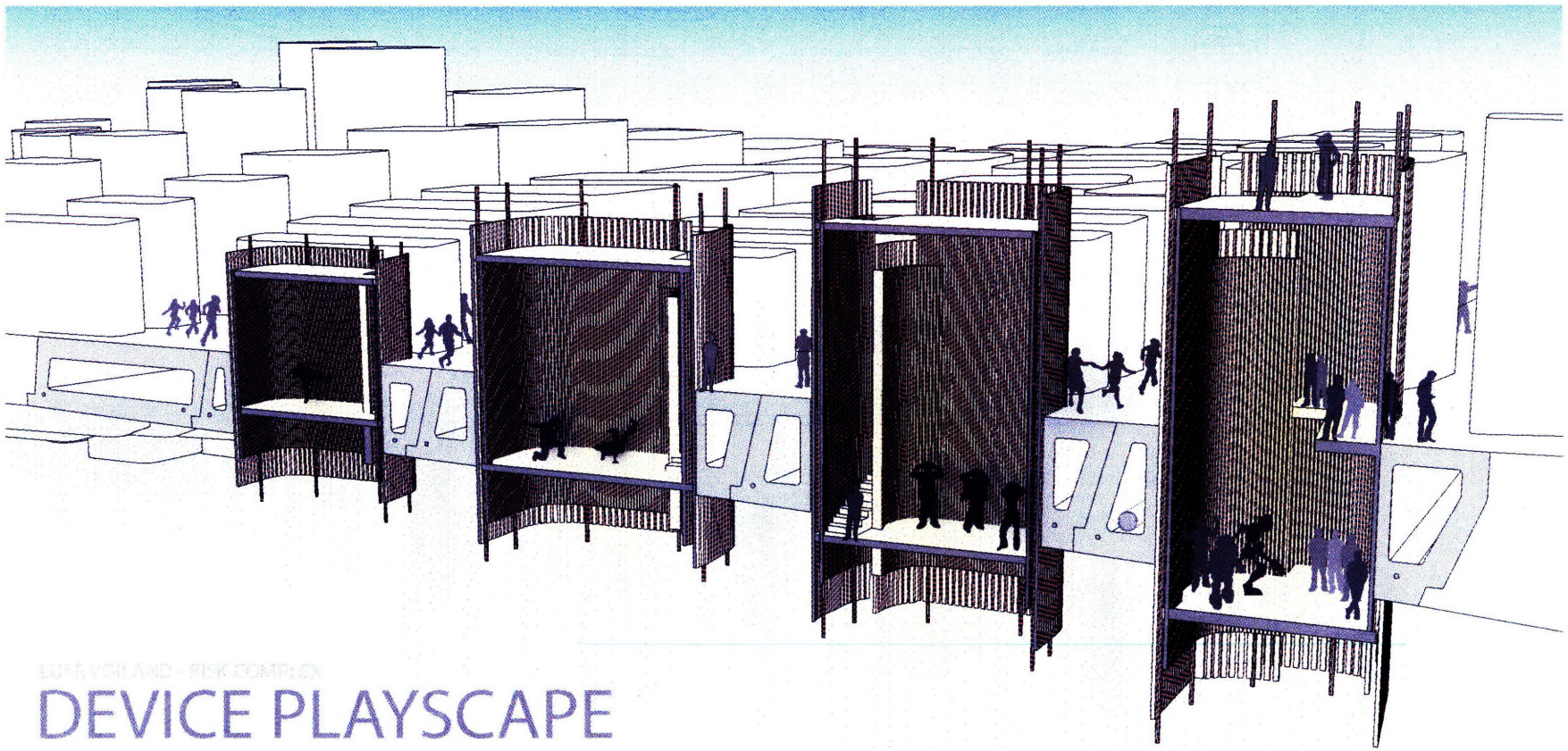



DEVICE DISTRIBUTION
TICKETING
"DEVICE"
B.2


RESEARCH OFFICE SPACE
DOWN
UP

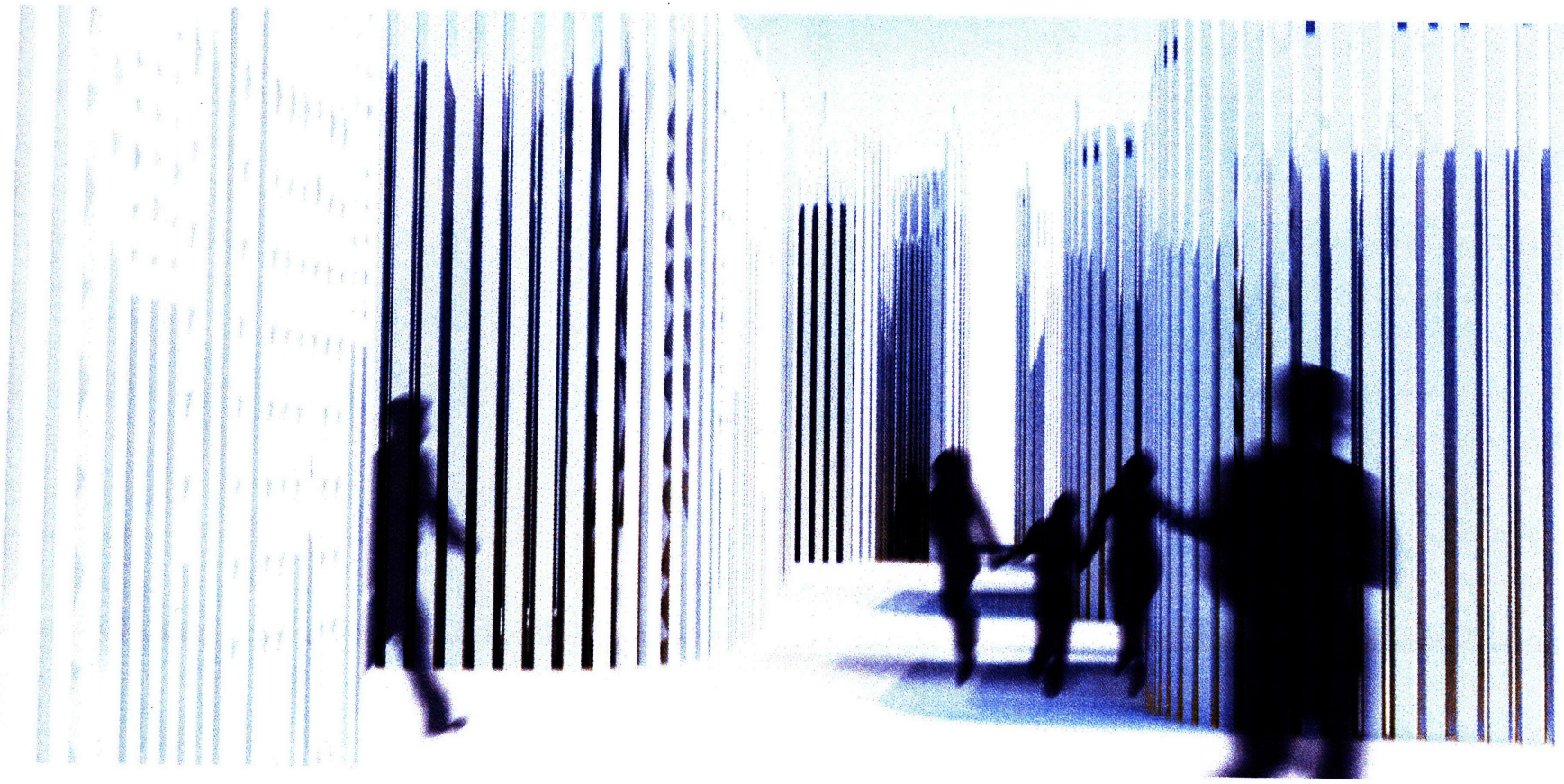


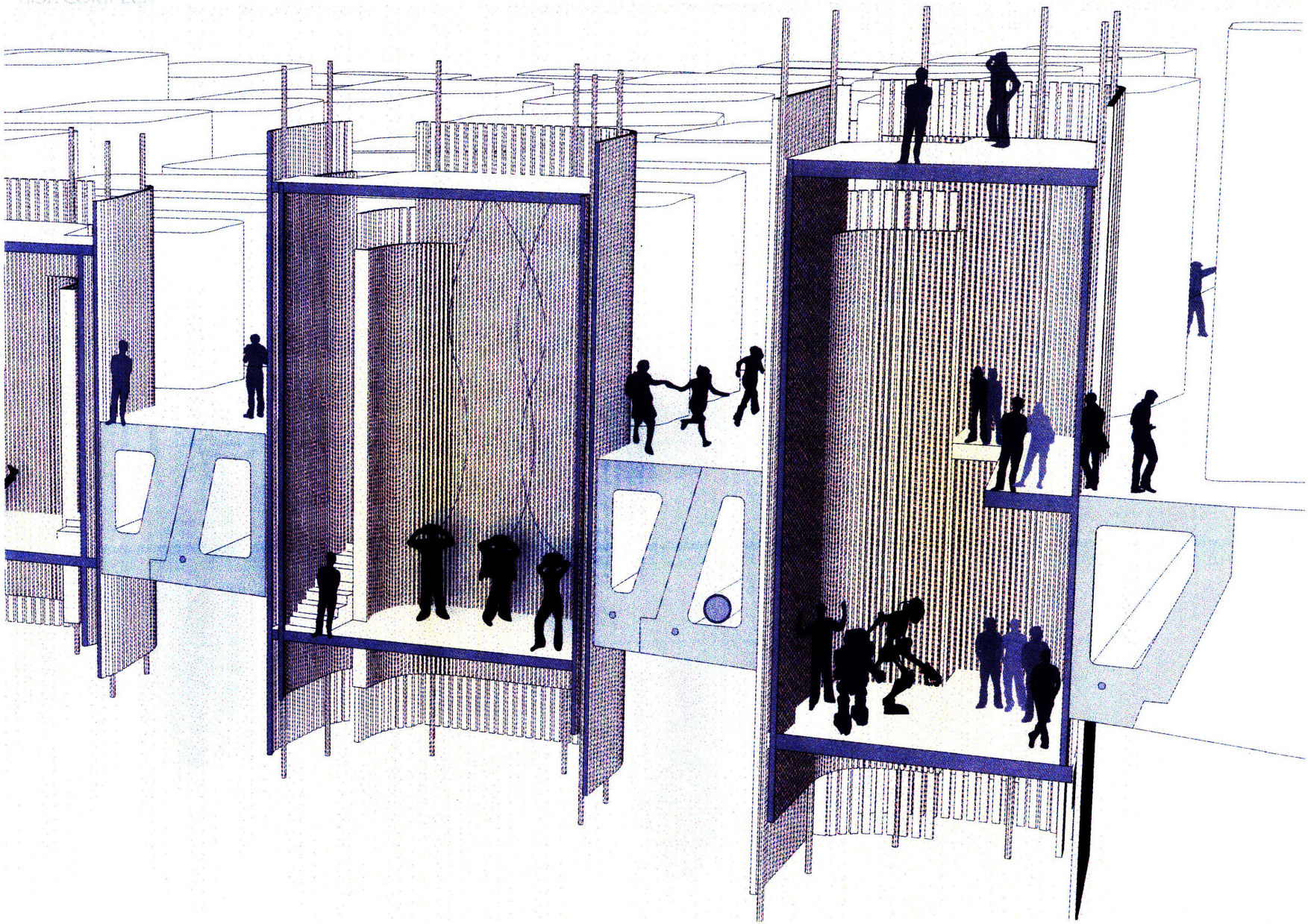

LOBBY
COATROOM
EATING PODS
BAR
KITCHEN
EATING PODS
IN "GAME"
"BODY"
A.3

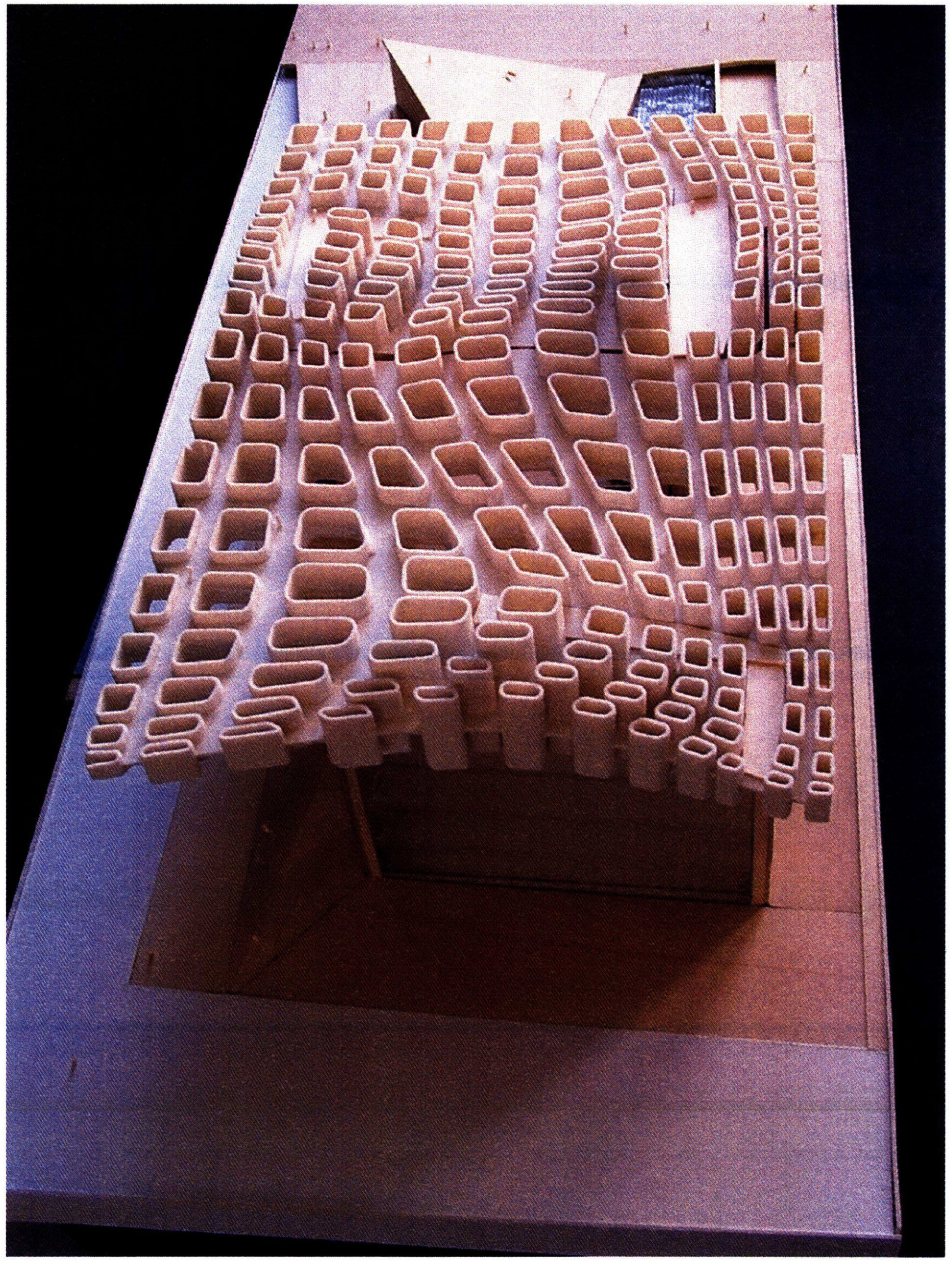


LUKE VOLAND - RISK COMPLEX

DEVICE PLAYSCAPE

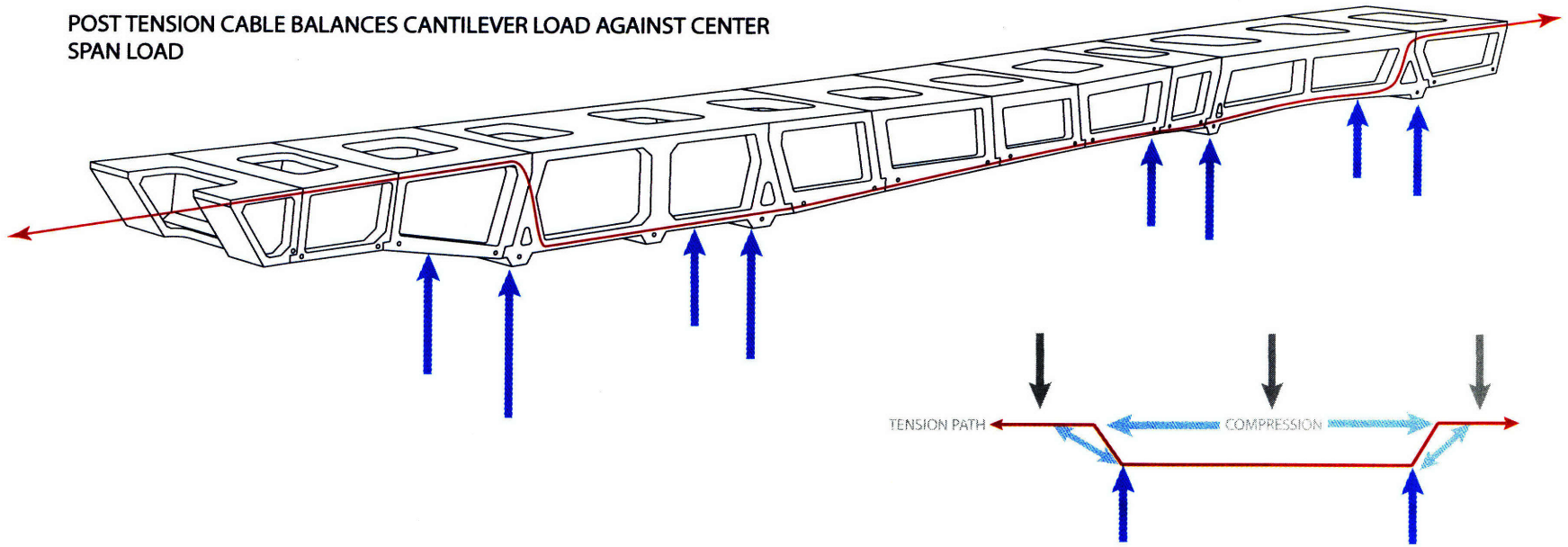




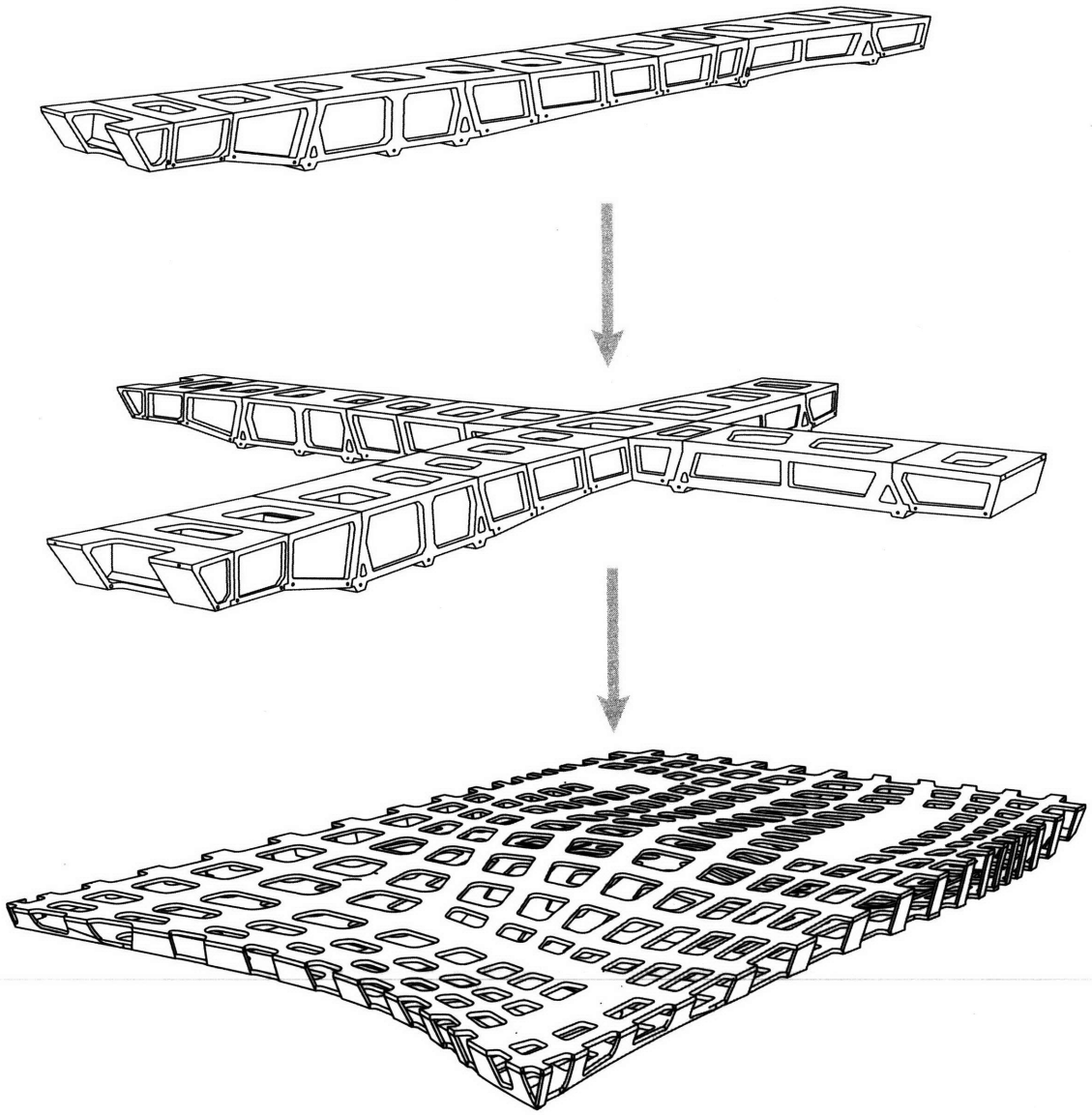


STRUCTURAL SYSTEM

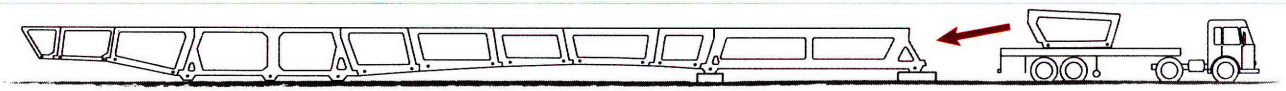
POST TENSION CABLE BALANCES CANTILEVER LOAD AGAINST CENTER SPAN LOAD



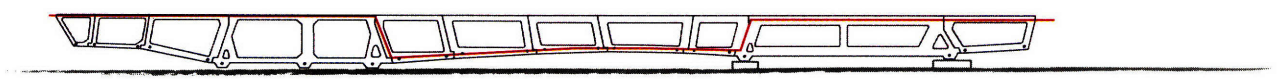
SYSTEM OPERATES BIDIRECTIONALLY TO CREATE PERFORATED DECK



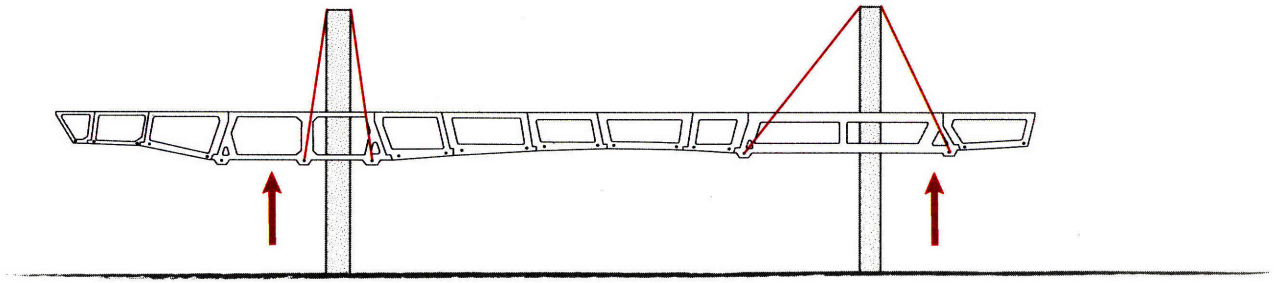
ASSEMBLY SEQUENCE



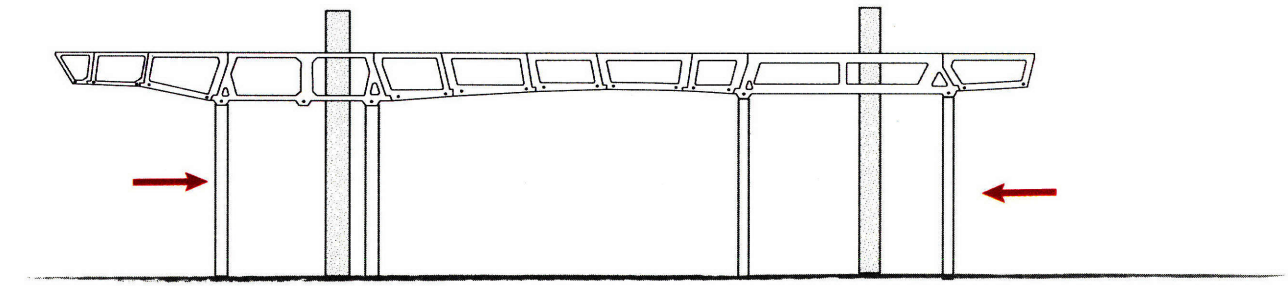
PRECAST SECTIONS ASSEMBLED AT GROUND LEVEL



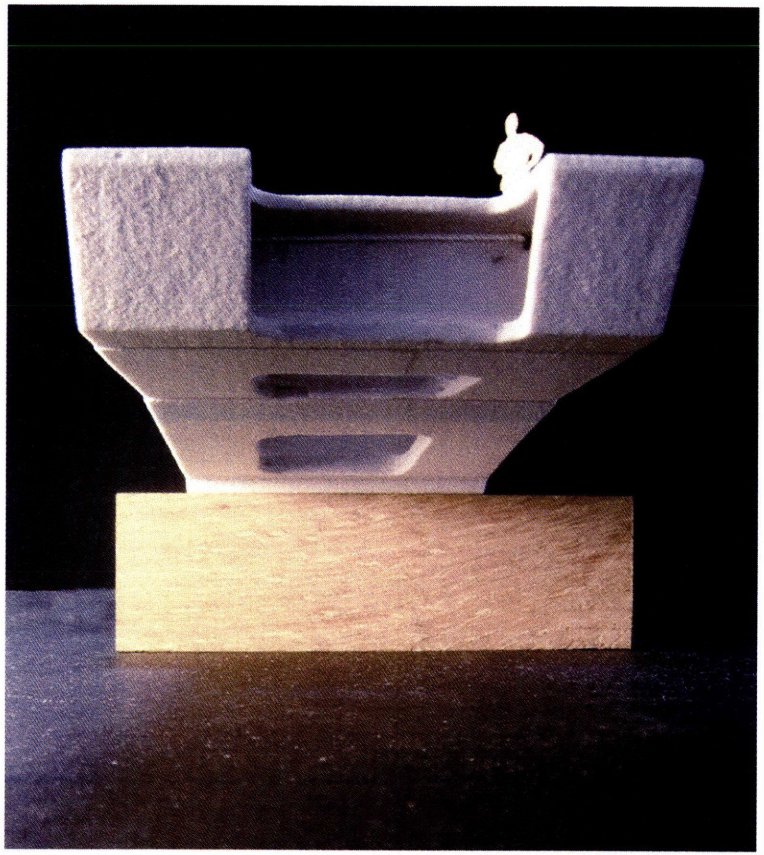
TENDONS ARE TENSIONED AT GROUND LEVEL

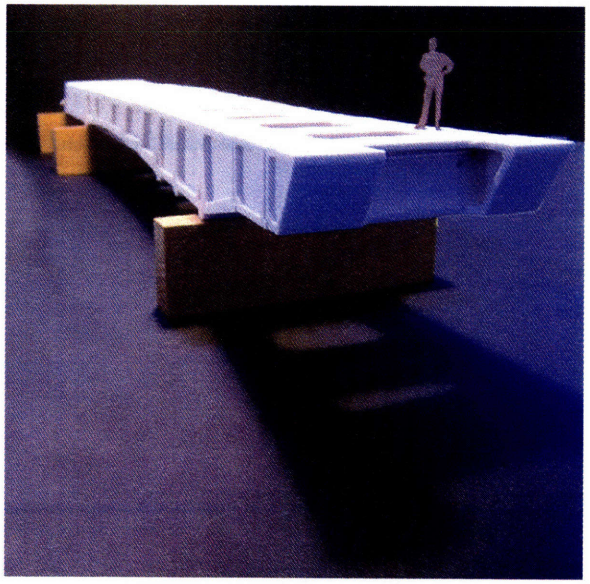


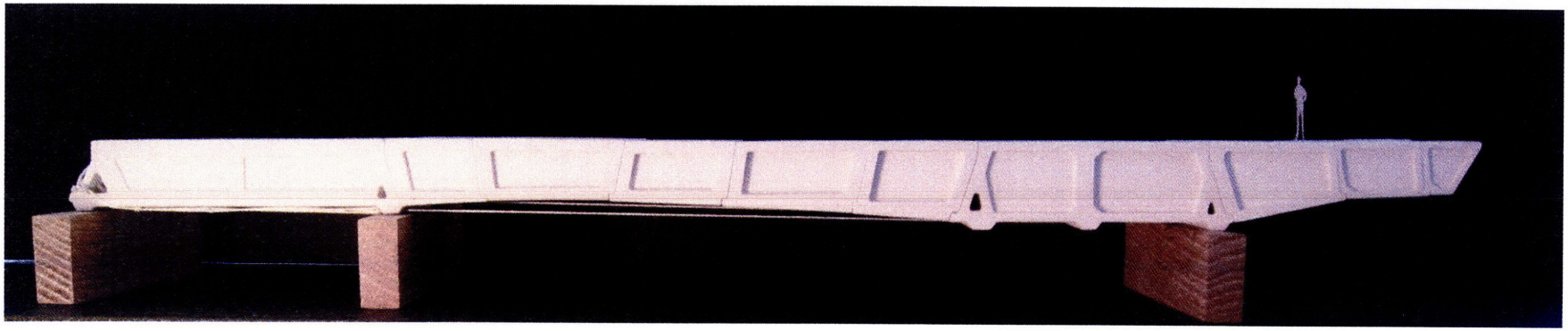
TEMPORARY SUPPORTS WITHIN POD HOLES ARE USED TO LIFT DECK



FINAL SUPPORTING WALLS ARE BUILD UNDERNEATH COMPLETE DECK



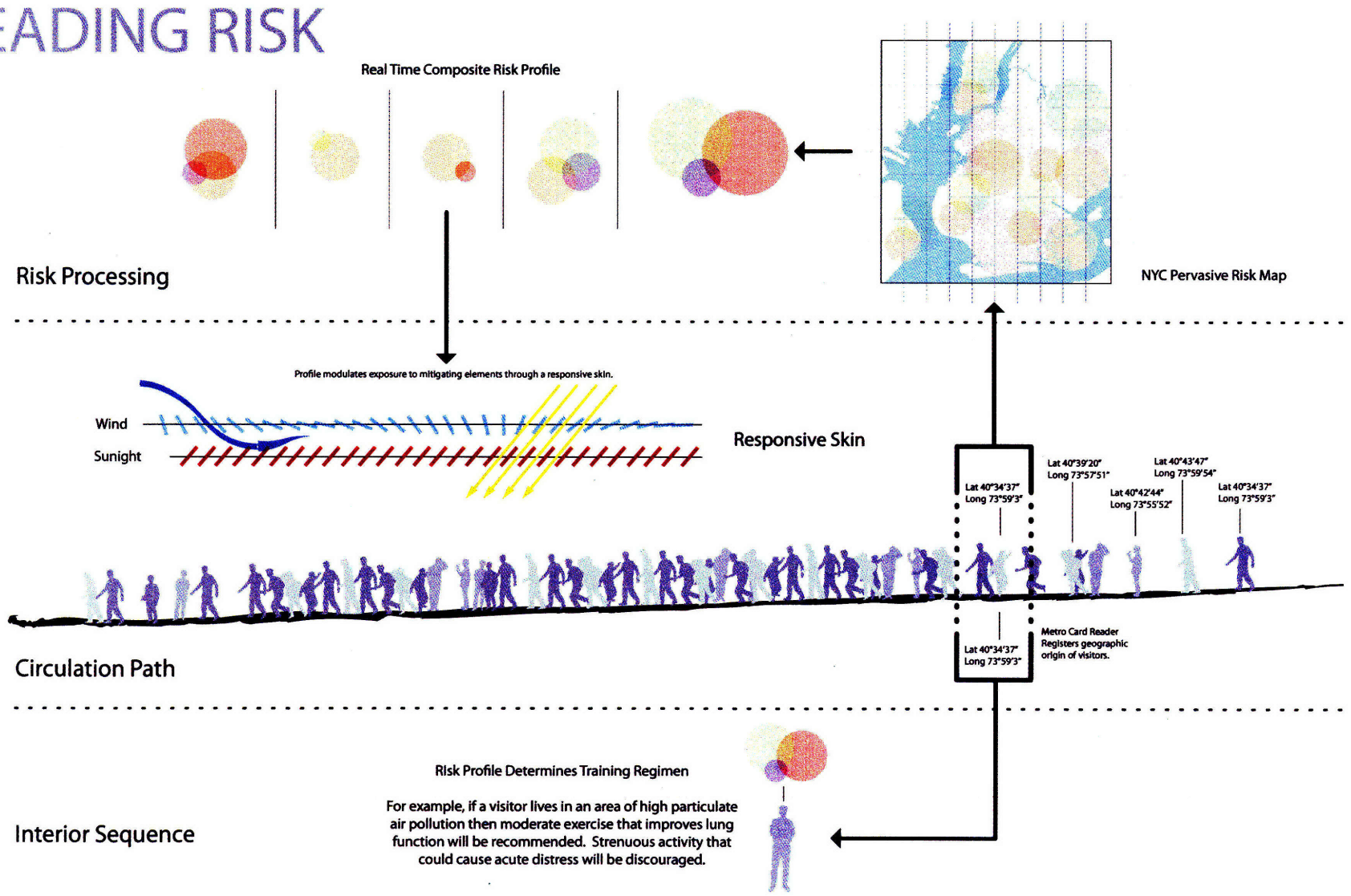




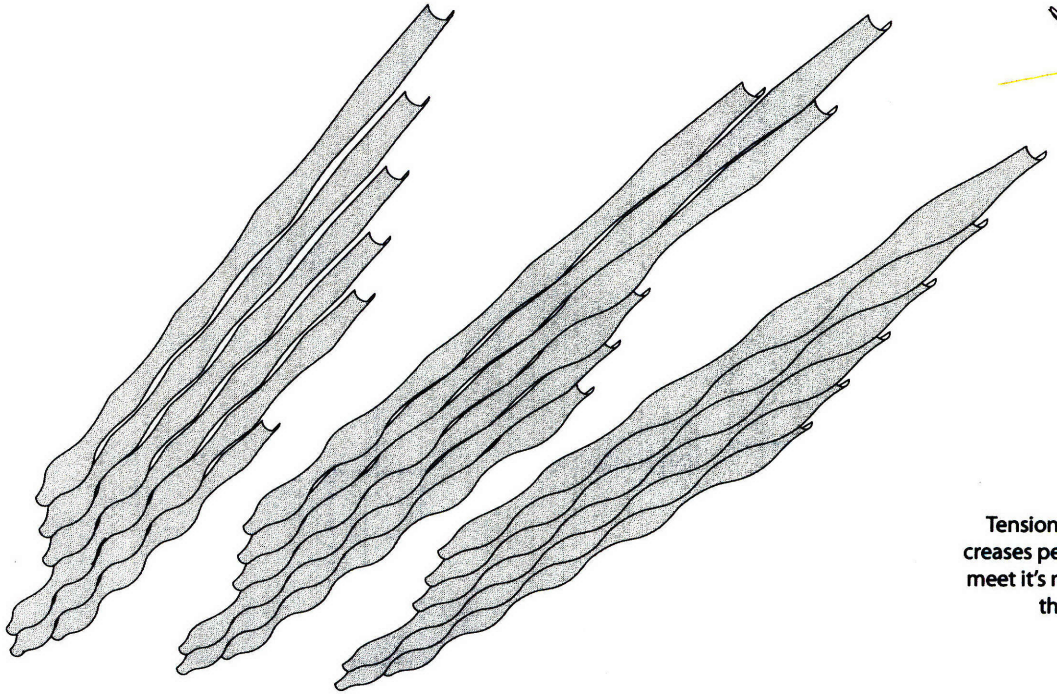
RESEARCH AND DEVELOPMENT

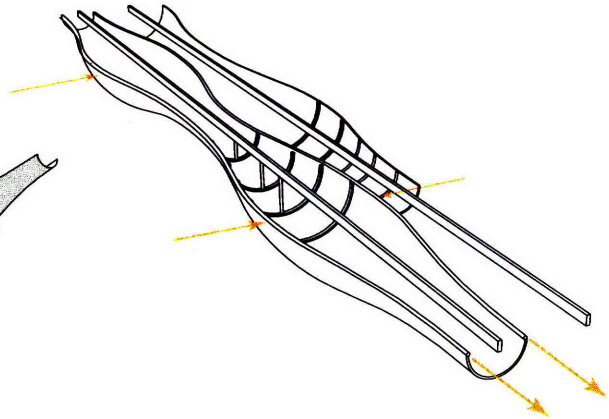
Several topics were explored through the process of creating the RISK COMPLEX. Some were manifest in the final scheme and some were not. This section contains a sampling of some of the ideas that were developed throughout the process.

READING RISK

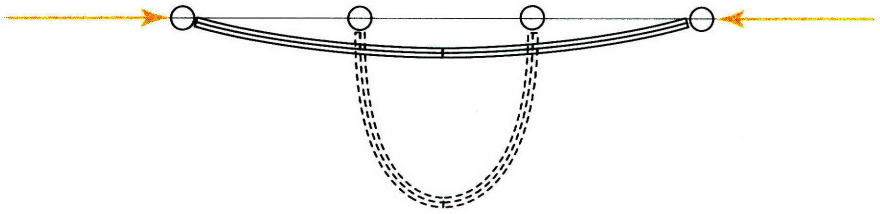


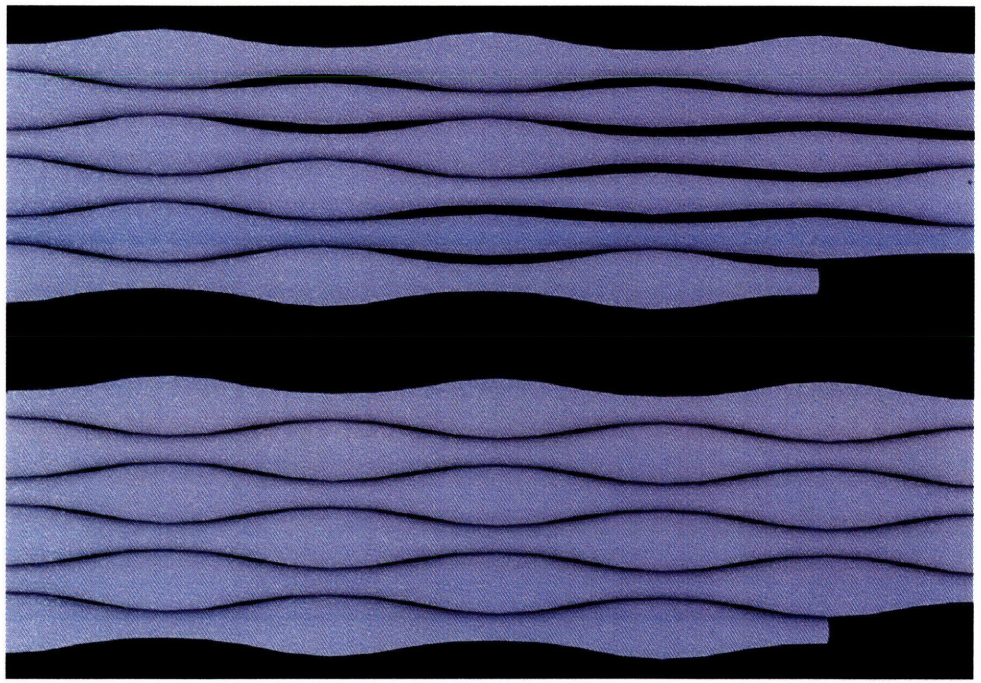
REACTIVE PERMEABILITY

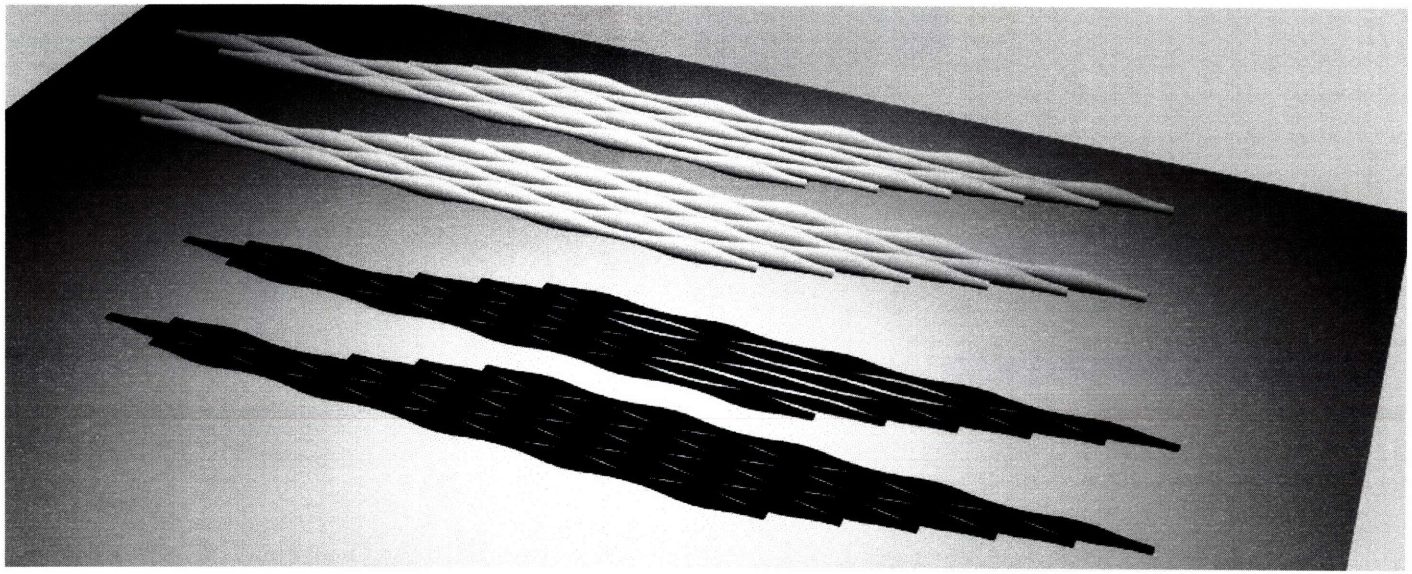




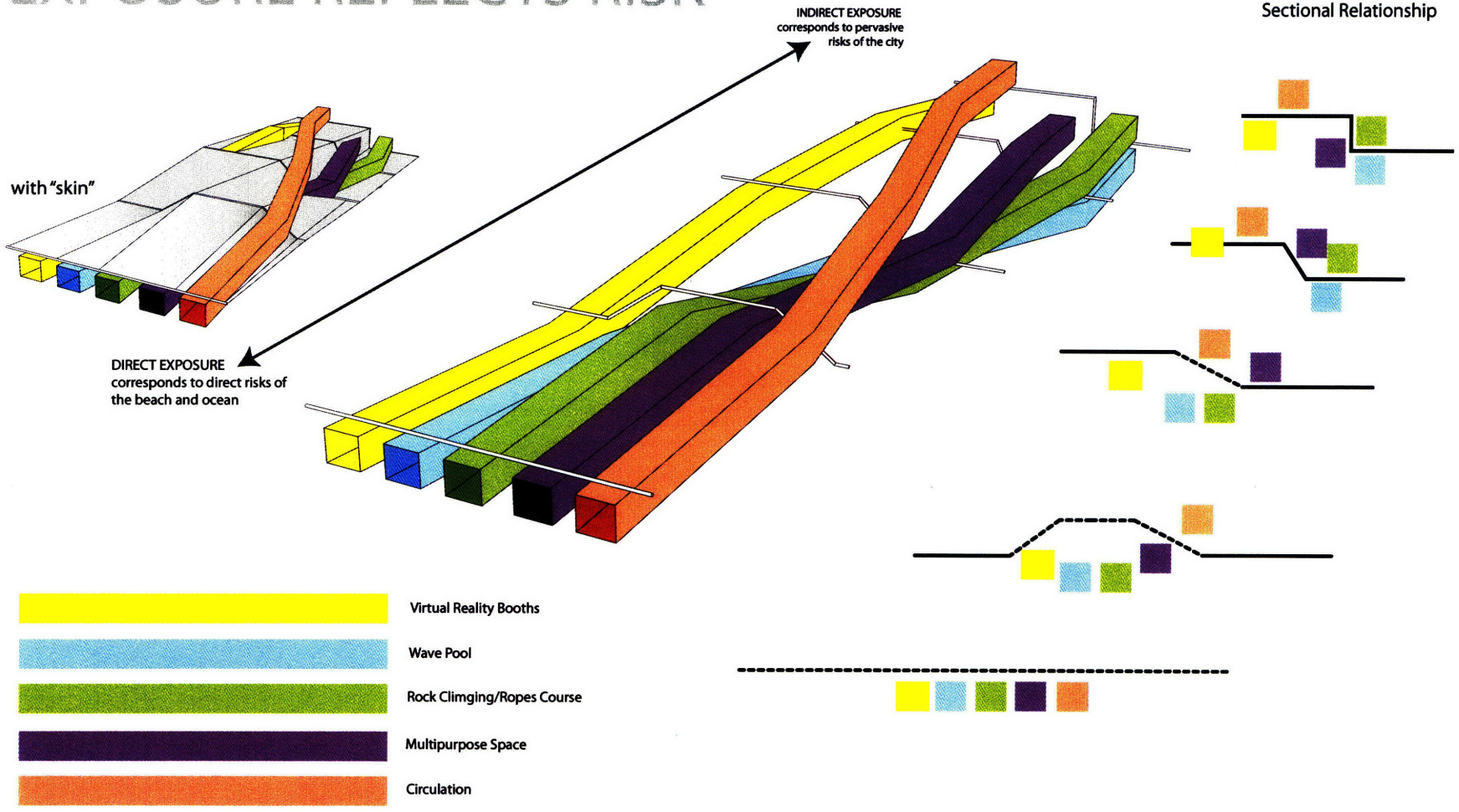
Tension applied through the system increases or decreases permeability of the system. Each unit expands to meet it's neighboor. When tension is applied to one row the rest expand to accomodate the gaps.



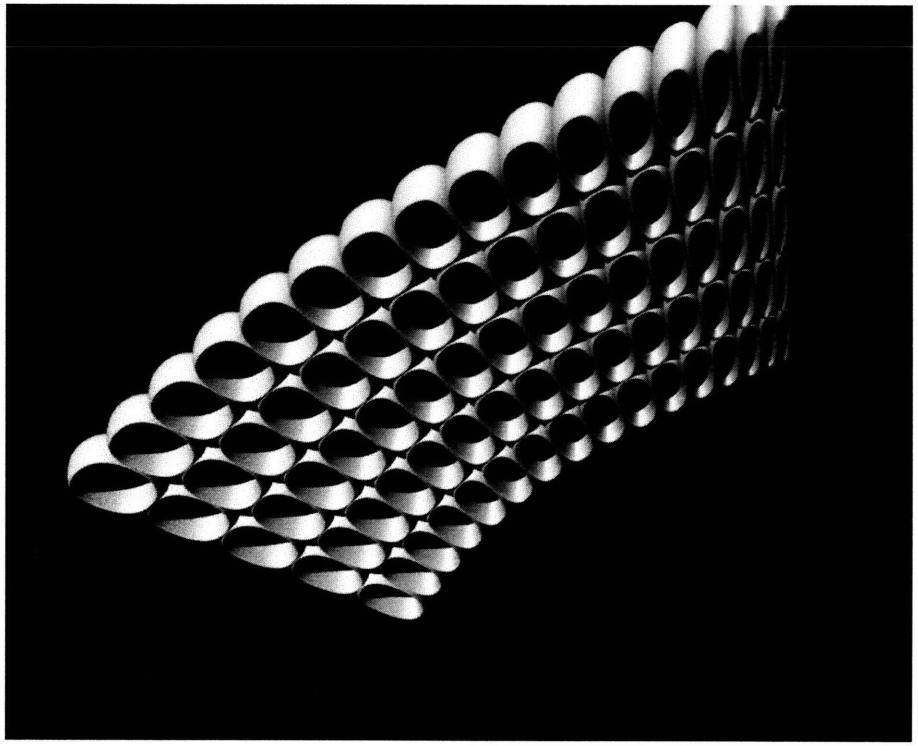




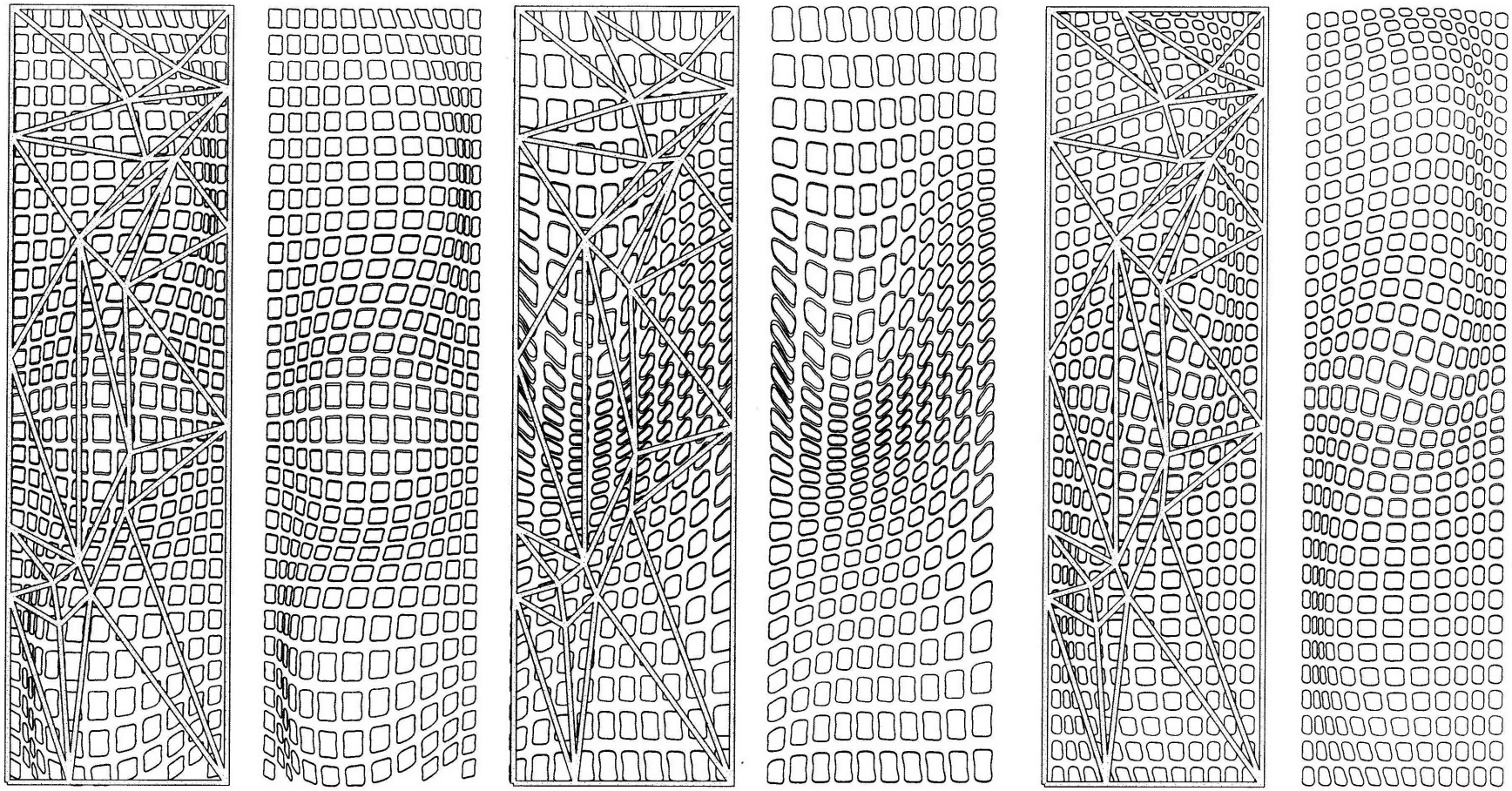
EXPOSURE REFLECTS RISK

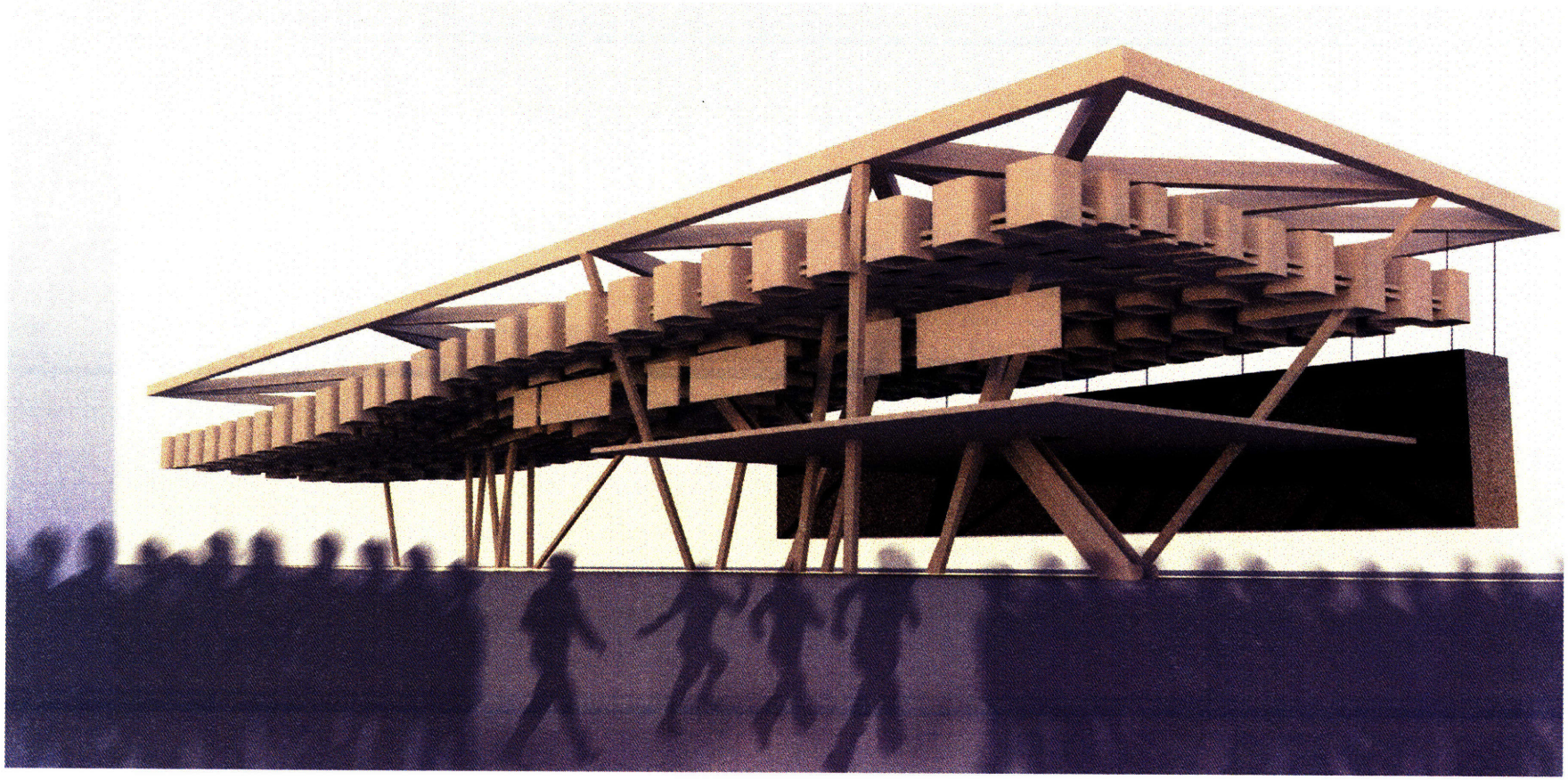


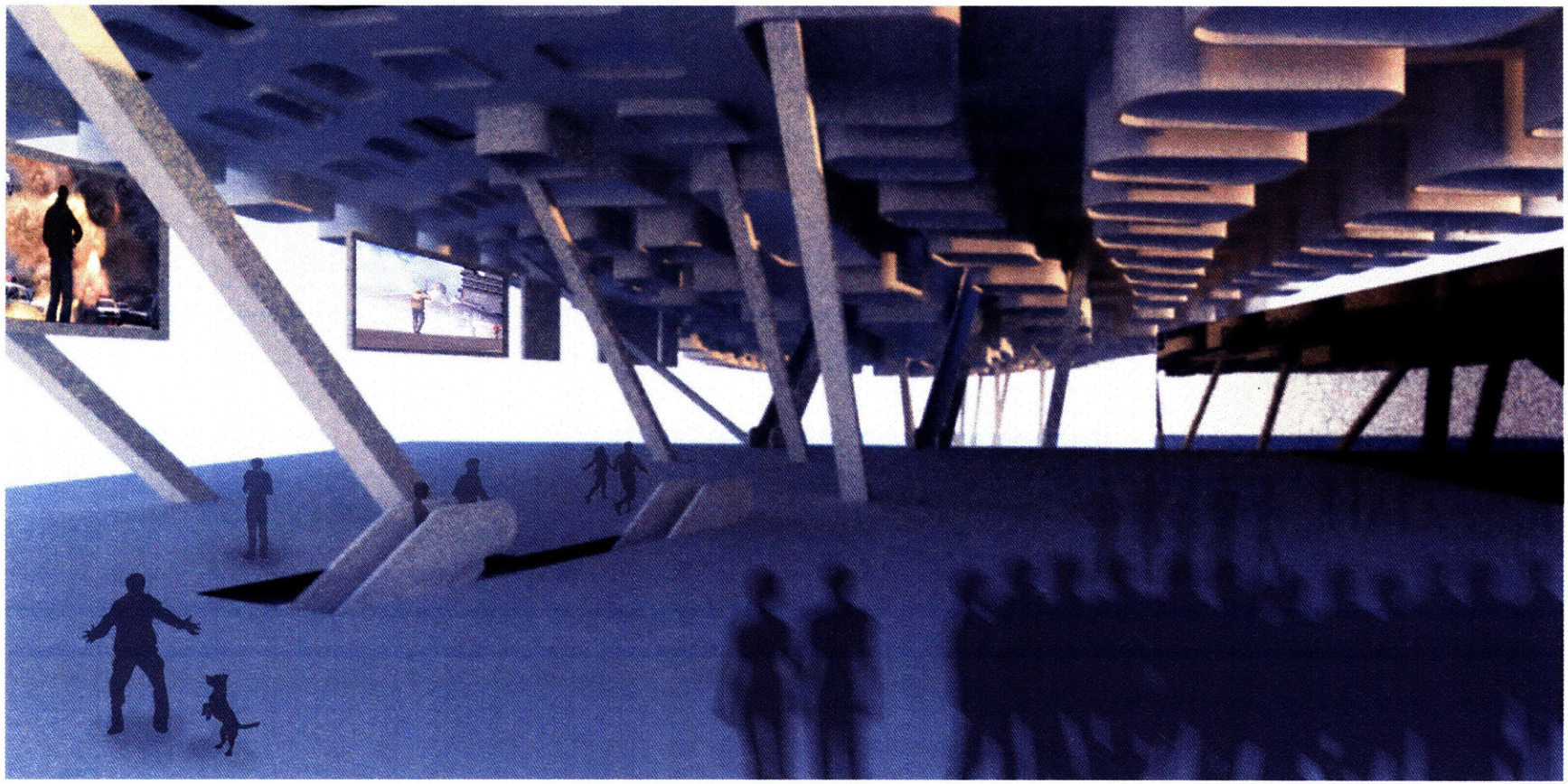
```
Function                = function (surface,int num,spacefac,spacefac2)

                        {

                            for (int i = 1; i < num; ++i)

                          {
                              double U= Sin(spacefac*i);
                              double V= Series(0,1.5,(spacefac2)/Sqrt(i)*2);
                             Point pt01 = new Point(this);

                              pt01.ByUVParametersOnSurface(surface,U,V);

                          }

                        };
   FunctionArguments        = {bsplineSurface02,24,u_s,v_s};
```



EARLY SCHEME







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