INTRODUCTION

This portfolio contains architecture design works from Gejin Zhu in GSAPP.

Rensselaer Polytechnic Institute SoA
Bachelor of Architecture

Columbia University GSAPP
Master of Science in Advanced Architecture Design

My thirteen semesters of architecture design studies in RPI and GSAPP exploit between architecture methodology, spatial framework, and spiritual conditions, that exist between the historically and the contemporarily, the perceived environment and the imaginative space, the ideal visions and material realities.

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CONTENTS

Weaving Bridges
Cross Bronx Expressway
Mobility Infrastructure
Fall 2021 GSAPP

Subterranean District One
Death Valley, CA
Micro City Prototype
Spring 2022 GSAPP

Ford Foundation Building
New York, NY
Renovation with Communal Space
Spring 2022 GSAPP

Central Park Solar Follies
New York, NY
Solar Energy Infrastructure
Spring 2022 GSAPP

Water After Oil
Big City, TX
Water Cycle Infrastructure
Summer 2021 GSAPP

Anxiety Age
Unreal Engine 5
Video Game Design
Spring 2022 GSAPP
Average temperatures above 125 °F like those in Death Valley seem unusual, however according to recent climate data, northern cities will soon experience similar temperatures to southern cities, and many southern cities will reach extremely hot temperatures like those in Death Valley by 2050. Additionally, recent projections from the United Nation predict that while world population will increase by 50 percent in the next 30 years, current farm yields will decrease by 50 percent due to climate change.

Subterranean District One aims to transform current solar farm communities or the lack thereof, by creating a city that harmoniously merges people’s daily lives, with good jobs, energy, food and water production. The project centers around an agro-voltaic farm and a climate data center, while integrating common city program, such as apartments, restaurants, plazas, shops, and retail. As a prototype city, the Subterranean District One is not a monumental object but a project with progressive effort for a “green revolution” in clean energy and farming practices under the environmental pressure of extreme heat.
1. Water Facility Room
2. Water Heating System Room
3. Climate Research Lab
4. Apartments
5. Individual Apartment
6. Hotel
7. Reception House
8. Visitor Center
9. Water Pool
10. Commercial Plaza
11. Agriculture Plaza
12. Mobile Retail
13. Agri-voltaic Farm

Rendering of Daily Life

4 am - residential apartment
10 am - plaza
6 am - pathway to solar farm
12 pm - facility room

12 pm - residential apartments
4 pm - plaza

2 pm - visitor center
6 pm - lab
1. Mobile Retail
2. Farm Worker x70
3. Visitor x10
4. Agrivoltaic Farm with Mirror Panel x4
5. PV Panels x4,000
6. Big City and Solar Plants around

Input
Output to site
Output to off-site

10% Used by Subterranean District One
90% Export to surrounding solar plants
1% Used by Subterranean District One
99% Export to surrounding big cities

1 hectare of solar
1 hectare of crop

160% energy
160% crop

Subterranean District One Applications 2100 Forecast

New Micro Agrivoltaic Cities Appear in Other Regions Along With Big Cities
The Weaving Bridges is designed as a light-conscious construction of future mobility above cross bronx expressway, with a syntax of cable-stayed bridge systems. The main design purpose of this project is to intervene in the expressway to prevent pollution and provide transportation and potential educational benefits for those communities around who cannot afford a vehicle for transportation but suffer from the noise and air pollution. The main program elements include educational events, study area, and gallery. For raising health awareness and prevent emission from cross bronx expressway, a series of light-weight PVC-PES filter devices are embedded in-between the cable stayed framework.

In this collaborative studio course, I work with the students from Mailman School of Public Health in Columbia University, imaging a new way of collaborating and expanding what we see as the intermarriage of social policy and design intended to re-envision infrastructure that has harmed the well-being of those who are of color or socio-economically disadvantaged.
Prototype Strategy
These weaving bridges are repetitive and can be classified by three types which are designed with “woolly urban paths” to minimize the detour of passengers. The first one is diagonally connecting the ends of two pathways. The second is vertically parallel to a pair of pathways from north to south. And the third is connecting the opposite ends of two pathways that are parallel and would never join together. Therefore, these three types of bridges can be applied and arrayed along the expressway in repetitions.

Mobility Strategy
The electron wireless electric vehicle charging rail functions through a system of copper coils embedded in the decking. The energy from these coils are transferred wirelessly to the vehicle batteries through magnetic induction as the vehicle travels along the pathways. This very idea of wireless charging has been applied in Scotland, Sweden and Italy.
Water After Oil
Water Cycle Infrastructure
Posted by GSAPP official website

Advanced Architecture Design Studio
Columbia University
Instructor: Jorge Ambrosi, Gabriela Etchegaray
Site: Big City, TX
Team: Gejin Zhu, Risa Mimura

The purpose of this research is to explore the intricate water cycle behind the crude oil extraction tasked, one of the most dominating extraction industries in the world. Before oil extraction, a process called hydraulic fracturing that requires enormous amount of water to extend the lifespan and flow rate of oil wells takes place for each well. After the process, the majority of fracking water remains underground and becomes an invisible contamination source that infiltrates the ecosystem and our daily life. By analyzing existing data and focusing on the water cycle impacts caused by the hydraulic fracturing process at multiple scales, our approach generates an inflatable device that intervenes this issue in a subtle way that will be embedded in the existing tasked and evoke awareness of this water crisis.

The fields of floating balloon devices transform this invisible relationship of water after oil into visible forms by flipping the underground tasked to above-ground. The device interacts with different states of water cycle and becomes an active agent that performs and operates in relation to water. The main concept of this project is to convert the water crisis into an opportunity of architectural performance design that transcends the terrestrial limitations.
Big Wells City, Texas
Population: 712
Indoor Water Usage: 71,200 gallons

Dilley, Frio County, Texas
Population: 3,894
Indoor Water Usage: 389,400 gallons

Cotulla, La Salle County, Texas
Population: 4,136
Indoor Water Usage: 413,600 gallons

Nueces River
2mi

Shallow aquifer
Confining layer
Oil reservoir
Confining layer
Gas reservoir
Coal
Saline water

Potential groundwater contamination areas

Fracking well
Fracking zone
Drilling well

Potential underground contamination map

Water cycle sectional diagram

Fracking use vs water use map

Columbia University GSAPP / Advanced Design Studio
The main design concept of this project is to maximize circulation and communal space and minimize the loose of daylighting for Ford Foundation Building on 43rd Street in midtown of Manhattan. Almost half of the space inside the building is the atrium and garden, however the interior curtain walls separated the atrium space with the working area. What’s more, the exterior playground is lifted up to the streets, and its disconnected with the indoor landscape by a layer of curtain wall system. Therefore, both the public and the office workers in ford foundation do not interact with the interior landscape a lot.

By proposing a series of ramps that bridge between floors and designing communal spaces in-between garden and atrium, our team are trying to improve the interior circulation and space use without sacrificing daylight. Through using grasshopper to analysis the efficiency of circulation and daylighting, we optimize the best solution for ford foundation with the inspiration from existing public-owned-private spaces in the city of New York.
Public-Owned-Private Spaces Analysis of Manhattan

FORD FOUNDATION BUILDING / RENOVATION WITH COMMUNAL SPACE

Columbia University GSAPP / Rethinking BIM
Central Park Solar Folies
Optimization for Great Hill Central Park

Generative Design
Columbia University
Instructor: Danil Nagy
Site: Great Hill
Team: Gejin Zhu, Bingyu Xia,
Yining Lai, Zihan Sun, Risa Mimura

“Solar Mushroom Folie” is a design proposal to suggest a possibility to make better use of the abundant sunlight that shines on Central Park. More specifically, we are introducing a multi-layer system of single column supported solar panels in the meadows located in Central Park. Great Hill, one of the highest points located at the northwest corner of the park, is selected as the site for this study. The goal for this project is not only to increase the solar energy production and reduce greenhouse gas emission in New York City, but also to raise awareness of the scarcity of sunlight in the city of New York. Renewable energy is becoming a central topic for energy production during the era of climate change. It is crucial for people to understand the production of solar energy in relation to the power usage of the entire city.

The objective for our project is to maximize solar energy production through solar panels with a series of solar angles without disrupting the existing space use and circulation. Great Hill is closed during winter season but is a very active area of Central Park during the other seasons, the solar panel installation would not be disturbing the original purposes of the meadow.
CENTRAL PARK SOLAR FOLIES / OPTIMIZATION FOR GREAT HILL CENTRAL PARK

Perspective Rendering of Best Solution

Daylighting Analysis with Ladybug

Site Plan - I Existing Plan - II Optimization Plan - III Best Solution Plan

Optimization Progress in Discover with Rhino

Columbia University GSAPP / Generative Design
Work Flow Diagram

Environmental Elements
- Sunlight data of New York City
- The height, size and location of trees

Model Generation Process
1. Sunlight analysis of site

2. Divide the site into different areas according to the sunlight hours

3. Center point colliding & packing
- Colliding when they are intersecting
- Packing when they are far away

4. Distribute center points of 3 types of panels in different areas

5. Generate 3 types of panels and columns

Objectives
- Sunlight Hours for Solar Panels

Manual Inputs
- Height of solar panels
- Radius of 3 types of solar panels

Constraints
- Cull panels intersected with trees
- Cull panels overlapping with other panels

GH Parameters
- Coordinates of center of solar panels
- Rotation angle of each solar panel

Columbia University GSAPP / Generative Design
This project is an installment of architecture, acoustic and visual art, that conjures the bombardment of emotion, secrecy, and information. It aims to arouse the public emotional resonance of negative feelings, like anxiety, fear and pressure. To illuminate human’s anxiety that arises from conflicted desires, the character is trapped in an infinite corridor with a series of scenes when being in highly approach motivated states.

Anxiety Age is imaged with a physical maze of corridors that fully immerse viewers. By organizing random sequences and infinite scenes, this project provides distinct experiences to individuals with broached themes of isolation, disassociation, transmission, interconnectedness, etc.