

Fountains and Urban Transformations
in New York City

by

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Abstract

The purpose of this study is to imagine how water might transform the city, creating both dwelling space and sublime experience. This project developed from an examination of the variety of important roles played by fountains, both as urban water-supply infrastructures in Baroque Rome, and as works of visual display and pleasure, supporting civic life in urban environments. This thesis proposes new forms in the design of fountains, from small to large-scale architectural and infrastructural interventions, along the High Line in New York City. These designs explore the boundary and environmental conditions by which water shows its various properties according to season, scale, and effect. I have designed a series of interventions to suggest new possibilities for sublime urban experience. The designs should engage and impress city-dwellers, not only because of their size, but also due to their exquisite and advanced technology. Once these principles are employed, fountains should be more than decorative objects but dwelling makers. They should create spaces for dreaming, for the creation of memories and for the revitalization of city life.

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My sincere thanks go to my family members, among them are my father and brother who encouraged me to start the pursue of this master's degree. I am grateful to Professor Yvan Cazabon and Janine Debanne for their unique and intriguing ways of teaching me Architecture. During the final year my thesis group member Brett Shaw has always been glad to share with me his understanding of architectural ideas, which gave me a precious support. What makes this research possible is the guidance of my advisor, Professor Catherine Bonier, Thank you.

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**Unless otherwise noted, all images are by author.*

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The form of water is determined by various conditions as shown in this illustration. It can be ice, mist or ocean. The power of water is also frightening if it is not controlled.

Illustration 1: Water Forms under Various Conditions

1 Chapter: Introduction

A fountain is always a celebration of human technological effort and social motivation. As a most visible part, the fountain is connected to a vast water infrastructure and its realization needs a strong construction purpose. In history, Rome has been renowned for its fountains and the restoration of water works provided a basis for the rebirth of Baroque Rome. “Fountains are fundamental to Rome’s identity and indispensable to civic life.”¹ Today, it is valuable to rethink the roles of fountains in the transformation of urban landscapes. In the process of human civilization, fountains could be a more active part in generating cultural environments to nurture and cultivate a “deeper” humanity and “larger” world².

The design of fountains is water-centered. The property of water is so varied that the changes in physical conditions can produce

¹ Rinne, Katherine W. 2010. *The Waters of Rome: Aqueducts, Fountains, and the Birth of the Baroque City*. New Haven and London: Yale University Press, 1.

² Mumford, Lewis. 1961. *The City in History: Its Origins, Its Transformations, and Its Prospects*. New York: Harcourt, Brace and World, 573.

multiple water forms. With the help of technology, modern fountains can be of a fantastic scale. Scale as a geometrical variable is one of my special research interests: when the scale is big enough, a sublime effect emerges. Experiments were performed to investigate how boundary conditions determine the water expressions as well as how scale plays a pivotal role in water effects. From these experiments, a category of new water forms is obtained, and some fountain design aspirations are achieved.

The functions of fountains are examined in a metropolitan background. The High Line park in New York city is a repurposed infrastructure which is restored from a neglected railroad viaduct into a public green park³. Over this 1.45-mile long uplifted linear landscape, another layer of water interventions is to be constructed. The fountains are to intensify the identity of the place and enhance the orientation for people. As a landmark in urban public space, fountains are gathering people and inviting people to meditate about their existence. Water is providing sensational abundance in urban life.

³ Hock, Karen. 2002. *Reclaiming the High Line*. New York: AOL Time Warner, 44.

In the circumstances of New York, the design works are connected to the subterranean networks and systems. However, the functions of fountains are not to be examined as a working device with some excellent performance. Unlike in the ancient Rome where fountains were providing some washing places for economic reasons, this design is to focus on the leisure created by a set of modern fountains. Nor would they be imagined within the context of religion, power or money, since the social and cultural conditions have changed enormously from the Baroque Rome.

Dwelling is realized by living in touch with wind, light and water.



Illustration 2: Fountain and Dwelling

Following this chapter is Chapter 2 where the concept of the sublime is discussed. Besides the classical definition by Kant, technology brings forward other varieties of the sublime.⁴ The power of imagination from our mind in response to the outside objects' stimulations is of our concern. In Chapter 3, the functions of fountains in Baroque Rome is presented to understand the relationship between water systems and the revitalization of a city. City is examined as a dwelling place⁵ where people can gather and choose. The methodology for the study of water form is provided in Chapter 4. Here the central theme is to learn and innovate by experimentation.⁶ A catalog of water forms is invented together with the design of nozzles which work as boundary conditions. As a result, some design inspirations are obtained. Chapter 5 is the site analysis where the High Line park in New York city is chosen as an urban landscape for the interventions of new fountains. A linear uplifted green public

⁴ Nye, David E. 1994. *American Technological Sublime*. London: MIT Press.

⁵ Heidegger, Martin. 1993. *Basic Writing: from Being and Time (1927) to the Task of Thinking (1964)*. New York: HarperCollins Publishers, 344.

⁶ Thomke, Stefan H. 2003. *Experimentation Matters- Unlocking the Potential of New Technologies for Innovation*. Boston: Harvard Business School Press, 6.

space is changing the life of Manhattan. In Chapter 6 new fountain designs are proposed to accelerate the speed of transformation. A dramatic design is targeting to enrich the physical sensation in city life. The last chapter is the conclusion of the research where the limitation and future possibilities are reflected.

One imagination shows the urban sublime scale water works. The life is deeply affected by the existence of water.

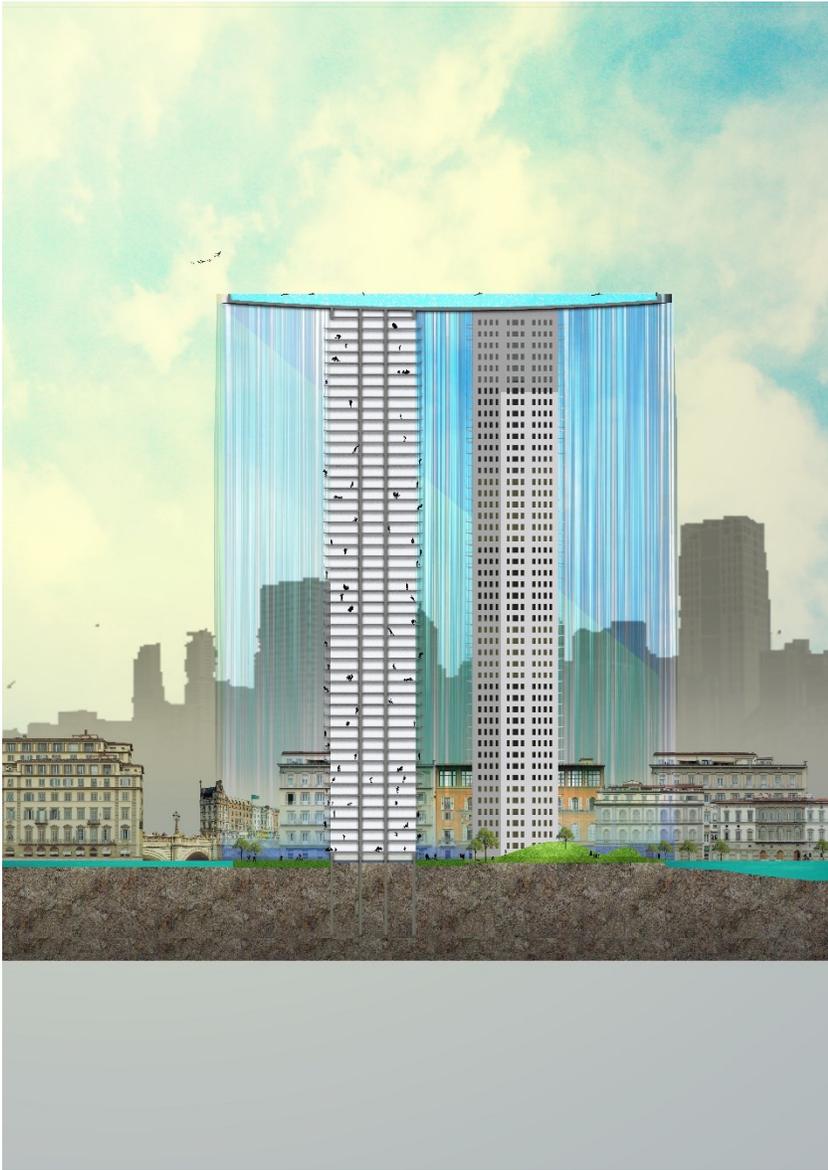


Illustration 3: Sublime Water Works in City

2 Chapter: Sublime Water Works

2.1 Definitions of the Sublime

The sublime is a kind of human response to the outside stimulations produced by objects with some specific qualities. One of these qualities is the extremely large scale as exemplified in the Niagara Falls, with its height and width frightening the travelers.⁷ However, in the above case the scale is large to the extent of extreme and the definition of sublime dimension is obscure. When attempting to utilize this concept in the design of water works, this paper intends to consider the scale of sublime in a relative way. However, the relativity is related to a variety of factors, including the size of the surroundings and the mind-status in which the viewers encounter the sublime objects.

Since the sublime is an old concept with various definition in different fields, some historical review would help to clarify what this paper means by *Sublime*. In the first century, the sublime was

⁷ Nye, David E. 1994. *American Technological Sublime*. London: MIT Press, 1.

defined as an attribute of oratory and fine writing. If a speech or writing can “touch the spirit with a sense of grandeur” and afterwards can stand for “repeated examination” in keeping this effect, then it is a sublime literary work.⁸ It was believed that this was a universal attribute: men with different backgrounds could share the same judgment on a work.

<https://www.mutualart.com/Artwork/Grand-Canyon-and-Colorado-River/D6BC091DEBFA720C>

Visitors are frightened by nature's grand scale.

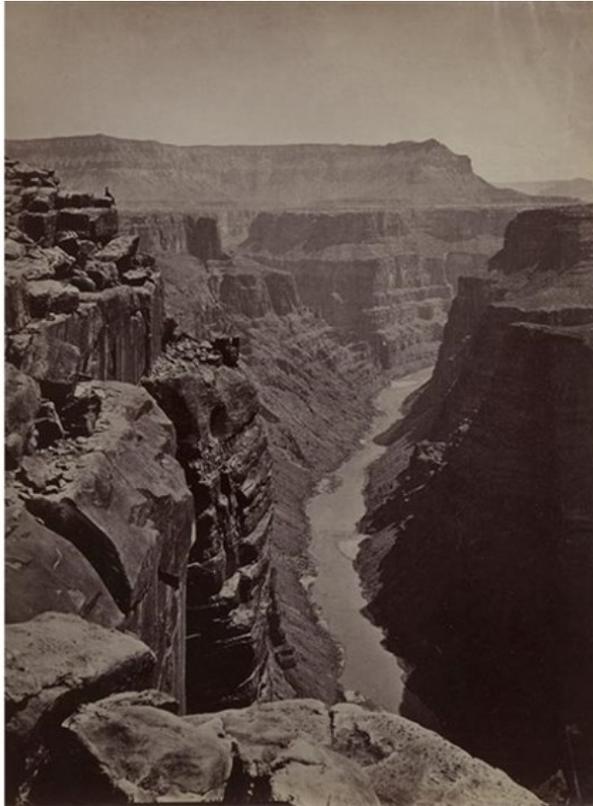


Illustration 4: The Grand Canyon / by John K. Hillers

⁸ S., Dorth. 1965. *Aristotle, Horace, Longinus: Classical Literature Criticism*. Penguin, 107.

In European theory, the sublime arises in theories of literature, fine arts and philosophy. Paintings expressing the sublime intend to draw unreal, monstrous and nightmarish objects to promote fearful emotions. Architecture was designed in vast form, with striking contrast of lightness and darkness. Novels depict healthy shocking experiences in the natural world including mountain, sea and cosmos. The Oxford English Dictionary gives the definition as “Of things in Nature and Art, affecting the mind with a sense of overwhelming grandeur or irresistible power; calculated to inspire awe, deep reverence or lofty emotion by reasons of its beauty, vastness, or grandeur.”

In the field of philosophy, Kant gave a clear and useful definition with two types of sublime in his book *Critique of Judgement*.⁹ One is the mathematical sublime: the encounter with extreme magnitude or vastness, as in the case of viewing from the mountain. Another form is the dynamic sublime: the contemplation of scenes that arouse terror, as in the situation of seeing a volcanic eruption. In the mathematical sublime, the

⁹ Kant, Immanuel. 1790. *Critique of Judgement*. Oxford University Press, 504.

object is incomparably or absolutely great. In the dynamic sublime, people are confronted with a dangerous situation but is witnessed in a state of security.

In Kant's definition, the inner mind plays a determinant role in the formation of sublime. According to Kant, the sublime includes not only the perceptual response to the outer world, but also the contemplation of mind. Some critics have summarized Kant's theory as that from fear human mind realized the insignificance of oneself and explained it in a religious way: the existence of God.¹⁰ However, our mind can direct this fear to more than religious aspects and this may be subject to individual opinion. With industrialization, the sublime objects are not limited to natural things. There are possibilities to define different types of sublimity.

¹⁰ Goldthwait, John T. 1960. *Observation on the Beautiful and Sublime*. University of California Press, 37.

Gabriele Boretti
/ Postcards
from the future
<http://gabrieleborettiarchitettura.tumblr.com/>

An imagination
shows the
magnificent
structure with
sublime effect.



Illustration 5: Istanbul Project / by Gabriele Boretti

2.2 Technology and the Construction of a New Sublime

Kant's definition is acceptable in an age previous to rapid industrialization when the power of technology was not fully exhibited. The American technological sublime, as described in the writing of David Nye, is a new version of Kant's mathematical and dynamic sublime.¹¹ Technology created new sublime objects which embodied the omnipotent human power in *Geometrical Sublime*, *Industrial Sublime*, and *Electrical Sublime* and served to

¹¹ Nye, David E. 1994. *American Technological Sublime*. London: MIT Press, 45.

generate other types of sublime such as *Political Sublime* and *Consumer's Sublime*. In the industrial age, the sublime was no longer limited to Nature; God is no longer the only reason to explain the awe and fear. Since technology can bring us both positive convenience and negative disaster, the technological sublime such as the atomic bomb was criticized as “the death world”¹² of pure technology dedicated to destructive ends.

<https://www.local.gov/item/today-in-history/may-01/>

This is an example of *Geometrical Sublime*.



Illustration 6: The Empire State Building / by Irving Underhill

¹² Mumford, Lewis. 1946. "Gentlemen, You Are Mad!" *Saturday Review of Literature*, March 2.

The railroad, skyscrapers, mills, atomic bomb and Apollo XI all are unordinary objects of technological sublime. Skyscrapers changed the phenomenology of the city by providing people a chance to redefine the relationship between each other. When you stand on the street looking upward, the height of the building invokes the awareness of the insignificance of oneself. When you climb on the top of the building looking down to the street, the small cars and walking people looks like ants which induce contempt towards other people. The panorama view, designed to the realization of human will, enhances the privilege of the office owner.

<http://www.spoakesman.com/stories/2012/may/27/spanning-75-years/>

*Technological
Sublime serves
to unit a
multicultural
nation in a way
of making
event.*



Illustration 7: Golden Gate Bridge Celebration / by *Author Unknown*

Technological Sublime serves to establish new identity of a nation in a way of making events.¹³ As demonstrated in 1987 for the celebration of 50th anniversary of the Golden Gate Bridge, in which 250,000 pedestrians walked across the straining bridge, when a hope or fear of individual is experienced in group, then a kind of social belonging arises. The event changed into a ritual which “can produce bonds of solidarity without requiring uniformity of belief.”¹⁴ Sublime helps to bind a multicultural society where no single religion could perform this function. The member of a multicultural society need not understand the meaning of a rite, but to participate.

The *Technological Sublime* serves to create the consumer’s sublime which emphasizes irrationality, chance and discontinuity. The consumer’s sublime is defined from the thriving of theme park such as Disneyland and entertainment city such as Las Vegas. What becomes the sublime object is the special effects; what is evoked in tourist’s mind is fantasy; and what is thought about is the power of financial investment. Technology is erased for its

¹³ Nye, David E. 1994. *American Technological Sublime*. London: MIT Press, 268.

¹⁴ Kertzer, David I. 1988. *Ritual, Politics, and Power*. Yale University Press, 67.

celebration of work, neglected for its reason, and expelled for its domination. The presentation provides tourists with sublime experience in a profane, artificial and fake way.

Olafur Eliasson
/ Waterfall
Versailles,
France
<http://olafureliasson.net/archive/artwork/WEK110140/waterfall>

Water work with the sublime effect is determined by its scale against the surrounding environment.



Illustration 8: Waterfall Versailles / by Olafur Eliasson

2.3 Hydrological Sculptures and the Sublime

Olafur Eliasson is famous for his large-scale sculptural installations employing elemental materials such as light, water and temperature to enhance the viewer's experience. One of his projects is *The Weather Project* which includes monochromatic lamps, huge reflecting roof mirrors and humidified mist to produce a man-made nature environment where visitors can lie

on the ground to wave their hands to their reflections above. As explained by Eliasson: “I am interested in people: how people engage sensually with the qualities of weather-rain, mist, ice, snow, humidity- so that through their engagement they may understand how much of our lives are cultural construction.”¹⁵

Following this human engagement and technologically large-scale method, Eliasson’s *Waterfall Versailles* is a tall, narrow waterfall, which cascades into the basin of the Grand Canal, along the primary visual axis of the Gardens of Versailles. The visible waters call for attention to both itself and the surrounding gardens, while the tumbling water highlights the presence of natural wind and light. The artist explains, “it invites visitors to take control of the authorship of their experience instead of simply consuming and being dazzled by the grandeur. It asks them to exercise their senses, to embrace the unexpected, to drift through the gardens, and to feel the landscape take shape through their movement.”¹⁶

¹⁵ Eliasson, Olafur. n.d. *Olafur Eliasson*. Accessed 1 20, 2018. <http://www.olafureliasson.net>.

¹⁶ Ibid.



An illustration examines the scale of the fountain, its landmark function and the sublime effect.

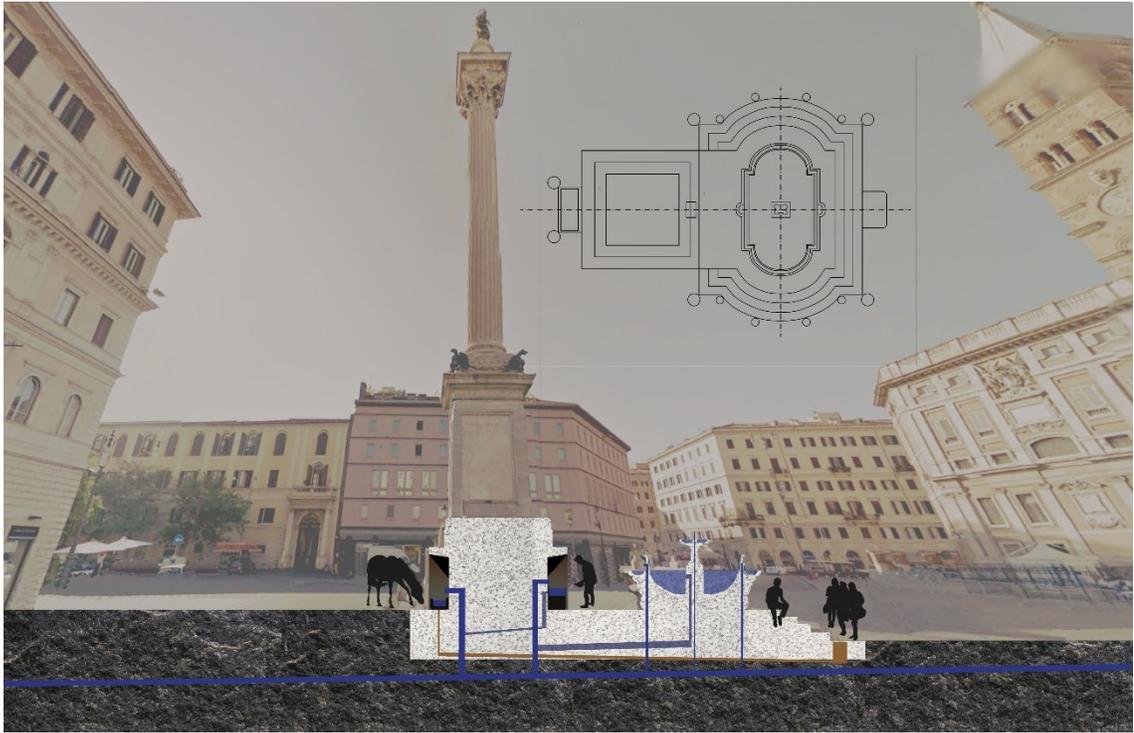
Illustration 9: Landmark Function of Fountain

From a landmark point of view, the *Waterfall* cascade explained and centered the garden landscape. The Versailles garden is characterized by its water in Grand Canal. The *Waterfall* connects sky to canal water to form a kind of totality. Visually, the *Waterfall* is a center to attract viewers who approach it from different directions. The expectation from far away, the excitement during the coming way, and the meditation at the final arrival constitute an experience for visitors. This explanation and orientation about a place is realized by a fountain. At the same time, an understanding and gathering, a type of dwelling together, is accomplished for visitors to Versailles garden.

The height of the cascade is forty meters which seems to meet the definition of sublime scale. From normal to large scale and to sublime scale, the effect of an object is related to the surrounding

environment and the feeling of the viewers. Dissimilar to the scale of a natural object such as mountain and sea, a sublime scale in an urban background can be a relative one. This relativity makes the definition complex and obscure. Even the same height can produce different effects when the material is water instead of stone or steel.

However, if we accept Kant's definition of sublime: it is a kind of human response to the outside world, then a feeling of insecurity can be enlarged or intensified into fear. Fear is not only determined by the scale such as in the *Technological Sublime*. When a man is riding on a fast train, he can feel a kind of danger while he is safe. But for a geometrical sublime where scale is determinant, can we say only if an object makes you feel astonished then it is a sublime scale? In an urban environment whenever a water work makes you feel uncommonly high, disturbs your silent mood into something uneasy, and invites you to think about the meaning of life, a sublime scale is working.



This illustration shows the multiple functions of the Baroque Rome fountains and the hierarchy of the usage of water.

Illustration 10: Fountain Piazza di Santa Maria Maggiore

3 Chapter: Roles of Fountains in Civic Life, Art, and Dwelling

3.1 Three Major Functions Played by Rome's Civic Fountains

Before the modern restoration, the original classical fountains in Rome were gravity fountains whose work totally depended on the gravity and topography of city. If we consider streets as wraps and building as imbrications then a water system is another deeper wrap or layer including aqueducts, fountains and drains. The flow of water through a city is a process of ramification¹⁷ which is a branched system originated from a source such as an aqueduct terminal and serves a series of fountains in different parts of the city. The system of Baroque Rome included three water supplies: The Acqua Vergine, the Acqua Felica and the Acqua Paola. Fountains are the fruits on the branches.

¹⁷ Rinne, Katherine W. 2010. *The Waters of Rome: Aqueducts, Fountains, and the Birth of the Baroque City*. New Haven and London: Yale University Press, 9.

Aqueducts play an important role in the Baroque Rome water system.



Illustration 11: Acqua Felice

For Rome's fountains three major functions were employed: distributing water, displaying, and serving the civic life. The distribution system of Rome was a renovation at the time which was executed with knowledge of surveying and hydraulic techniques. The hierarchy of flows, as described by Katherine Rinne in her book *The Waters of Rome*, is that water is first transformed to ornamental fountains and then the runoff water is redirected to other public utility basins. The principle of gravity flow is simple, but many factors are affecting the flow. Once the water reaches its destination, it flows into a large basin, called a

Castello,¹⁸ fitted with pipes. As water flows into these pipes, pressure is created so that it can return to the same level as the original basin when released. It could be difficult to determine the exact amount of water and the pressure at a remote location.

To restore water was to restore Roman and Papal authority. Fountains as the most visible parts of the integrated program were intended to display the prestige and generosity of the Catholic Church. During the 16th century Rome as the center of Catholicism center was facing the pressure of losing of faith in the face of the Protestant Reformation and other threats to their hegemony. Water works were intended to restore the former Rome glory by recalling the paradigm of the eleven ancient aqueducts, hundreds of fountains, and numerous drains. Fountains in front of churches are a representation of the commandment of Popes. The Pope, who was the most powerful person in Rome, still had to cooperate with Roman Council and the cardinals. Pope Pius IV constructed this network of fountains to show his authority and responsibility as well.

¹⁸ Rinne, Katherine W. 2010. *The Waters of Rome: Aqueducts, Fountains, and the Birth of the Baroque City*. New Haven and London: Yale University Press, 57.

Behind the Moses Fountain is hiding a reservoir over which workers are living daily life.

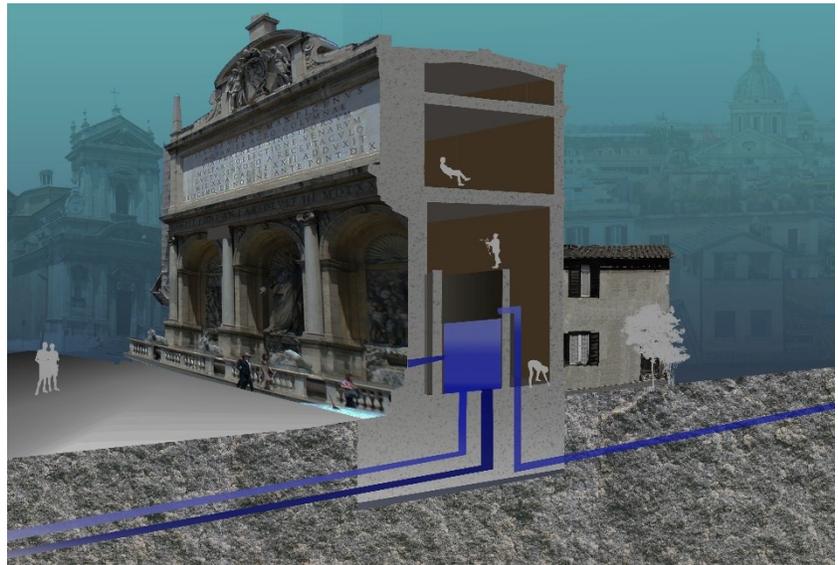


Illustration 12: Fountain Terminal - The Moses Fountain

Some ornamental public fountains were built by private individuals such as members of Rome Council or cardinals.¹⁹ It was a trend to build a palace adjacent to a civic fountain, accessible to aqueduct water. Water display reflected the ambitions and status within the civic or papal administration. The splashing and sparkling of water certainly dazzles the eyes of people passing by. Constructing a fountain or having the Rome Council to construct one in front of your palace is more than an exterior decoration, it

¹⁹ Rinne, Katherine W. 2010. *The Waters of Rome: Aqueducts, Fountains, and the Birth of the Baroque City*. New Haven and London: Yale University Press, 109.

is a kind of luxury goods. Even the symbolic possession is a kind of self-presentation. Elite Romans appreciate their upper views from their upper windows which is not only a sensory pleasure but also a heightened awareness of their privileged positions.

The two blue points are the locations of the two fountains studied by author.

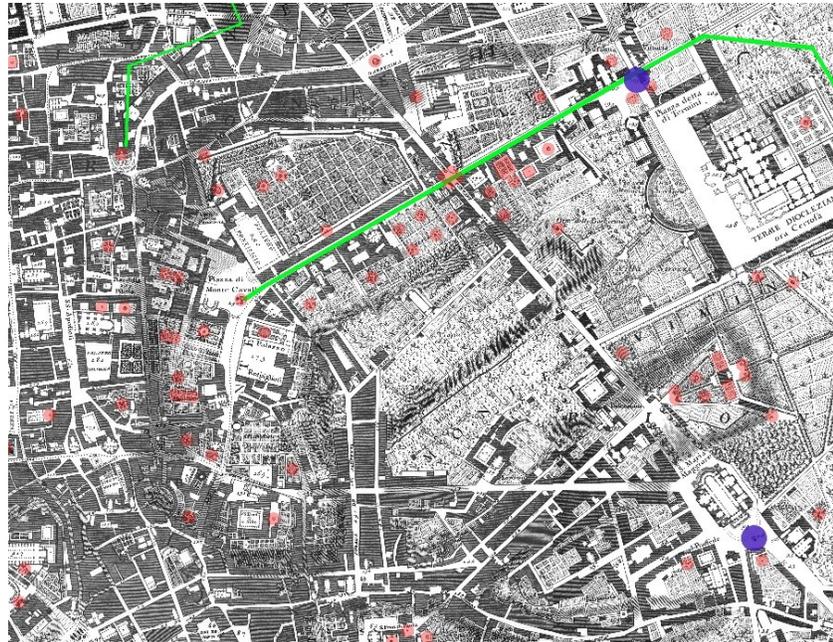


Illustration 13: Two Fountains Studied in Blue Dots

Although the civic fountains are basically designed to give ornamentation to the city, their run-off water was not to be wasted. Under the basins of fountains, pipes were connected to enable the displaced water flow to other utility basins to serve the public welfare. Rinne catalogs five types of public fountains

according to their use and patronage.²⁰ *Beveratori* is for the use of animals and workers and financed by the Roman Council.

Fontane Pubbliche are exclusively for drinking and financed by the Roman Council. *Fontane Semi-Pubbliche* are drinking fountains and paid by private citizens. *Lavatori* are laundry basins provided by the Pope, the Roman Council or private citizens. *Purgatori* are intended to manufacture wool and sponsored by Popes.

²⁰ Rinne, Katherine W. 2010. *The Waters of Rome: Aqueducts, Fountains, and the Birth of the Baroque City*. New Haven and London: Yale University Press, 156.

Nolli,
Giambattista.
1991. *Rome
1748: Being a
One-half Scale
Reduction of
Giambattista
Nolli's Pianta
Grande di
Roma.*

The red dots
are fountains
from which we
can see how
they are
connected to
the life of
Rome.



Illustration 14: Nolli Map with Fountains' Positions / by Giambattista Nolli

3.2 Fountains Help with the Revitalization of Rome

What happened during the 1560s to the 1630s demonstrated how a water work can transform a city into a new one by restoration. A refined water supply and distribution system made life in Rome healthier by providing public fresh water. The church regained its faith from pilgrims by restoring the urban structure with the integrated water programs paired to pilgrimage sites and public squares. New mills and washing places gave the poor people more working chances. Fountains as a water distributing nexus, most

visible water displaying, and a kind of public utilities, are both symbolic and physical index of the revitalization of Rome.

http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=1674373&partId=1&searchText=piranesi+rome&page=2

Sailor's fountain creates a typical Baroque space.



Illustration 15: Sailors' Fountain / by Giovanni Battista Piranesi

Public health is often determined by the health of drinking water. However in the early sixteenth century, prior to the interventions of Popes Pius IV and Pius V, there were only two or three public fountains in Rome.²¹ Drinking waters were mainly sold by water carriers. By 1630, Rome's water distribution system was in shape and water flowed in an astonishing amount: twelve thousand

²¹ Rinne, Katherine W. 2010. *The Waters of Rome: Aqueducts, Fountains, and the Birth of the Baroque City*. New Haven and London: Yale University Press, 7.

liters per second. Considering the population of the time to be about one hundred and twenty thousand, this is a higher per capita water supply than is typical nowadays. The public ornamental fountains were mainly located at piazzas where important palaces and churches are located and at intersects of main roads. But from there, conduits connect the nearby densely populated neighborhoods. The public can easily get water for drinking, washing and gardening.

In 1548 and 1549, after the flood of Tiber River, a violent malaria epidemic exploded.²² Pope Pius was aware that the standing water is related to water-borne diseases and decided to prevent this health hazard. The city sewage system should be renovated. What was most important was that the lack of drains meant the streets were flooded during rains and easily damaged. The construction of new drains integrated the creation of a city-wide system of paved streets. *Via Felice* was opened in 1588, which is a five-coaches wide and probably the most important road in Rome.

²² Rinne, Katherine W. 2010. *The Waters of Rome: Aqueducts, Fountains, and the Birth of the Baroque City*. New Haven and London: Yale University Press, 195.

Now the pilgrims could enjoy a healthier, more convenient and durable physical crust of Rome.

Beyond the physical restoration is the spiritual recovery by regaining the faith in the Catholic Church in Rome. In the sixteenth century the Ottoman Empire was intruding westward into Europe and the Church was impelled to prevent the intrusion by Islam. But Rome was in shameful shape and could not welcome larger numbers of pilgrims. By the middle of the fifteenth century, buildings were in ruins, streets were impassable, and the once famous water infrastructure had vanished. But in 1570 Rome began to change. The new water supply brought advances in many aspects and help to restore the faith in Rome as a center of religion.

One direct relation between water works and the recovery of the Roman economy was the new *Purgatori*,²³ purging basins intended specifically for manufacturing wool which were sponsored by the Pope to encourage industrial development.

²³ Rinne, Katherine W. 2010. *The Waters of Rome: Aqueducts, Fountains, and the Birth of the Baroque City*. New Haven and London: Yale University Press, 170.

Wool production was one of the few important manufacturing activities in medieval Rome, but the industry had practically disappeared by the mid-sixteenth century owing in part to its large assumption of water. In 1570, Pope Pius V provided the laundress a separate *Purgatori*. Along with the public laundry, some *Casa del Lavatore*, a kind of washhouse were built to meet the growing demand of cleaning services by the growing population, especially of many new cardinals.

This section drawing is to demonstrate a possible intervention of water works to the High Line park in New York city.



Illustration 16: New Fountain and City

3.3 City Occupied as a Dwelling Place

Martin Heidegger in his work “Building Dwelling Thinking” distinguishes building from dwelling, in his words, “we take dwelling and building as two separate activities.”²⁴ . He asserts that “The way in which you and I am, the manner in which we humans are on the earth is dwelling.”²⁵ He relates his “fourfold” as a central aspect of dwelling, which is earth, sky, divinities and mortals. He considers the four things as oneness which means they cannot be divided, and each of these can only be what it is if the others are kept in mind. Then building is “cultivating²⁶ and construction” which means bringing the essence of the fourfold into things.

In case of the relationship between man and space, Heidegger explains this with the example of a bridge stretched across a river. Building is what allows for a sense of place in which dwelling occurs. A bridge is more than a functional object and symbolic

²⁴ Heidegger, Martin. 1993. *Basic Writing: from Being and Time (1927) to the Task of Thinking (1964)*. New York: HarperCollins Publishers, 348.

²⁵ Ibid, 349.

²⁶ Ibid, 353.

object, it is a manifestation of the fourfold. A bridge collects and unites all aspect of the fourfold into a “thing”. Therefore, space is something which is created before it is experienced. Building is a form of dwelling, and dwelling is a form of thinking. In Heidegger’s opinion, the Black Forest farm house serves to illustrate how dwelling should be carried out.

If we think about dwelling, to dwell implies the establishment of a meaningful relationship between man and a given environment. According to Christian Norberg-Schulz, this relationship consists of identification and orientation.²⁷ Identification means to experience a total environment as meaningful. Orientation relates to the spatial interrelationship. Identification corresponds to the bodily form to embody meaning, while orientation relates to organized space to admit things. Identification means to gain the world through the understanding of things. Orientation implies structuring the environment into domains by means of paths and centers. Building therefore is a combination of gathering of built form and the visualization of spatial property.

²⁷ Norberg-Schulz, Christian. 1993. *The Concept of Dwelling*. Milan: Rizzoli International Publication INC., 15.

<https://www.museo Thyssen.org/en/collection/artists/wittel-gaspar-van/piazza-navona-rome>

Squares are the dwelling place for people's gathering where fountains are well displayed.



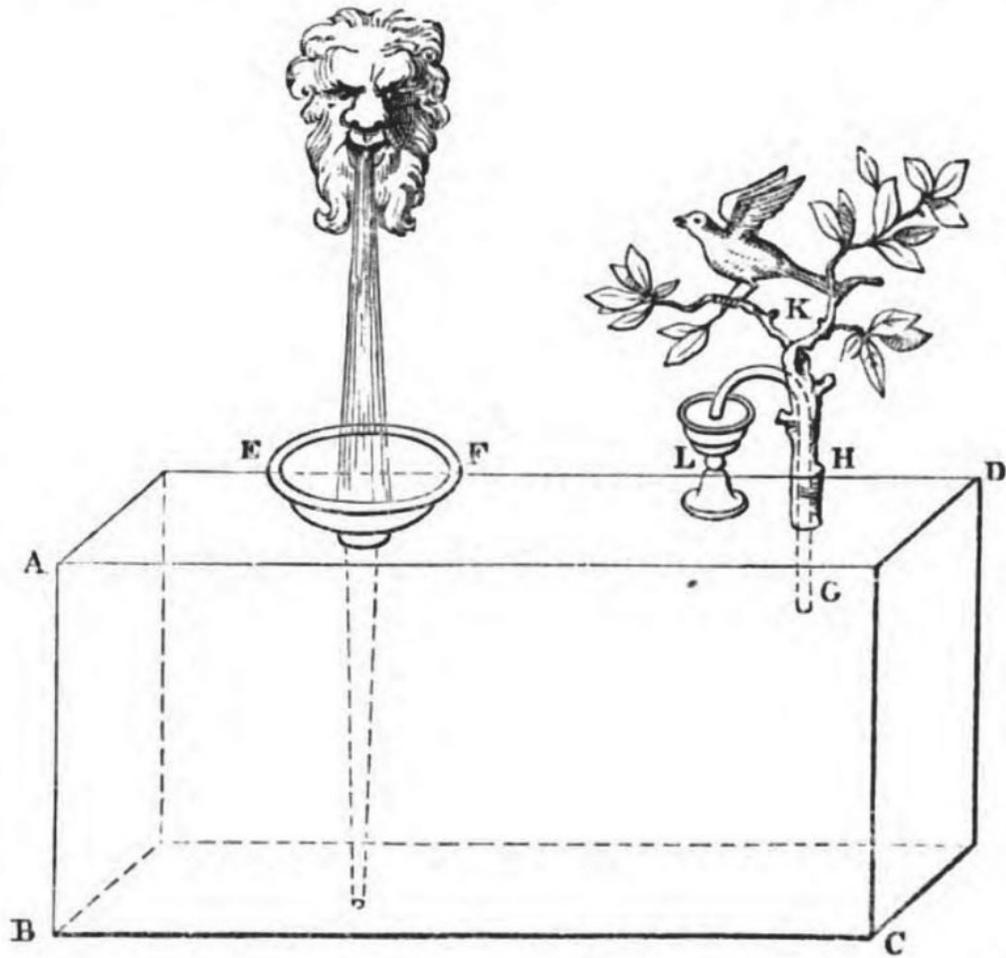
Illustration 17: Piazza Navona / by Caspar van Wittel

City as a collective dwelling,²⁸ according to Norberg-Schulz, is a place of encounters. The city is where we meet and choose. In order to meet, we require orientation, and as a result of choice we have an identity. The city is where men come together to discover the worlds of others. The city offers a sense of belonging despite the array of individual choices. Cities provide life with richness and life and places to belong together. Collective dwelling is not a mere coming together, but a being in the world somewhere as somebody. “I am a New Yorker”²⁹ is a dwelling slogan for city.

²⁸ Norberg-Schulz, Christian. 1993. *The Concept of Dwelling*. Milan: Rizzoli International Publication INC., 51.

²⁹ Ibid, 51.

Fountains can intensify this sense of meeting. Streets and squares are the main spaces for encountering. The boundary of streets and squares determines the local character. The street is primarily distinguished by its horizontal rhythm which expresses the process of meeting and discovery. The intersection of streets implies a possible change of direction and the continuous movement is slowed down. When street opens to a square, movement is stopped, and we find time to rest and meditate on the contents of meeting. The cross and square are often decorated by something particular, such as fountains to emphasize this gathering function.



Hero. 1851.
*Inventions of
the Ancients.*
London:
Taylor,
Walton and
Maberly.

Illustration 18: Hero Fountain / by Hero

This fountain
was recorded
in an
experiment.

4 Chapter: Experiments on Water Forms

4.1 Historical Water Inventions Born from Experiments

Hero of Alexandria is the greatest experimenter of antiquity and a learned writer who produced a manuscript entitled "*Spiritualia seu Pneumatica*."³⁰ It is uncertain whether Hero invented the devices described in his work. Hero states in his introduction to describe existing machines and early inventions and to add his own. Among them the most famous is the first recorded steam engine. However, there are interesting and impressive fountain designs which provide us hints of ancient Hellenistic world: the cities, parks and gardens are filled with fountains. It is proof that these experiments were a useful method in technological design.

In his *Proposition 14*,³¹ Hero designed a bird made to whistle by flowing water. As described in the work, the vessels are made such that when water is poured into them, the note of the black-cap, or a whistling sound is produced. The construction is simple:

³⁰ Hero. 1851. *Inventions of the Ancients*. London: Taylor, Walton and Maberly.

³¹ *Ibid*, 29.

Let ABCD be a hollow air-tight pedestal and a funnel EF is soldered into the surface. Let GHK a small pipe soldered into AD and its extremity is curved and dipped into water contained in a small vessel. If water be poured in through the funnel EF, the result will be that the air, being driven out, pass through the pipe GHK and emit sound. The quality of the sounds will vary as the pipes are longer or shorter.

4.2 Experimentation for Both Learning and Innovation

The central theme is to learn by experimentation. By the use of models, prototypes that allow you to reflect, improvise and evaluate, learning is accomplished through physical testing. The manipulation of independent variables gives chances to observe dependent variables. Careful observation and analysis give rise to learning about relationships between cause and effect. In the real world, linkages between variables are complex, uncertain, and poorly understood, the experiment results in iteration: progress is made through iterative experimentation. This principle is employed in developing water boundary conditions to investigate water effects in relation to scale.

The framework is a four-step iterative cycle, inspired by the ideas of Stefan Thomke³²: design, build, run and analyze. Step 1-Design: provides individuals a chance to define what they expect to learn from the experiment. New ideas are generated through brainstorming by investigating existing designs. Step 2-Build: one builds prototypes and testing apparatus. Step 3-Run: The experiment is then conducted in either laboratory conditions or in a real setting. Step 4-Analyze: one can analyze the result, compare it against the expected outcome and adjust their understanding of what is under investigation. During this step most of the learning can happen and forms the basis of experiment for the next cycle.

³² Thomke, Stefan H. 2003. *Experimentation Matters- Unlocking the Potential of New Technologies for Innovation*. Boston: Harvard Business School Press, 94.

4.3 Set up the Experiment Devices

A display of the basic elements of the experiment device.

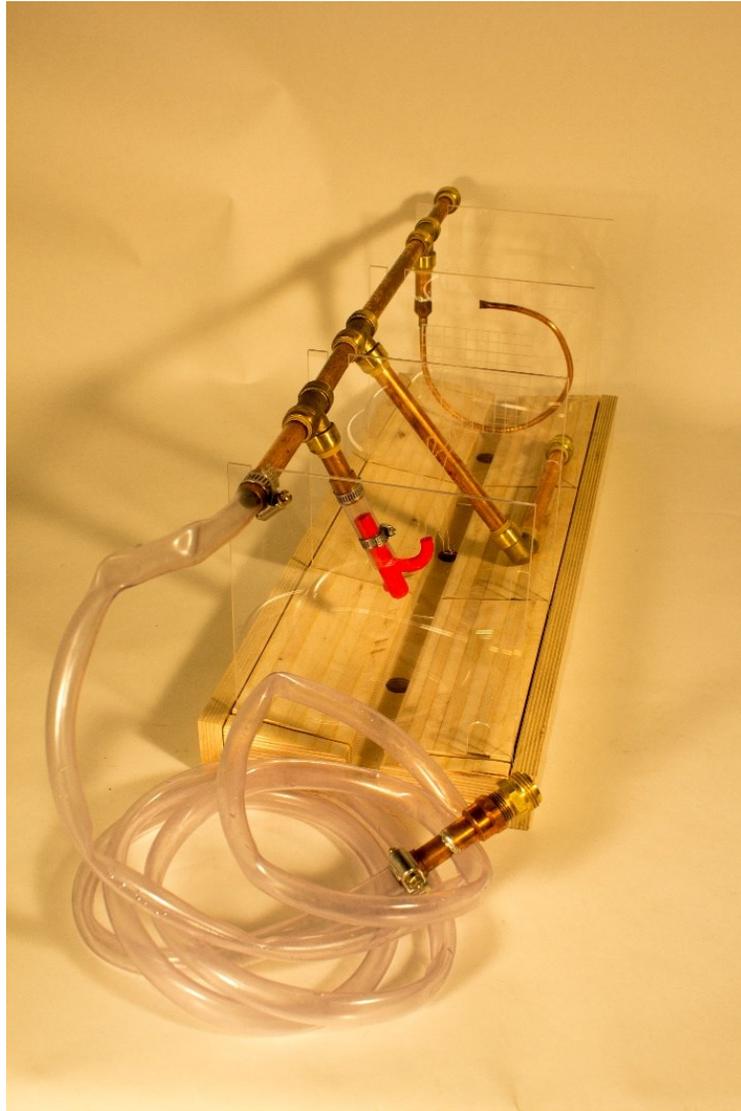


Illustration 19: Experiment System

The experimentation is carried out in a controlled 3-dimensional system. A reference coordinate plane is set up as the background

where a 1-centimeter square size grids are printed. As scale is of special concern, this coordinate system helps to understand the real water effect. The water effect image can be visually enlarged to a larger scale including sublime, but the physics of water would operate differently at that expanded scale. Nonetheless, the tests at the smaller scale do provide lessons which contribute to the next experiments and ideas. The pressed water creates a water stream in horizontal, vertical (up and down) and forward directions. These are the basic water effects. After the first iteration of this basic experimentation, careful surveys are conducted on water effects to design the next tests.

For the hardware, ½ inch copper pipes including elbows, ends and connections are used. These connecting parts are detachable to rearrange the system freely. Plastic water pipes are utilized to connect the system to the building water supply tube. Plastic plate and wood basin are designed to support the whole pipes. A printed grid board is set up as background. The experimentation is documented by video and camera.

Some 3D prints and CNC works are employed in the experiments.



Illustration 20: Nozzles and Surfaces Design

For the water effect, physical phase changes relating to temperature such as cool to ice or warm to mist is not considered.

As a boundary condition, nozzle devices are designed in 3D printing. However, the whole experiment is water centered, the interesting device shape is a result of desired water effects. The experiment is not confined to water form, the water force and

work are also examined. Swirl effect is studied since rotation is an independent freedom. Some complicated surface boundary conditions by CNC cutting models are designed to observe how water flow over various surfaces.

4.4 Design of Boundary Conditions and Water Effects

Category 1

Three basic directions including horizontal, vertical and forward.

However, gravity is playing an additional role which demands both upward and downward directions.

A black reference coordinate plane is set up as the background where a 1-centimeter square size grids are printed.



Illustration 21: Vertical Direction - Upwards Force and Downward Fall



Illustration 22: Vertical Direction - Downwards Force and Fall



Illustration 23: Horizontal Direction - Sideways Force and Downwards Fall

Category 2

Centrifugal and centripetal effects are examined. For the centrifugal arrangement, water intervention effect is investigated.



Illustration 24: Centrifugal Effect



Illustration 25: Centripetal Effect

Category 3

Swirl as an independent rotation freedom is examined.



Illustration 26: Swirl Movement

Category 4

Water force and work are examined by a rotation device. First water pushes the round piece up, and the three water streams turn the piece rotating by the unbalance of the compound force.

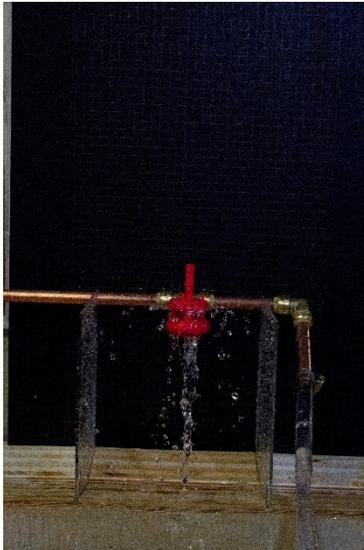


Illustration 27: Water Force and Work

Category 5

Surface effects are examined.



Illustration 28: Surface Effect 1



Illustration 29: Surface Effect 2

4.5 Inspirations from Experimentation Results

The High Line park
is considered as
the future site of
the design works.



Illustration 30: Inspiration 1



Illustration 31: Inspiration 2



Illustration 32: Inspiration 3

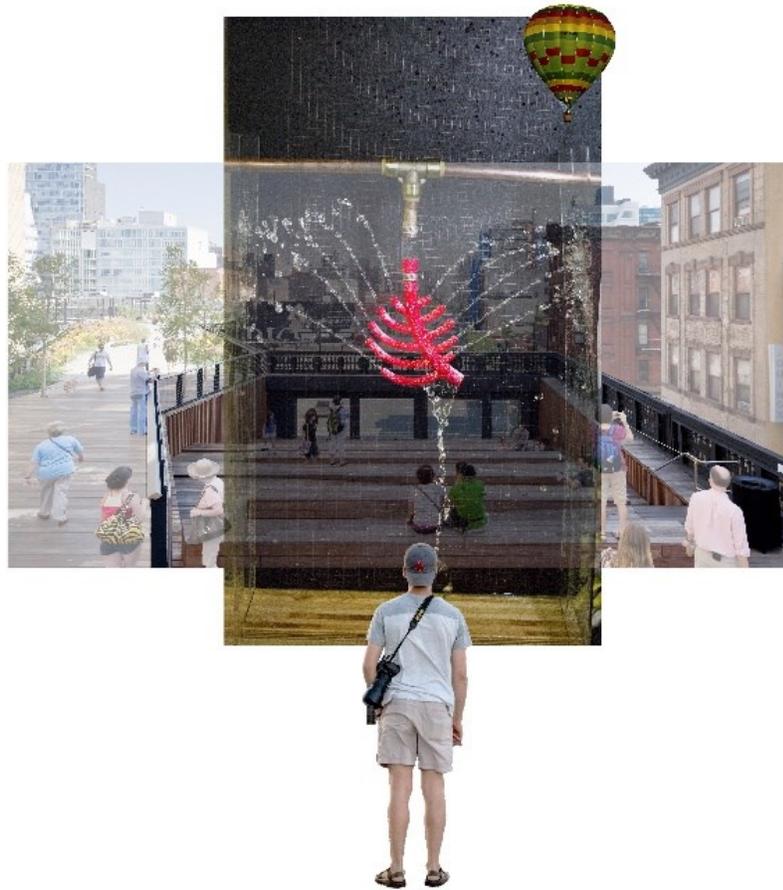


Illustration 33: Inspiration 4



Illustration 34: Inspiration 5



Illustration 35: Inspiration 6



Illustration 36: Inspiration 7



Illustration 37: Inspiration 8

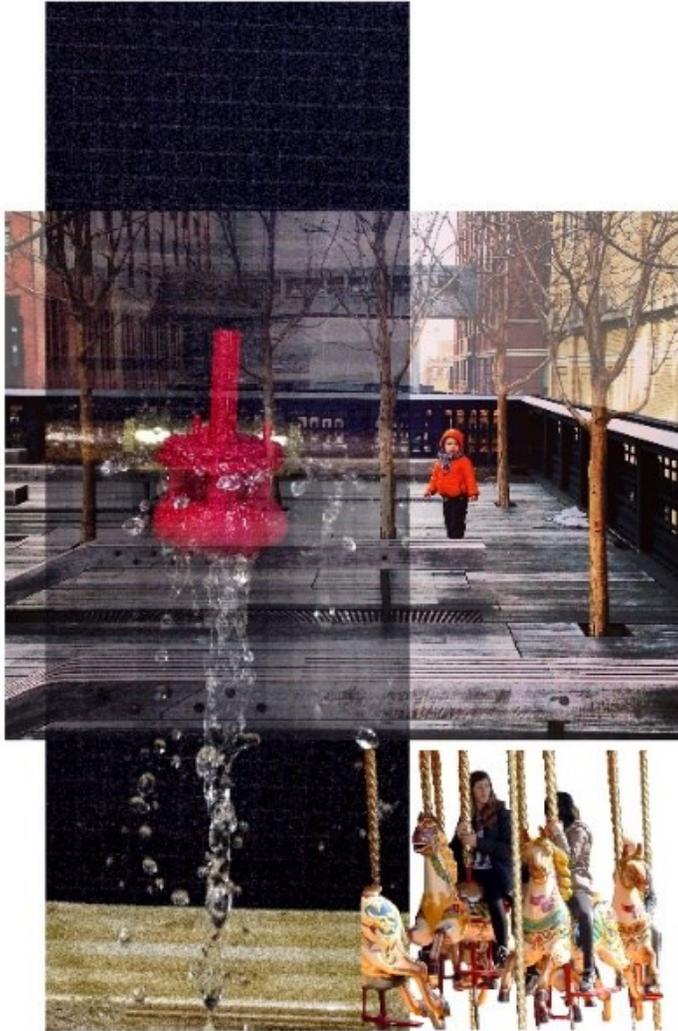


Illustration 38: Inspiration 9

Another possible site: The Flushing Meadows Corona public park is also under consideration.



Illustration 39: Inspiration 10



Illustration 40: Inspiration 11



Friends of the
High Line
<http://www.thehighline.org/>

Illustration 41: The High Line Park / by Friends of The High Line

5 Chapter: Site-The High Line Park at the New York City

5.1 Brief Introduction

During the last century, infrastructure for the movement of freight by rail was built, rebuilt and then abandoned on the West Side of Manhattan. The High Line elevated rail duct is a 1.45-mile-long, 6.7-acre public space constructed in 1930s to alleviate the traffic congestion on the street. The rise of air travel and trucking in the mid-century brought a decline in rail traffic. The southernmost portion of the High Line was demolished. The remaining part was neglected and shifted into a self-sown landscape.³³ In 2004 the High Line park was designed by repurposing the existing infrastructure and a successful public linear pedestrian park was created.

³³ David, Joshua. 2008. *Designing the High Line-Gansevoort Street to 30th Street*. New York: Finlay Printing, 26.

5.2 The High Line Functioned as a City Infrastructure

Rail on the Ground

In 1847, authorized by the City of New York, the Hudson River Railroad constructed tracks on Manhattan's West Side as far south as to Canal Street.³⁴ Then trains run between Albany and lower Manhattan, led by a "West Side Cowboy"³⁵ to warn the pedestrians of the approaching locomotive. On the surface of street, there are significant conflicts between trains and street traffic so that the operation of freight and passenger trains are regarded as an evil to the safety of people. In 1908, a protest was held to solve the dangerous conditions of "Death Avenue,"³⁶ which indicates the parts of 10th, 11th and 12th avenue.

Elevated Railroad

In 1928, the New York City Grade Crossing Elimination Act formed the legal framework for the West Side Engineering Committee to present a plan to the New York City Board of Estimate to elevate

³⁴ Hock, Karen. 2002. *Reclaiming the High Line*. New York: AOL Time Warner, 44-50.

³⁵ Ibid, 44.

³⁶ Ibid, 45.

the railroad's tracks from Spring to 30th Street. After 4 years of construction, the first High Line trains delivered freight cargo to the R.C. Williams & Company warehouse. The official opening was held on July 28, 1934, with an estimated cost of \$85 million. The full operation lasted from 1934 to 1960. Expectations were given to the track to affect the development of the West Side.

<http://www.thehighline.org/blog/2013/08/22/from-frozen-turkeys-to-park-visitors-a-history-of-what-the-high-line-carried>

The full operation lasted from 1934 to 1960.



Illustration 42: Locomotive on the High Line / by *Jim Shaughnesy*

Decline of Rail

The New York Central Railroad was forced to sell St. John's Park Terminal and stop the service on the southernmost section of the High Line in 1960. During 1961 and 1963 the plan of demolishing the southern section of the High Line was declared and executed. The last train ran down the High Line in 1980, carrying three boxcars of frozen turkeys. The next year saw the Northern Rail Service Act creating a three-phase process to divest the unprofitable freight lines.

Reuse of the Trail

In 1999 Friends of the High Line (FHL)³⁷ was formed to preserve the High Line and to reuse it as an elevated public space. Photographs by the fine-art photographer Joel Sternfeld were published to bring national attention to the High Line. In a Daily News editorial, Douglas Feiden wrote, "Such a project would rejuvenate an industrial neighborhood, add an elevated jewel to the city's park system, boost the value of underutilized properties nearby -- and create a corridor to an expanded midtown along a

³⁷ Hock, Karen. 2002. *Reclaiming the High Line*. New York: AOL Time Warner, 53.

majestic pedestrian walkway at lamppost level.”³⁸ Finally, the Council of the City of New York announced resolution 1747 to reuse the High Line as a public space.

5.3 The Birth of the High Line Park

The team of landscape architect James Corner Field Operations and architect Diller Scofidio+Renfro³⁹ won the competition and successfully designed the High Line park. They identified and respected the innate character of the almost abandoned the High Line as an otherworldly landscape. The High Line is self-seeded with meadows, thickets, vines, mosses, flowers grown in the gravel ballast. This wildness helped to protect the High Line from being demolished. The High Line is also notable for its singularity and linearity. The 1.45-mile-long, elevated rail viaduct used to serve the Chelsea area with food goods and raw material. Inspired by the beauty of this ruin, an urban infrastructure reclaimed by

³⁸ Hock, Karen. 2002. *Reclaiming the High Line*. New York: AOL Time Warner, 10.

³⁹ David, Joshua. 2008. *Designing the High Line-Gansevoort Street to 30th Street*. New York: Finlay Printing.

nature, the designers intended to transform the park into “an instrument of leisure”⁴⁰, a place about nature and culture.

Sternfeld,
Joel. 2012.
Walking the
High Line.
Gottingen:
steidl.

The photo
helps to
protect the
existence of the
High Line.



Illustration 43: Self-Sown Landscape / by Joel Sternfeld

A threefold strategy is employed in the design work. First, they invent a system of pavements made of planks with open joints and tapered edges and seams. This system allows the plants to intermix with the concrete materials and make it easy to collect water. As Joshua David describes the project, the combed

⁴⁰ David, Joshua. 2008. *Designing the High Line-Gansevoort Street to 30th Street*. New York: Finlay Printing, 31.

landscape texture produces an effect of “among” instead of “away”.⁴¹ The second strategy is to slow down, to promote a sense of duration where time is not pressing. Most of the pathways are meandering plus the seating is placed to encourage people to spend time. The last is to minimize things in contrast to the trends of making things giant. The width of the planks is 8” which is very delicate in measuring the High Line.

As a result, a line with varied sequence of public space and landscape is realized. The landscape is a biotope⁴² with networks of small gardening to show the human respect to other living things. The new plantings build up a specific environment with microclimates associated with sun, shade, wet, and wind. The line contains a series of vistas elevated to see Manhattan and the Hudson River. But much flexibility and responsiveness are left in the design, which leaves space for the demands of changing needs and the tastes of time.

⁴¹ David, Joshua. 2008. *Designing the High Line-Gansevoort Street to 30th Street*. New York: Finlay Printing, 30.

⁴² Ibid, 30.

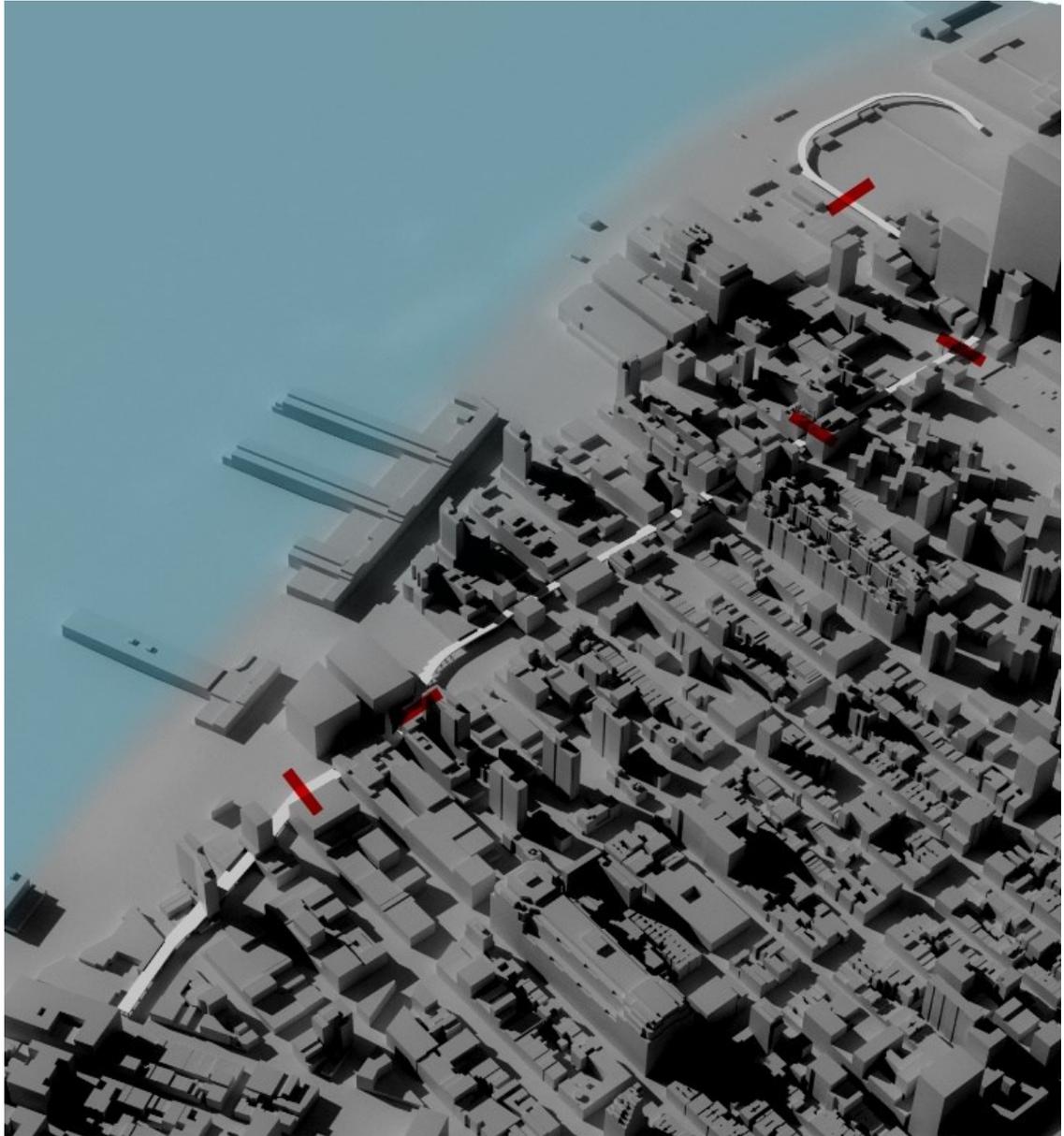


Illustration 44: Site Model

6 Chapter: Designs of the Five Water Effects

6.1 Introduction

Over the High Line park another layer of water works is to be introduced. The design is composed of five micro narrative sceneries inspired from experimentation and imagination. By adding five fountains along the 1.45-mile-long park, the atmosphere is activated, while the identity of the place is intensified. Visitors are orientated by the fountain landmarks and are gathered to meet each other. Waters are displayed in a range of scales and forms to provide an abundant sensory stimulation to viewers. The five fountain spots constitute a macro narrative scenery to represent the spirit of New York.



Illustration 45: Site Photo

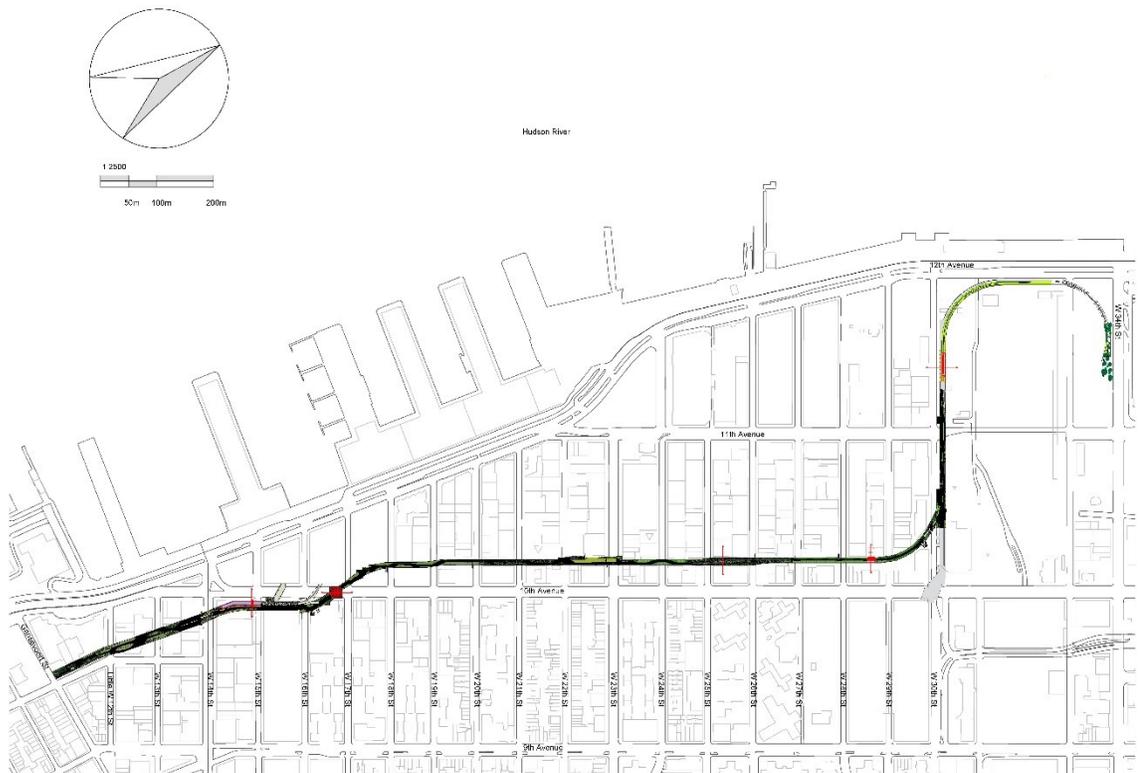


Illustration 46: Site Plan

6.2 Five Micro Narrative Sceneries Tell about the City Lives

Scenery 1: Ring

A nearly 40-meter-high circular ring ejects 12 centrifugal water streams which intervene with each other and pour down to the pool. It is intended to symbolize the attraction of New York to gather people around the world together. The elevated water leads people to the green plants under it, by which to intensify the identity of the place. The location of the water cascade is near the crossing of the West 15th Street and the 10th Avenue and opposite from the 14th Street park, through which the water can be seen from the Hudson River.

The water is facing the entrance of West 14th Street and performing to give visitors, who come up from below, a surprise with its uncommon effect. People who come out of the Chelsea Market Passage are suddenly in face of a 30-meter-high cascade which can create a fearful feeling. The design is at the sundeck yard where people sitting near the foot of the cascade can feel the powerful mass of the water. By managing the way people

encounter this water work, a 30-meter height which is nothing to the skyscrapers, is intended to produce a sublime effect.

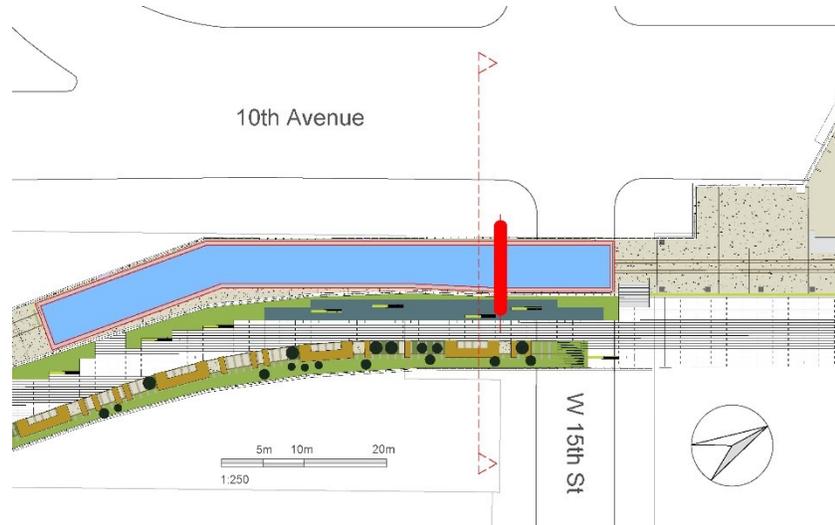


Illustration 47: Plan of Scenery 1

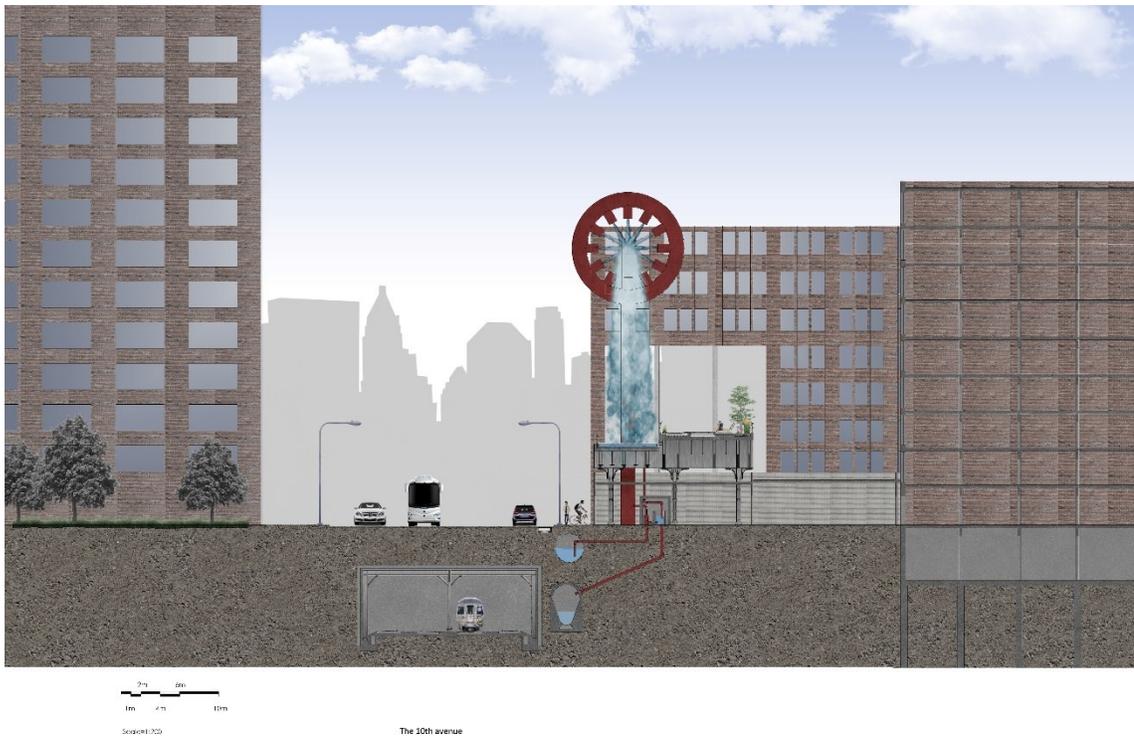


Illustration 48: Section of Scenery 1



Illustration 49: Rendering of Scenery 1

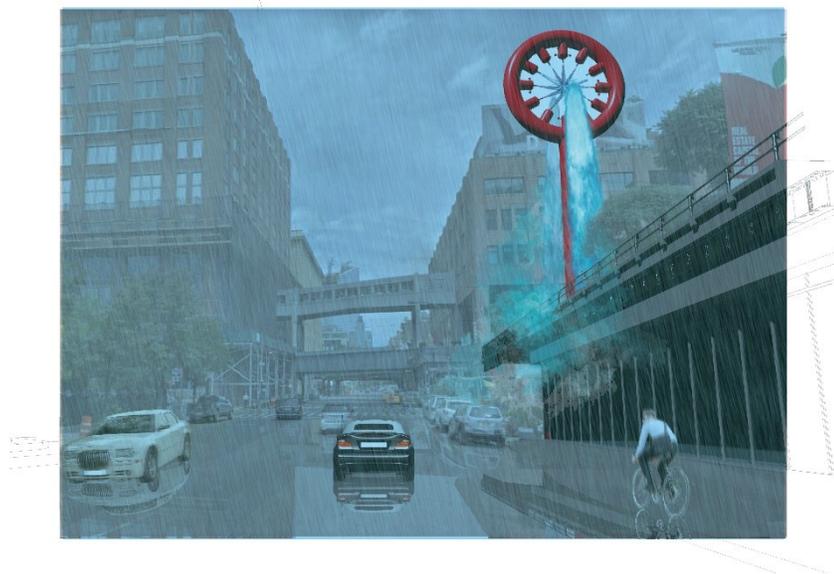


Illustration 50: Vignette of Scenery 1

Scenery 2: Fog

The 10th Avenue Square is occupied by a set of 9 weather wave form fountains. The fountain is designed to produce fogs in all seasons. No water basin is needed. The fogs dance with winds which reminds us about climate changes and appeals for collaboration with natural environment. By immersing in the fog masses, people are encouraged to experience with all senses rather than simply visual. This tender fog invites people to participate to feel the fog on skin, to feel the wind on face and to think about our belonging to nature.



Illustration 51: Plan of Scenery 2



Illustration 52: Section of Scenery 2

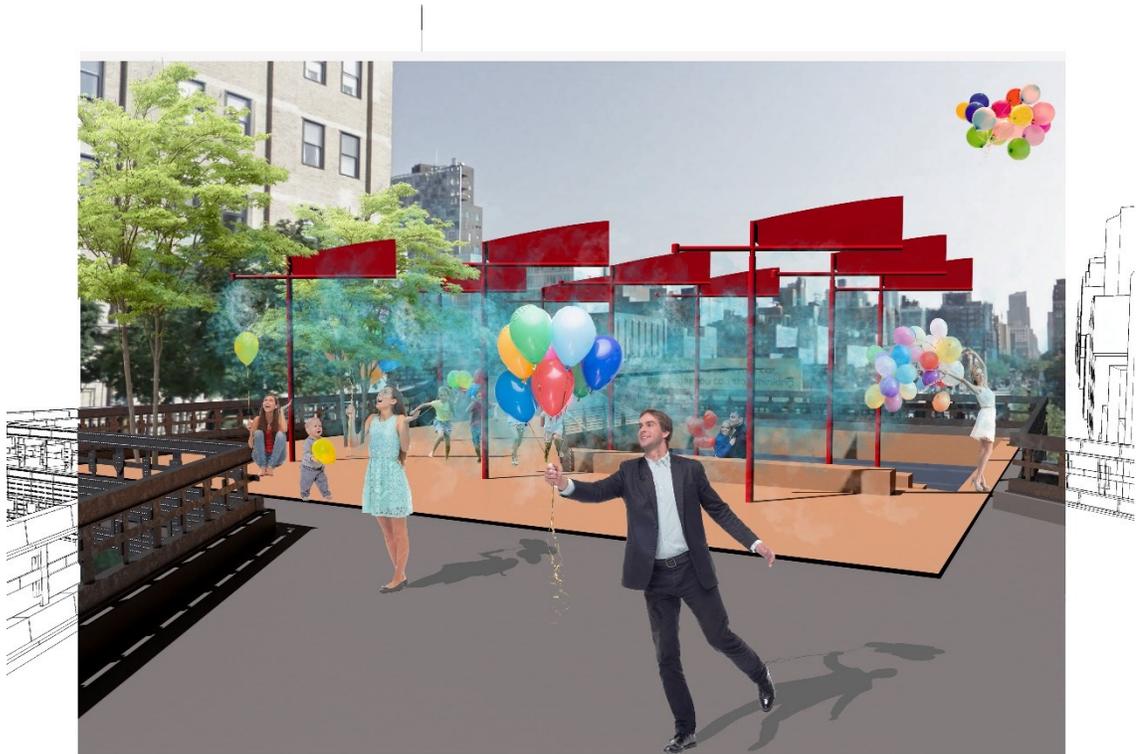


Illustration 53: Rendering of Scenery 2



Illustration 54: Vignette of Scenery 2

Scenery 3: River

A wall fountain is located at the West 29th Street. The design reveals the adaptive property of water when it flows over a set of obstacles. The water resembles the Hudson River nearby to remind the viewer the close relationship of New York to river. A pool and bridge are added to set up a scene of summer moon dream and winter skating yard. The function of the fountain wall is to produce a nearby microclimate. During a hot summer, the coolness near the wall captures the winds from the river.

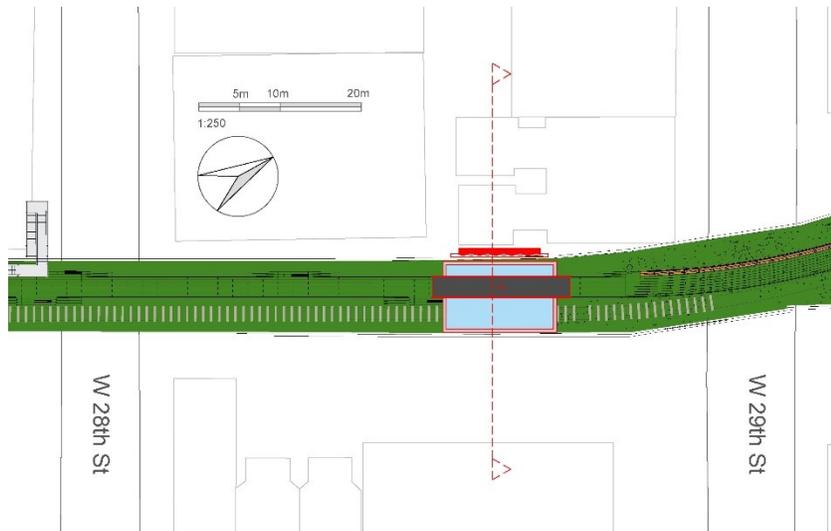


Illustration 55: Plan of Scenery 3

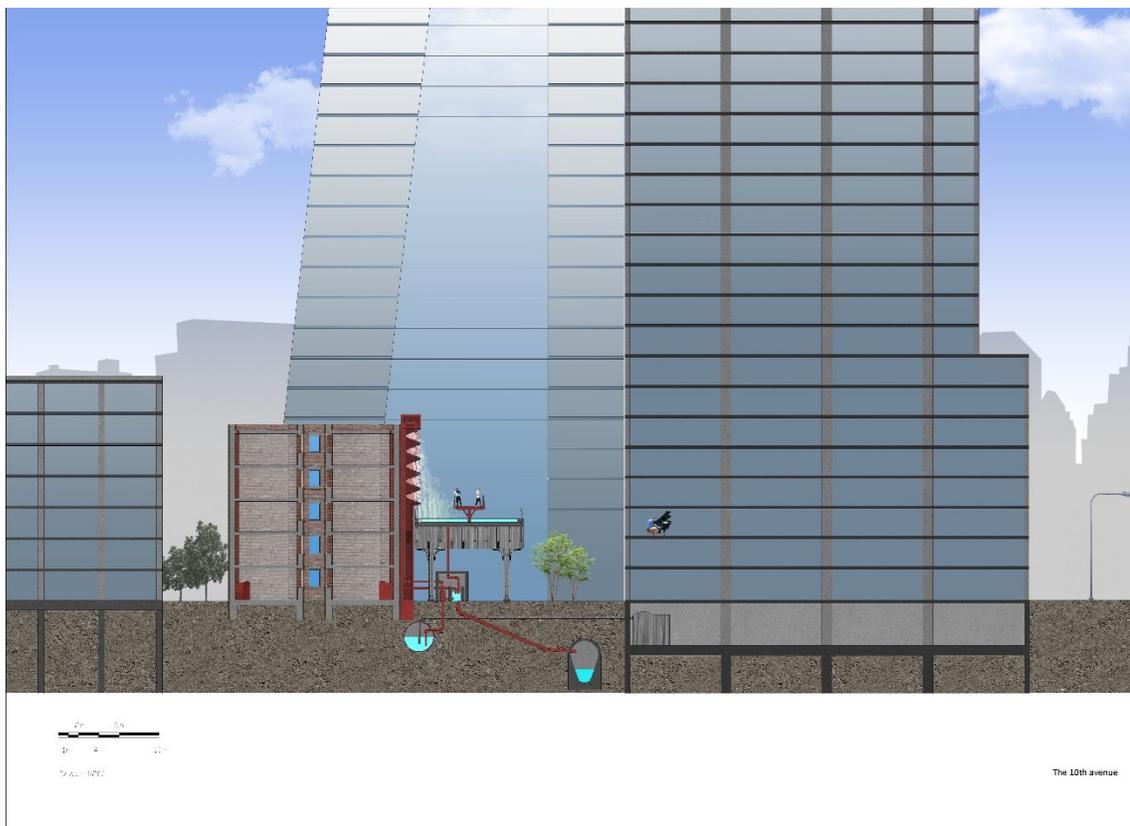


Illustration 56: Section of Scenery 3



Illustration 57: Rendering of Scenery 3

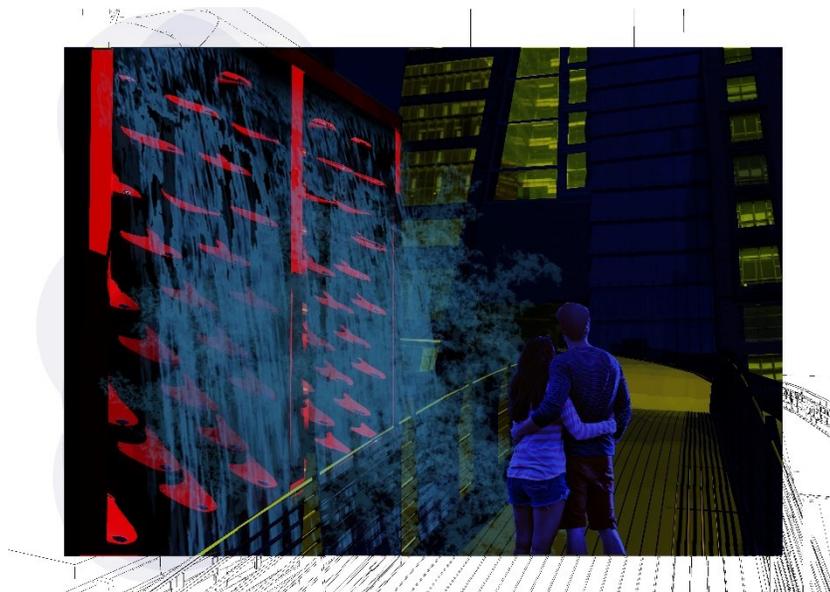


Illustration 58: Vignette of Scenery 3

Scenery 4: Rotation

Along West 30th Street, the High Line runs vertical to Hudson River bank. A wide view of Hudson River provides a background for the exhibition of swirling movement of water. A compact man-made wave device adds the High Line a 40-meter-long surf park. The combination of adventure water sports with exhibition of water produces a new destination for the young New Yorkers to experience water in a safe and controlled environment. When you are surfing you can not control the waves but have to adjust yourself to interact with waves. This is just the same as in life.

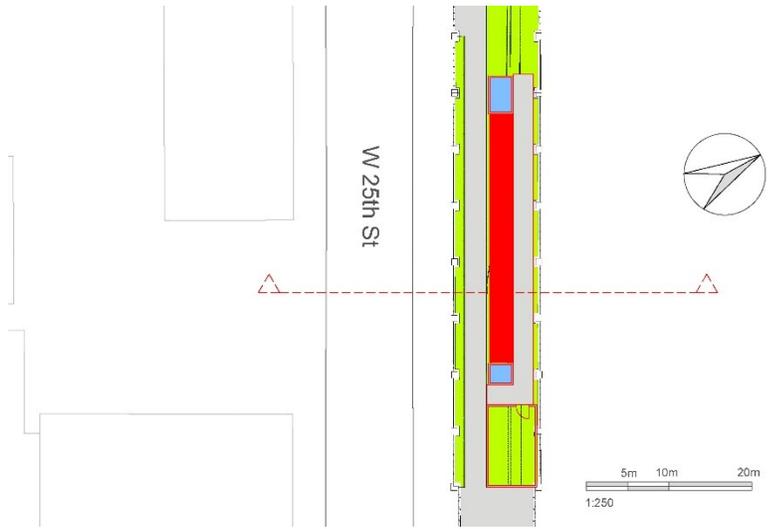


Illustration 59: Plan of Scenery 4



Illustration 60: Section of Scenery 4



Illustration 61: Rendering of Scenery 4

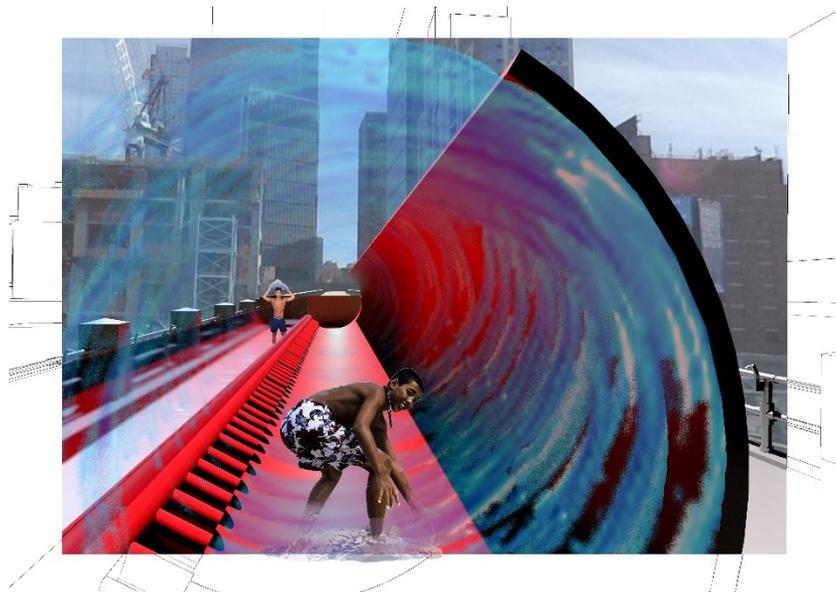


Illustration 62: Vignette of Scenery 4

Scenery 5: Favor

The drinking fountain is the origin of civic fountains. This function is almost neglected by modern people, who can easily have access to fresh bottled water, from the coffee shop or corner store. This design is to remind people about the existence of water infrastructures and the preciousness of water. Furthermore, the design of the fountain is to reveal the force water has and the work water can do. By moving a small piece of an object, the power of water is shown. While drinking the fresh water from such a small-scale fountain, people enjoy the gift water gives us.



Illustration 63: Plan of Scenery 5



Illustration 64: Section of Scenery 5



Illustration 65: Rendering of Scenery 5



Illustration 66: Vignette of Scenery 5

6.3 One Macro Narrative Scenery Intensifies the City Identity

Along the High Line Park five fountains are interwoven within the repurposed infrastructure. They are intensifying the High Line park as a green landscape by displaying water. They are also dialoguing with the garden environment to demonstrate the meaning of water. The five designs constitute another layer to present stories of their own. As the most visible part of the water infrastructure, fountains are the symbols of the unseen water network. Water and green as a whole is reinforcing the spirit of New York, a city which has taken garden as an indispensable element of city planning.

A slow walk through the High Line park would take thirty minutes. Visitors feel the park even more energetic, since water is more active and dynamic than the plants. They are also enjoying an enlarged landscape space, since their visions are attracted not only by things around but also by those from above. With changing of seasons and times of day, water is presenting different forms to different people. The moments of surprise supplied by water are enriching the emotional experience of

citizens. The numerous sensory stimulations created by water are changing city life in a special way and gathering people into urban dwelling together.

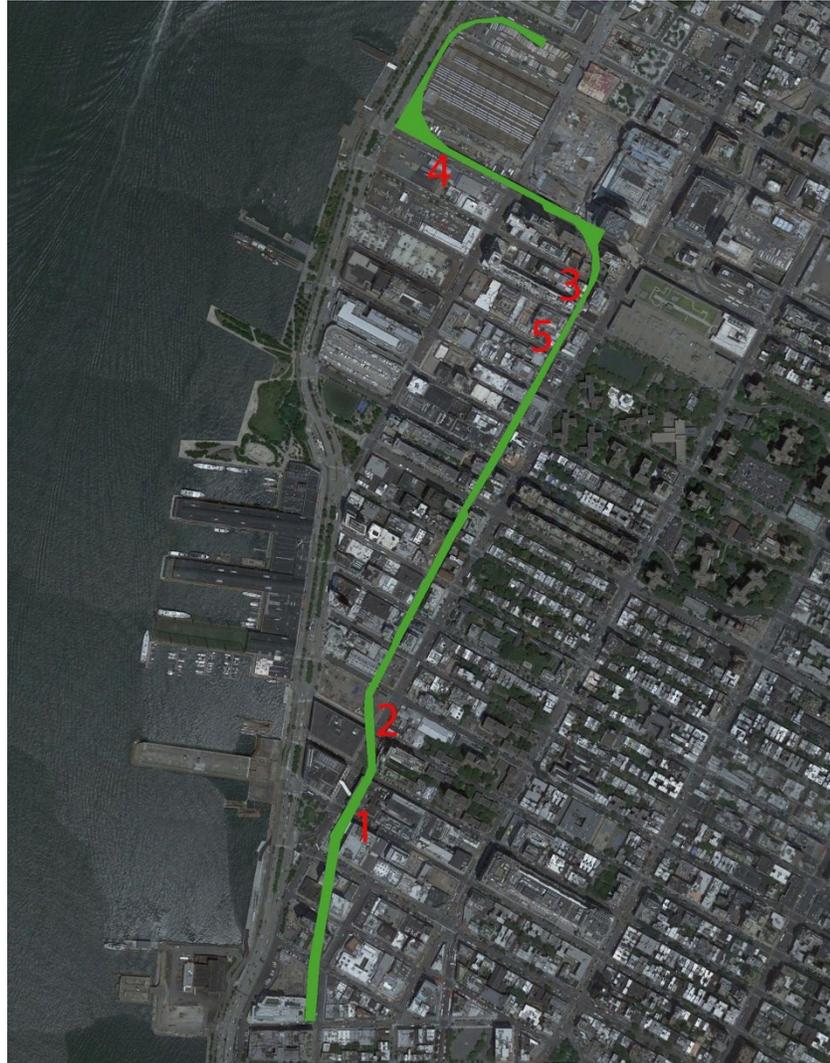


Illustration 67: The Macro Scenery

7 Chapter: Conclusions

New York is famous for its skyscraper skyline and its Central Park, both of which required the transformation of the urban landscape through technological interventions. The High Line Park as a new attraction of the city, acquires a layer of water to be experienced as a real garden. However, the property of water is so varied, and the modern technology has made its form even more multiple to adapt to a variety of environments. This thesis explored an experimental method to acquire inspirations in the design of water forms. Then, a set of five fountain interventions to the High Line park were carried out with a sensitivity to particular types of urban experiences, related both to dwelling and to the sublime.

New York is the home of Geometrical Sublime, which is examined in the first part of this thesis. The sublime experience is not only determined by the absolute scale of the object but also related to the reaction of mind to image. The roles of fountains in the restoration of Baroque Rome also influenced these five designs for High Line fountains, which similarly distribute, display and serve. Experimentation with small-scale fountains allowed the imagination of new meaningful water forms. The landmark

function of these contemporary fountains contributes to the collective dwelling of city life, by gathering people together in common experience and providing new opportunities for interaction, sensation, and emotion.

Further experiments could be designed to test other water properties in a future study. Once the design context changed, a different design strategy could be considered. However, this thesis proved that sublime can be brought into life by water works and experimentation can stimulate creativity in form finding. The final five micro sceneries represent the sensory abundance in city life. A subtle and real transformation occurred in the High Line park by complementing it with another layer of water scenery. The story of city life finds a new dimension in watery sublime experiences.

Epilogue

During the final defense, the relationship between the subterranean insanity of New York city and the proposed project was well discussed. The objectified water conditions could be perceived as a token gesture of a hidden system or a function device of the underground engineering miracles. Another well criticized point is the sublime experience, which can be a situation by a glimpse of the absurdity of the subterranean system or in a micro scale such as the power felt by the first sip of water after a long fasting. However, the project is not extended to the exploration of the insight and inspiration triggered by the combination of the above ground architectural interventions and underground engineering considerations. This thesis focused on the functional elements of fountains as gathering and leisure, and water as sculpture and geometrical sublime device.

Appendices

Appendix A Photos of Defense

A.1 Photo of Layout



Illustration 68: Photo of Defense Layout

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Illustration 4: The Grand Canyon / *by John K. Hillers*

<https://www.mutualart.com/Artwork/Grand-Canyon-and-Colorado-River/D6BC091DEBFA720C>

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Illustration 7: Golden Gate Bridge Celebration / *by Author*

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Illustration 8: Waterfall Versailles / *by Olafur Eliasson*

<http://olafureliasson.net/archive/artwork/WEK110140/waterfall>

Illustration 14: Nolli Map with Fountains' Positions / *by*

Giambattista Nolli

Nolli, Giambattista. 1991. *Rome 1748: Being a One-half Scale Reduction of Giambattista Nolli's Pianta Grande di Roma*

Illustration 15: Sailors' Fountain / *by Giovanni Battista Piranesi*

http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=1674373&partId=1&searchText=piranesi+rome&page=2

Illustration 17: Piazza Navona / *by Caspar van Wittel*

<https://www.museothyssen.org/en/collection/artists/wittel-gaspar-van/piazza-navona-rome>

Illustration 18: Hero Fountain / *by Hero*

Hero. 1851. *Inventions of the Ancients*. London: Taylor, Walton and Maberly.

Illustration 41: The High Line Park / *by Friends of The High Line*

<http://www.thehighline.org/>

Illustration 42: Locomotive on the High Line / *by Jim Shaughnesy*

<http://www.thehighline.org/blog/2013/08/22/from-frozen-turkeys-to-park-visitors-a-history-of-what-the-high-line-carried>

Illustration 43: Self-Sown Landscape / *by Joel Sternfeld*

Sternfeld, Joel. 2012. *Walking the High Line*. Gottingen: Steidl