5-2017

The Delamination of Manhattan: Living in the Layers of a Post-land Society

Dylan Hursley

The Delamination of Manhattan: Living in the Layers of a Post-land Society

Dylan Hursley

University of Arkansas

Fay Jones School of Architecture and Design

May 2017

Introduction

The purpose of this study will be to attain a better understanding of the application of biomimetic principles to a design project, specifically a skyscraper. Multiple organisms will be chosen for observation and analysis. Organisms respond to their environment at micro and macro levels. Looking at the way organisms react to their environment through their skin will influence the way the building envelope is composed. Studying the way organisms interact with their environment will influence the way the building operates as a system. Learning the behavior and interaction of these organisms with their environments will result in an architecture that better communicates and interacts with its environment.

The findings of the study will be applied to the design of a skyscraper with the intention of submitting the design to the annual Evolo Skyscraper Competition. The brief for the competition is as follows:

> eVolo Magazine is pleased to invite architects, students, engineers, designers, and artists from around the globe to take part in the annual Skyscraper Competition. Established in 2006, the annual Skyscraper Competition is one of the world's most prestigious awards for high-rise architecture. It recognizes outstanding ideas that redefine skyscraper design through the implementation of novel technologies, materials, programs, aesthetics, and spatial organizations along with studies on globalization, flexibility, adaptability, and the digital revolution. It is a forum that examines the relationship between the skyscraper and the natural world, the skyscraper and the community, and the skyscraper and the city.
>
> The participants should take into consideration the advances in technology, the exploration of sustainable systems, and the establishment of new urban and architectural methods to solve economic, social, and cultural problems of the contemporary city including the scarcity of natural resources and infrastructure and the exponential increase of inhabitants, pollution, economic division, and unplanned urban sprawl.
>
> The competition is an investigation on the public and private space and the role of the individual and the collective in the creation of a dynamic and adaptive vertical community. It is also a response to the exploration and adaptation of new habitats and territories based on a dynamic

> equilibrium between man and nature – a new kind of responsive and adaptive design capable of intelligent growth through the self-regulation of its own systems.
>
> There are no restrictions in regards to site, program or size. The objective is to provide maximum freedom to the participants to engage the project without constraints in the most creative way. What is a skyscraper in the 21st century? What are the historical, contextual, social, urban, and environmental responsibilities of these mega-structures?
>
> eVolo Magazine is committed to continue stimulating the imagination of designers around the world – thinkers that initiate a new architectural discourse of economic, environmental, intellectual, and perceptual responsibility that could ultimately modify what we understand as a contemporary skyscraper, its impact on urban planning and on the improvement of our way of life.

Environmental concerns raised by the brief will be the primary focus of the design with the adaptability of architecture as the secondary concern. Ecosystems exist because of the relationship of organism to organism. Looking at the way an organism interacts with its environment will lead to ideas of integrating buildings with their context to promote a healthier ecosystem. Organisms are also able to adapt to changes in their surroundings and applying this same principle will result in a building that will be able to maintain an environment and also be able to adapt to any changes that occur.

Literature Review

This study is determined on finding a methodology for analyzing and then applying principles of biomimicry to a design project. The idea of skin is important when studying how an animal effectively protects itself from its surroundings. Mazzoleni describes skin as: “Skin is understood as an interface, transcending its surface, giving the appearance of something that separates, but instead acts as a threshold or boundary, allowing for interaction with the elements in multiple directions, scales and timeframes (Mazzoleni, 2013).” Skin is not just a flat opaque

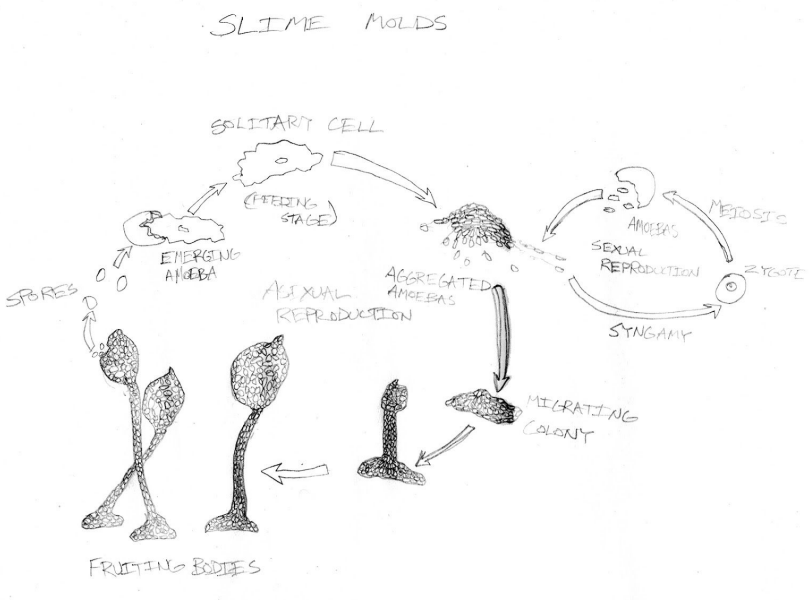
surface, but the boundary between inside and outside with many opportunities for adjustment and interaction. Frei Otto considers the problem: “The desire to create a deliberate design stands in contradiction to the search for a shape which, while as yet undiscovered, is nevertheless subject to the laws of nature (Otto and Winfried, 2005),” which results in the intention of allowing the laws of nature to shape and form the project. In this instance, the biomimetic principles would guide the form of the project in conjunction with the needs of the program and site.

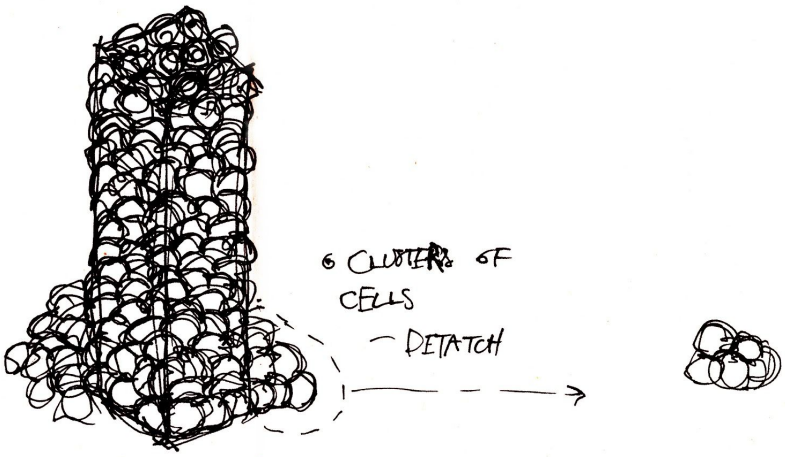
Methods

This study will focus around one or more organisms with the intention of observing and analyzing its features, specifically its skin and behavior. The data obtained from the analysis will then be interpreted into specific elements of the design of a skyscraper. The site will be determined by the climate and context appropriate to the organism observed so as to reinforce the notion that a biomimetic project can maintain an ecosystem. The program of the skyscraper will be determined by the location of the site and by precedent study to be done of a successful skyscraper project. Iterations will be developed for integrating the biomimetic principles into the design of the project. Computer models and hand sketching will be employed in the iterative process. The envelope will be explored extensively in relation to the data gathered from the organism and the relationship of the envelope to its site. The project will then be represented in a compelling manner for entry into the annual Evolo Skyscraper Competition.

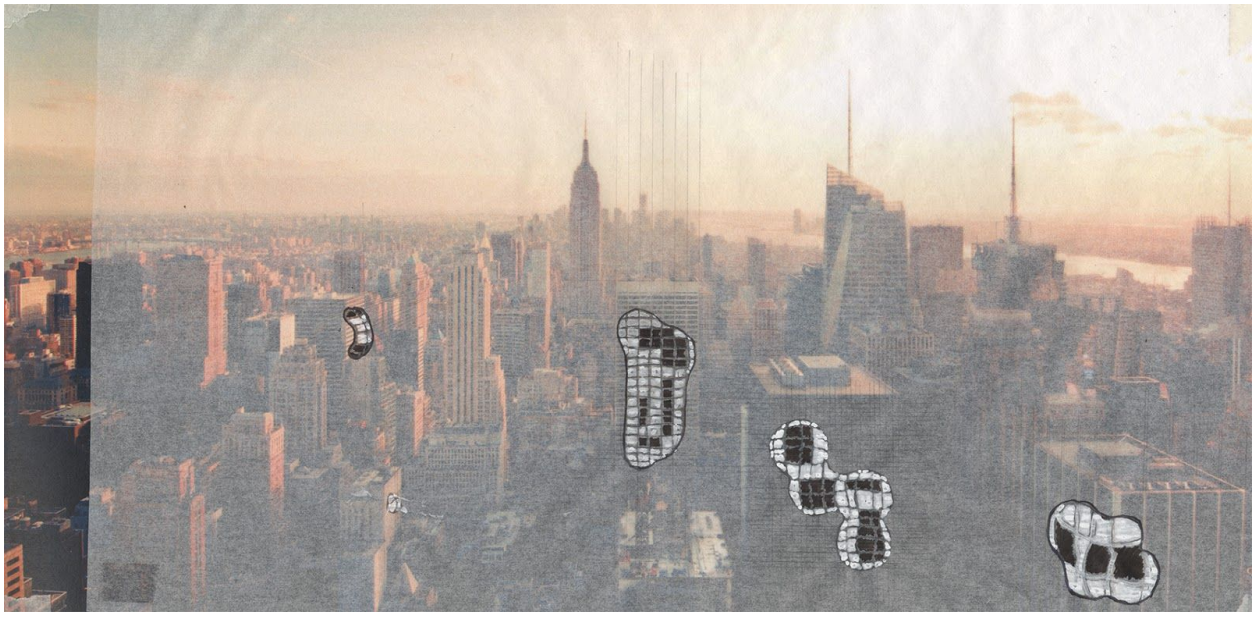
Process

The need for a location and an organism for inspiration were established as the first goals of the project. Early on, there was an interest in boreal forests and frozen tundra. There is a growing concern that carbon is contained within the permafrost and will be released as methane when thawing occurs. Creating a structure that cleans the gas into something less harmful was desired and thus the notion that one could create a tower that houses scientists for the study of the permafrost and provides an environment for bacteria that convert greenhouse gas into another product. There was no abstraction of the bacterium involved which proved to be problematic. In addition, methane lasts a relatively short amount of time in the atmosphere when compared to carbon dioxide. Furthermore, construction in those ecosystems could easily damage their delicate nature and thus cause more harm than good. Structures in extreme environments often have a fluctuating number of occupants. The idea of a structure that grows and decays with the amount of occupants resulted in a new direction for the project.





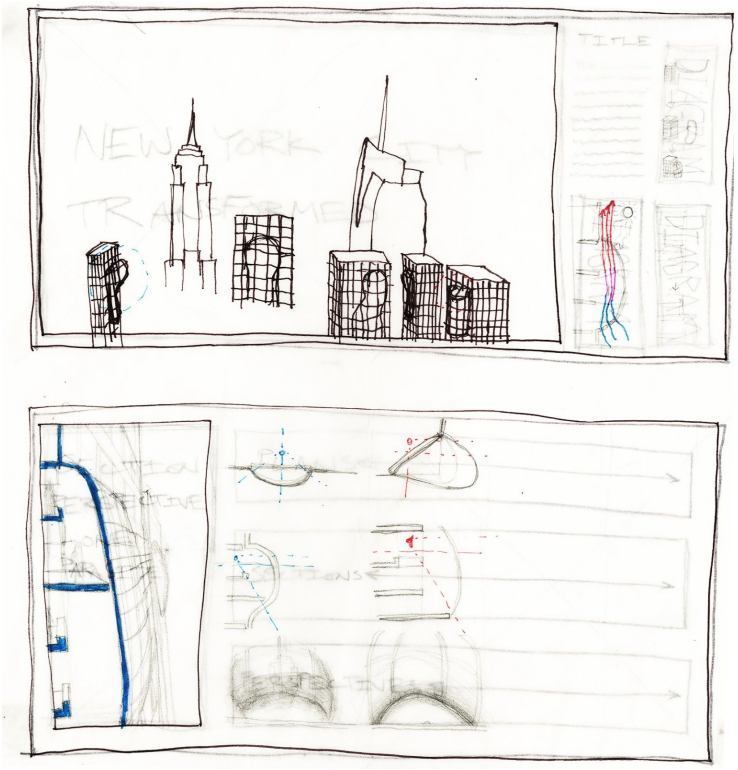
Growth and decay was a catalyst for the idea of a parasitic architecture. Lebbeus Woods served as further inspiration for a structure that requires a host. His work deals with the healing process of wartorn regions. The damage and decay form scabs that act as the first layer of reconstruction, however these new spaces do not attempt to reconcile between what is new and what is old. Architecture imbues the ordinary with something of the extraordinary like some parasites transform their host to their benefit. This might mean that they secrete a chemical that gives the parasite an easier time of feeding. They also latch onto their host in one location with multiple points of contact. They drain nutrients from their hosts. Abstracting these ideas resulted in the idea of providing an increased efficiency and an improved section to a structure. A series of parasitic structures latching onto decaying forms and renewing them spatially and functionally could be represented as being a global force, transforming structures around the world.



The idea of choosing multiple locations was abandoned due to concerns of an incoherent layout and project for the Evolo Skyscraper competition. Manhattan was chosen for its iconic skyline and for being the archetypal metropolis. A script or set of rules that define the shape and form of these additions became an important part of the project and were broken down into issues of aesthetics and issues of efficiency and function. A couple of the rules of aesthetics included: maintaining the regulating lines of host and assuming a foreign form to host (in terms of geometric definition). A few of the rules of efficiency included: creation of additions to floor plate, response to climate and environment, response to program at location of attachment, form influenced by daylighting concerns, enhances sectional quality of host, size influenced by inefficiency of host.

The Rhino plug-in, Grasshopper, was determined to be the most relevant method in implementing the idea of a script or ruleset. The computer could potentially generate the final product with relatively little input from the user which proved to be both interesting and problematic.

The layout became an investigation at this point. It became desirable to have a main image that represented Manhattan's skyline transformed by these parasitic additions. The first page would have this main image and supporting diagrams to explain the generation of these additions. The second page would have a section perspective, showing the interaction of the interior with the exterior and the city and would also contain a series of plans, sections, and perspectives, illustrating examples from multiple programs and the way the additions could transform their respective hosts.



Different form finding strategies were considered: compositional, physical model, script/equation, and program. Using all four would create a well-rounded form. Generative design was considered for the facade. Generative design uses technology that mimics nature's evolutionary approach to design as a means of creating variations and of selecting desirable

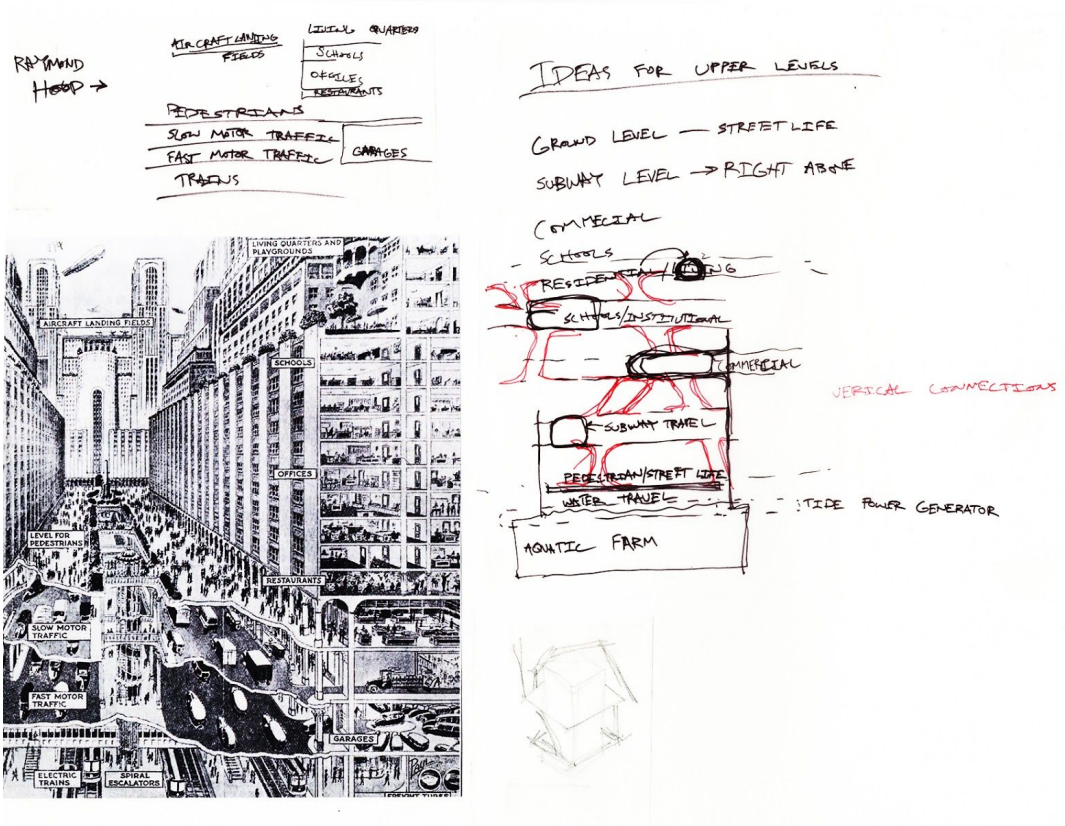
outcomes. The additions would consist of dynamic modules, moving and adjusting to the needs of the user.

The idea of these additions aggregating to form an assemblage sparked the idea of a network or an urban connector. An urban connector provides the opportunity of creating a new ground plane and a new means of transportation. New York is facing the issue of rising waters from climate change. Bjarke Ingels Group has been developing the Dry Line, a project that will help protect lower manhattan with a natural boundary that acts as a wall to the water however, this line of thinking only prolongs the inevitable; the water will become too high to hold it back. Hurricane Sandy proved that the water will make it inside the city eventually. Sandy made millions lose power, and over 250,000 vehicles were destroyed.

The worst case scenario is designed for, a fifty foot rise in water; Manhattan becomes a new Venice. The premise of living in layers is found throughout nature: the rainforest is the key example with its many different layers of life. Venice, Italy and Amsterdam, Netherlands are chosen as precedents due to their close relationship with water throughout the city. In Venice, the water acts as the main source of travel. In Amsterdam, water is second to land-based vehicular travel. Both precedents are largely made of artificial land and utilize barriers to keep flood water out.

The conception of a new ground plane is aligned with the ideology of Amsterdam. The connections between buildings are conceived as a porous island structure. The city is divided into a series of islands broken up by canals of varying size. The new ground plane exists sixty feet above the original, which is the same elevation required by setback laws for older skyscrapers. The water's use is reinterpreted as a new amenity for the city and can be used as a

source of tidal power, a pedestrian amenity, water farms, and also to provide polder parks. The subway is transitioned into an above ground rail system to avoid the problematic condition of being below the water. Boats are used to navigate along the canals, replacing cars. Every introduced element becomes an alternative layer for a new way of living.



There are many issues that occur from creating a city of "skybridges." The Skyway System in Minneapolis disrupted the activity of the streetlife. Many people choose to circulate between buildings exclusively through the bridges. The bridges provide a method of avoiding the harsh winter environment but at the loss of some of the amenities of streetlife. This system of skyways in Minneapolis is perceived as a separation of the ground plane or as a duplication. To

ensure that the ground plane does not become useless as it has in Minneapolis, many amenities are provided to the ground plane and to the network of urban connectors.

The network of urban connectors is a delamination of Manhattan, each layer providing a redundancy in travel and also in programmable, occupiable space. The layers create multiple "ground" planes that belong to the public. If each layer is understood as an opportunity to create a public zone or level, then each layer can be seen as a public amenity, providing multiple modes of transportation and routes. Redundancies provide failsafes, guaranteeing alternative routes for the worst of conditions. The city becomes a post-land society, taking advantage of the multiple ground planes to inhabit the city in all 3 dimensions.

A post-land society must accept the water and its consequences. In studying the matter of rising water, multiple issues must be addressed. A new ground plane must be established a substantial amount above the existing level of water. The water must be reinterpreted as an amenity and not a nuisance. Water will overcome any barriers requiring fail safes to be in place. Providing multiple planes of movement and existence are essential in ensuring the city adapts with nature's gradual change.

Bibliography

Bergdoll, Barry. *Rising Currents: Projects for New York's Waterfront*. Museum of Modern Art, New York, 2012.

Gruber, Petra. *Biomimetics in Architecture Architecture of Life and Buildings*. Vienna: Springer, 2011.

Mazzoleni, Ilaria. *Architecture Follows Nature: Biomimetic Principles for Innovative Design.* Boca Raton, FL: CRC Press, 2013.

Otto, Frei, and Winfried Nerdinger. *Frei Otto: Complete Works : Lightweight Construction, Natural Design*. Basel: Birkhäuser, 2005.

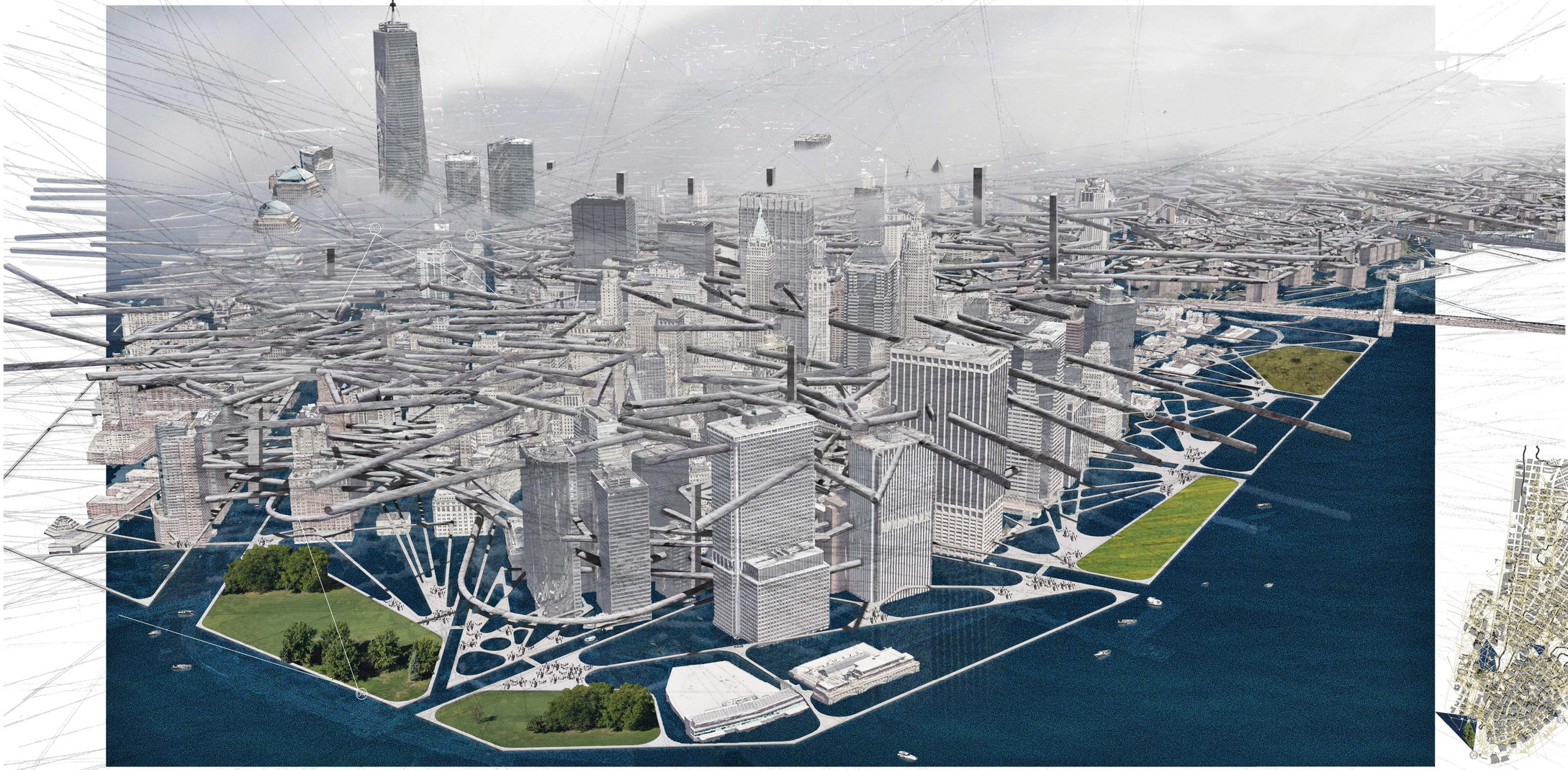
Thompson, D'arcy W. *Growth and Form.* Cambridge: University Press, 1959.

Woods, Lebbeus. *Anarchitecture: Architecture is a Political Act*. St. Martin's Press, 1992.

Wood, Lebbeus. *La Paret*. Fundació "la Caixa", 1995.

Woods, Lebbeus. *OneFiveFour*. Princeton Architectural Press, 1989.

Woods, Lebbeus. *Radical Reconstruction*. Princeton Architectural Press, 1997.

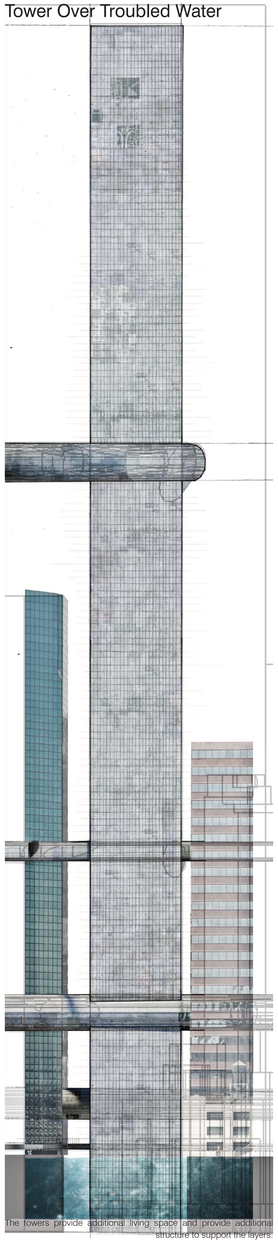


Rising water levels threaten the existence of many coastal cities throughout the world, including Lower Manhattan, which is in danger of sea level rise by as much as six feet by the end of the century! Higher sea levels mean that larger storms will occur with greater frequency. Assuming that humanity does not reverse its current ecological contribution, barriers to stop rising waters will not be adequate.

Manhattan is covered by 50 feet of water, transforming New York into a new Venice. The substantial bedrock of the city provides a hefty foundation capable of supporting Manhattan's structures for many years to come. However, the water scrubs away the ground plane, requiring a new, elevated plane of existence. A porous, artificial island structure provides connections between the stranded, free-standing structures. The layers of the city are pulled apart and re-conceptualized as urban connectors, providing multiple points of movement and occupiable space. The city provides multiple ground planes to create a style of living that truly occupies all three dimensions, and not one that is tied to a singular ground plane.

THE DELAMINATION OF MANHATTAN:
Living in the Layers of a Post-land Society

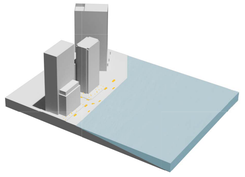
Tower Over Troubled Water



The towers provide additional living space and provide additional structure to support the layers.

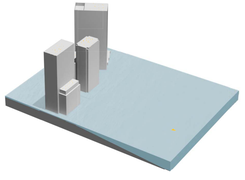
Stage 1

Water is under control and stays within its designated space.



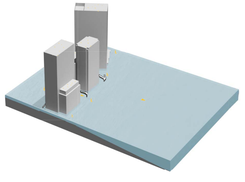
Stage 2

Water moves beyond the man made barriers. People evacuate, fleeing to a ground-plane lifestyle.



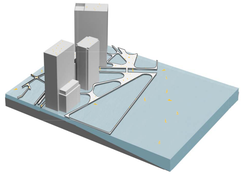
Stage 3

The city begins its transition to a post-land society. Some people chose to remain in the city and accept the water as a part of a new lifestyle.



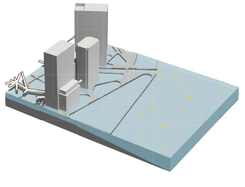
Stage 4

A new ground plane is established to accommodate a variety of modes of living and transportation.



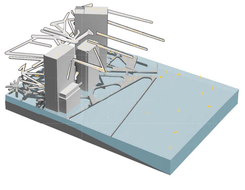
Stage 5

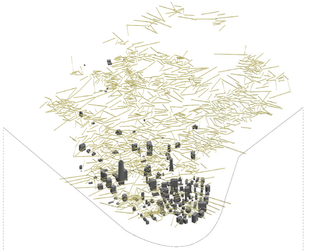
A three dimensional matrix of ground planes is created through introduction of urban connectors

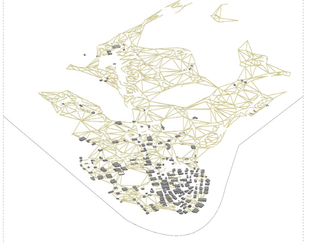


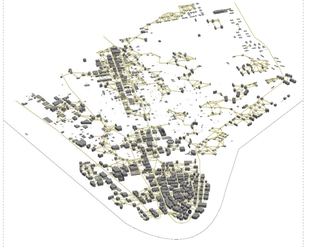
STAGE 6

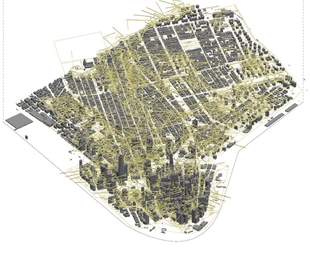
Additional urban connectors are provided to create further redundancy in movement in the event of storms or further sea-level rise.





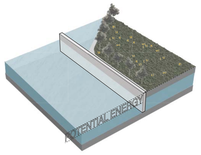






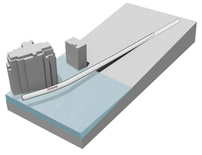
Turning the Tide with Tidal Power Parks

Lower Manhattan is surrounded by a wall that uses gates to capture the energy of the high tide to power the city. These walls provide the necessary structure for polder parks, which will become flooded during high tide.



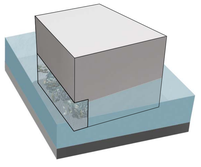
Aboveway Subway

Current subway transportation transitions into an above ground railway system to avoid the rising water.



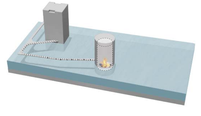
Fish Food

Facades of buildings are peeled away to reduce the corrosion of the buildings and also provides space for fish farms at the base of every skyscraper.



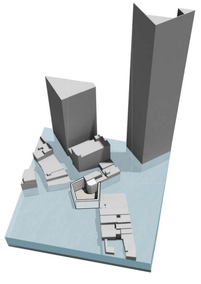
One Man's Trash, Another Man's Energy

Elevated walkways provide a system of pneumatic tubes that deliver trash to a receptacle tower that converts waste into energy.



Historic Havens

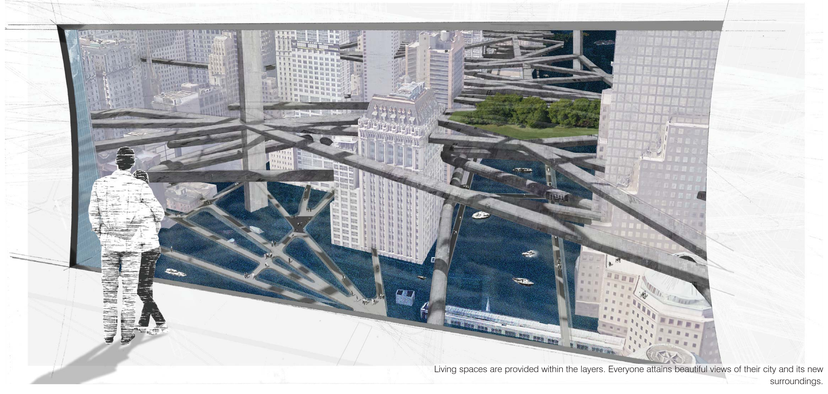
Historic Districts are established to protect important cultural icons and structures. Barriers are erected around these structures and immediate context.



01 Canal Life

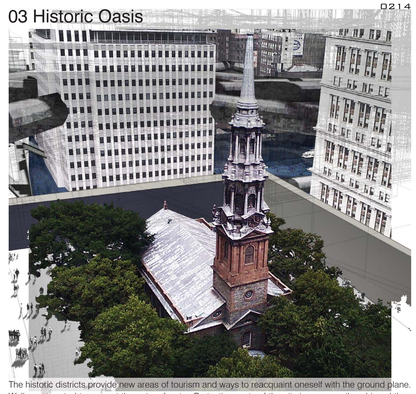
Street life evolves into an existence by the water. Boats become commonplace as either public or personal transportation. Swimming is an amenity that can be found at any location. Without the worry of vehicles, anywhere can become a meeting place.

02 Living Layer with a View



Living spaces are provided within the layers. Everyone attains beautiful views of their city and its new surroundings.

03 Historic Oasis

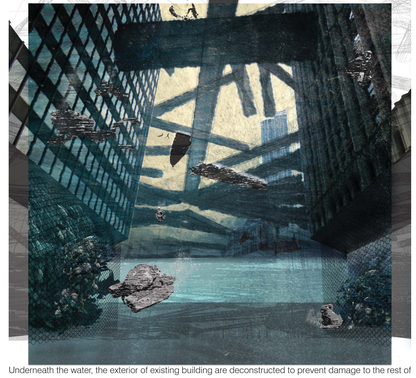


The historic districts provide new areas of tourism and ways to reacquaint oneself with the ground plane. Walls are created to prevent the entry of water. Protecting parts of the city is more easily achieved than protecting the entirety of the city.

04 Polder Park

Polder parks are reclaimed earth by building the land up to the water's current level and allowing the high tide to submerge the land in water. During that process, the vegetation is sustained by water and the tidal power generators create power through the difference in potential energy of the high and low waters.

05 Underwater Country



Underneath the water, the exterior of existing building are deconstructed to prevent damage to the rest of the facade and interior. Fish farms and other aquatic farming are created in the cavities left behind.