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abstract

Water is universally recognized as a fluid and dynamic element, whereas architecture is perceived as a fixed and stable part of our surroundings. The negotiation of this tension between water and architecture provides an imaginative design opportunity. Architects tend to consider water merely as the primary enemy, tailoring design to keep it out of and away from buildings. This neglectful and narrowly technical attitude does not allow water to become a legitimate design element or constraint. The conventional role of water in architecture, as an aesthetic feature or an enemy, will be inverted to allow water to become a critical design constituent in the redesign of the Saint John ferry terminal on the Bay of Fundy. With nearly thirty-foot tidal changes, the terminal will allow this significant tide to penetrate the building, continually transforming the interior, as well as the exterior.
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>Illustration List</td>
</tr>
<tr>
<td>002</td>
<td>Illustration Credits</td>
</tr>
<tr>
<td>003</td>
<td>Introduction</td>
</tr>
<tr>
<td>007</td>
<td>Water…It’s Been Around</td>
</tr>
<tr>
<td>013</td>
<td>And Around</td>
</tr>
<tr>
<td>018</td>
<td>Fixed Dynamic or Fluid Stability</td>
</tr>
<tr>
<td>026</td>
<td>Changing Tide</td>
</tr>
<tr>
<td>032</td>
<td>Bringing Water Back</td>
</tr>
<tr>
<td>042</td>
<td>Bibliography</td>
</tr>
</tbody>
</table>
image 001. diagram by author
image 004. photograph by author
image 007. http://www.flickr.com
image 009. Cliff and Paula Lazar for http://www.lazardev.com/Italy_2004/Italy_1_Sorrento.htm
image 011. Steele, James. [photograph section]
image 014. http://www.flickr.com
image 017. http://www.flickr.com
image 018. http://www.buffer.forestry.iastate.edu/Photogallery/illustrations/illustrations-1.htm
image 019. Imre Kinszki for Calado, Jorge. [p377]
image 020. Art Wolfe for Gilders, Michelle A. and Claus Biegert. [p029]
image 023. diagram by author
image 026. http://www.flickr.com
image 028. “Kastrup Sea Bath.” [p115]
image 029. diagram by author
image 030. Stephen Homer for Thurston, Harry. [p081]
image 032. http://www.flickr.com
image 033. Stephen Homer for Thurston, Harry. [p050]
image 034. Thurston, Harry. [p167]
image 035. Stephen Homer for Thurston, Harry. [p116]
image 036. diagram by author
image 038. photograph by author
image 040. image by author
image 041. http://www.flickr.com
image 042. image by author
image 043. image by author
image 044. photograph by author
image 045. diagram by author
image 046. image by author
The history and relationship of water, man, and shelter is quite complex and has transformed over time. To understand its present status, it is imperative to examine the past use and exploitation of water. “Water is more than habitat, it is life. It suffuses our planet, just as it suffuses our bodies. Water has shaped our Earth, our evolution, our physiology, our societies, our cultures, and our religions.”\(^1\) We cannot sustain ourselves or any other living matter without water. Despite being essential and fundamental in maintaining all life on Earth, water is often underappreciated, underutilized, and taken for granted in the modern world, in which its supply seems limitless. We carelessly use water everyday to flush our toilets, take showers, and wash our vehicles, without even a second thought. It is estimated that “a human being needs only two to three liters daily in order to survive; nevertheless, the overall water consumption per inhabitant in industrialized societies ranges between 120 and 180 liters per day.”\(^2\)

Architecture reflects this insensitive way of thinking by neglecting the useful and sensually stimulating possibilities for integrating water—in its three physical states and in a myriad of conditions of motion and stillness—in design. Water, genuinely fluid and dynamic, contradicts the fixed and stable attributes of conventional architecture. Architects design drains, basins, gutters, and downspouts to keep water out of and away from buildings. Numerous water features, such as fountains and pools, are not integrally designed and are even haphazardly added to buildings and spaces years after completion, playing little or no role in the building design or function. Architecture does not view water as a legitimate design element or constraint. This negligent attitude toward water can be supplanted with the recognition and reverence that the life-giving element deserves, by bringing water to the forefront of design, thought, and process. Through architecture and design, the value of water needs to be restored and enhanced by allowing water to become an integral part of architecture, through their mutual exploitation. By means of architecture, people can once again appreciate the cultural, social, and spiritual facets of water, and value its diverse physical and emotional characteristics. As Charles Moore states, “the key to understanding the water of architecture is to
understand the architecture of water—what physical laws govern its behavior, how the liquid acts and reacts with our senses, and, most of all, how its symbolism relates to us as human beings.”

Water was not always taken for granted. There was a time when water was praised and glorified as a life-giving source. This was a time before any configuration of plumbing or running water existed, a time when you went to the river or spring with a bladder or other container and carried the fresh water back to your dwelling to drink, bathe, and cook. Civilizations were founded around constant supplies of fresh water because it provided life for them, as drinking water, food, and transportation. Canals and irrigation trenches were built to help control flooding and grow crops. People attempted to live harmoniously with the water’s natural cycle because they understood the power that it contained and the destruction it could cause, through floods, tsunamis, and other natural disasters.

Water is typically considered a renewable resource because it is capable of being replaced by natural ecological cycles or sound management practices; however this does not give anyone the right to carelessly use as much as he or she pleases. There are consequences. Renewable resources can become non-renewable due to mis-management and pollution of the environment by humans. More then 75 percent of underground water is non-renewable, due to the fact that replenishing it would take centuries or more. Society also has a tendency to pollute water supplies with debris, waste, and chemicals, causing the water and surrounding soils to be polluted for a lifetime. As the population grows, water needs increase exponentially. With this in mind, water usage and cycles need to be understood in order to design sustainably, which is necessary to sustain life on this planet. This understanding not only concerns water, but all aspects of design including materials, energy, waste, transportation, and labor. It is everyone’s responsibility, including the architect, to educate the public about sustainability as a way of life through the design of their buildings and their actions.

Concerning the tension between water and architecture, it is imperative to open the mind and the emotions to the endless possibilities and variants that water can serve in architecture. Architects and

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4 http://www.eco-pros.com/renewableresources.htm
designers need to think beyond water in the conventional sense, how it can be deferred from buildings, and start thinking of the prospective ways to utilize water to enhance the environment. This involves investigating the different forms of water—solid, liquid, and gas—and exploring the multitude characteristics associated with water—purity, reflection, destruction, still, running, splashing, bubbling, and foaming. Clearly stated by LTL Architects, “Rather than relegating water to its conventional role as an aesthetic feature, (it needs to be) incorporated as a critical component in the orchestration of the design—opportunistically engaging water in its multiple forms as a functional, physical, and transformative medium.”

The Bay of Fundy, located on the eastern Canadian coastline, is an optimal location to explore the relationship of water and architecture, since it boasts the most significant tidal changes in the world. The bay is situated between New Brunswick and Nova Scotia, providing a unique, transformative environment for the surrounding area. The city of Saint John, New Brunswick, positioned on the northern shore, is still largely industrial and relies heavily on the bay for its livelihood. This thesis investigation calls for a new ferry terminal for the city of Saint John that will reflect the city’s heritage and serve as a landmark to the city for incoming water traffic. It will acknowledge the current tension between stable, fixed architecture and fluid, dynamic water, while attempting to dissolve that line of division. The new terminal will integrate design and water, so that one cannot survive without the other, creating a symbiotic relationship which learns from nature. It will encompass a multitude of sensuous qualities and emotions that water evokes, seducing the user to recognize the significance of water, and the power of the tides in the bay.

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5 http://www.ltlwork.net/index.html
Water has long been regarded as one of the four basic elements of the universe: earth, air, fire, and water. Water is a major source of all life and the great symbol for life; nothing can escape its influence, and nothing can survive without it. In fact, water can make up to 90 percent of an organism’s weight. The human body is around two-thirds water, with the brain composed of 70 percent water and the lungs nearly 90 percent water. Each day humans must replace 2.4 liters of water, mainly through drinking and some through the foods eaten.6 Without water we cannot survive. This is the reason why water consistently appears as a common thread woven through the religion, literature, and art of every culture. Early civilizations and settlements were established near a constant source of water, because it was essential for survival.

Pure water is colorless, odorless, and tasteless, yet over the course of time it has been used as a metaphor to exemplify everything from life, youth, health, beauty, fertility, chastity, and purity to destruction and even death. Tame water, clear, fresh, and reflective, is often associated with meanings of youth, health, and beauty. People have always enjoyed the healing and rejuvenating treatment of water, from the ancient baths to modern day spas. Special waters have also been thought to have healing powers, such as the mystical fountain of youth, which reverses the effects of time. Abundant water has also been seen as a symbol of fertility, by emphasizing the relationship between water and the fertility of the earth. Civilizations throughout time have devised a multitude of rituals and dances to bring them rain for crops to grow and for drinking. When water is pure and clean, it can also indicate chastity and the notion of cleansing or purifying. We have been bathing and cleansing ourselves with water from the beginning of time, but we have also given it a spiritual meaning in the metaphor that physical purification leads to spiritual rejuvenation. Water is used in many religious ceremonies, including baptisms and christenings to represent spiritual rebirth and the entrance into a new life. While water is more commonly seen as promoting and giving life; it can also be a symbol of death: empty, dark, and cold. Water dissolves bonds, it spoils, it drowns, it wears away, it rots, and it floods. You do not have to look very far to see the devastating effects of water; the 2004 Indian Ocean tsunami and hurricane Katrina in 2005 provide disturbing photographs and unbelievable stories. No other element can embody such diverse representations and evoke such an array of emotions. “Water is

6 http://ga.water.usgs.gov/edu/mwater.html
so immaterial that it is difficult to find something to say beyond a series of personal impressions." When each person thinks about water a different image comes to mind, which is influenced by our personal experiences and emotions. The amazing aspect is that we are all correct because water encompasses such a wide variety of characteristics and emotions depending on the function and location. But regardless of the connotations, water is undeniably a powerful force with which to be reckoned.

In the Christian tradition, water signifies the rebirth of a person into a spiritual life and the promise of eternal salvation. And therefore, water is often referenced in the Bible: "I will sprinkle clean water upon you, and you shall be clean from all your uncleanesses, and from all your idols I will cleanse you." The Koran states that water is a gift from God. And in India, during religious festivals, thousands flock to the Ganges for ritual immersion, despite the fact that the river is brown and muddy, it is believed to be purifying and never loses its redemptive power. Upon approaching a mosque there is a place for patrons to wash their face, hands, and feet before entering the mosque. This is done to physically cleanse the body, but also to cleanse the spirit before entering the mosque to worship. Religious texts also acknowledge the strength and dominance that water possesses through the threat of great floods. In the Christian faith God ordered Noah to build a boat for his family and two of each animal kind, in order to survive the oncoming flood, and repopulate the earth. God then made it rain for 40 days and 40 nights, completely destroying the Earth with water. Noah, his family, and the animals were forced to live at sea for another 140 days, until they could find dry land. Other cultures and religions have similar stories of devastation and destruction caused by an excessive amount of water.

Even though water does possess such destructive powers, it still encompasses a liveliness and energy by which people are mystified. Nicola Salvi completed the Trevi Fountain in Rome, in 1762, as a glorious affirmation of the water cycle. It contains the concepts of dreams and fantasies, while still relating to the everyday customs.

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8 Moore, Charles W. [p020]
9 Moore, Charles W. [p017]
10 Moore, Charles W. [p020]
First, a twisted crack splits its travertine pilaster, then rocks crumble from its face, and, finally, large boulders tumble off into a pile of rubble, magically fusing with natural rocks down below. As one enters the piazza, the sound of gushing water steadily mounts to a gentle rumble, then suddenly the street bursts into sunlight and a crash of water engulfs the senses. Out in the open, water rushes everywhere. The Trevi Fountain rises into full view, commanding attention as it overcomes the piazza with its formidable delight. Here, water makes its jubilant entry into the city.¹¹

The fountain water splashes, foams, churns, spits, caresses stone reefs, and at night creates a shimmering spectacle on the facades of the neighboring stonewalls, windows, and arcades. Some even believe that the Trevi Fountain is the ultimate joining of water and architecture, because with a relatively small amount of water, all of the world’s water is called to mind, and it is “water that provides the lifeblood for meaning in architecture.”¹²

One building that exemplifies the complex characteristics and spirituality of water is the Salk Institute for Biological Studies, in La Jolla, California, designed by Louis I. Kahn. The 27-acre site is rich with vegetation, overlooks the Pacific Ocean, and is adjacent to the campus of the University of California at San Diego. Jonas Salk was concerned about the appropriateness of the site for such a “serious institution.”¹³

After meeting with Kahn, and a second visit to the site, he determined that there could not be a better place to link science with the humanities. Not only does Kahn take advantage of the adjacency of the ocean and the natural views of the Pacific horizon, but he also manages to incorporate meaningful water elements, which divide space and focus your attention.

The courtyard, with its lack of vegetation and its continuous channel of streaming water, is the most powerful and awe-inspiring component of the Salk Institute. It is Kahn’s minimalist approach and treatment of the courtyard, that creates an exceedingly emotionally charged space, with very few architectural elements. Surprisingly, the final design for the courtyard was originally left undetermined. During construction it was used as a staging area. Kahn invited Mexican architect Luis Barragan to visit the site and asked his advice

¹¹ Moore, Charles W. [p022]
¹² Moore, Charles W. [p023]
Kahn then finalized the design of the courtyard, paving it entirely in Italian travertine and placing a one-foot-wide, continuously running stream down the center. The peaceful stream divides the courtyard in half but does not keep pedestrians from crossing over it, or curious souls from dipping their hands or feet. The stream terminates into a shallow pool, which seems to extend out into the ocean.

The heart of the Salk is an open-ended central courtyard that divides two parallel wings, each lined along the inside face by five free-standing towers—the wings house laboratories; the towers, arcaded at the base, house private studies. In plan, labs and studies form two serrated bars that straddle the sun-baked courtyard. Standing at the entrance to this scene, open-air nave, ten thousand eyes have lifted cameras to cheekbones to record Kahn’s perspective gift. A narrow ribbon of water pulls each lens due west along the courtyard’s centerline, launching the viewer into a distant belt of ocean that joins the surface of the court to infinite space.

After the pool, you do not discover where the water goes until you leave the courtyard and descend a set of stairs to a lower garden area. The water leaves the pool through an angled gap and falls into a lower catchment pool surrounded by seating. Workers from the Salk Institute often eat lunch, converse, and relax in this area, listening to the falling water.

...In the [lower] garden, the sound of water entering a pool will take the mind from work. We realized that splashing jet fountains seen from the Laboratory associated with the utilitarian use of water would seem like mimicry. The proposed idea of the use of water, paving and potted plants will be in sympathy with the Architecture.
The Salk Institute employs the existing ocean and man-made elements to provide workers and visitors alike with an emotional and spiritual experience that frames a breathless view of the Pacific Ocean and allows people to contemplate the defined versus the undefined. This proposal strives to achieve the emotional and inspiring experience that Kahn is able to create, through the use of water as an architectural constituent.

No other element on this earth has the significance and power that water does. Yet, we continue to disregard it everyday. Our outlook has become one of control. Anytime we want water, we walk over to the faucet, turn the handle and instantly, we have water. Before there was plumbing, people had to work hard to get water from a river, spring, or well, and they understood how precious it was, and did not use it carelessly. The beginnings of plumbing can be attributed to the Roman Empire, where they built aqueducts to bring water several miles to use in their baths, recreation centers, and communal fountains. Much later, water became available through pumps and hydrants placed throughout towns. As time went on, the growing population of cities brought waste disposal and contamination issues, which spawned the early water closets. Impure drinking water in the ground brought up by wells carried terrible diseases: cholera, typhus, tuberculosis, smallpox. During these times many people were actually afraid to bathe. The real advancements in plumbing have been within the past 200 years, finally providing a seemingly endless supply of water at our fingertips, but resulting in our failure to notice its purity and elegance.

We carelessly use water to flush toilets, wash our vehicles, and even to keep our lawns green; when did we become so excessive? If there was a drought for one day, we would not know what to do or how to react, it would be complete chaos. We would then realize how many of our daily activities involve water, and only then would we fully grasp the concept that we cannot survive without it. “…Something that we generally let run uselessly in the sink: a magical, precious, vital element that has always been part of daily normality, but that by and large has yet to be revealed in design endeavors.”

To negotiate the contradiction between water and architecture, it is imperative to understand the current exploitations and consumer habits, and how we can improve our current life styles. Fundamentally, we need to focus on preserving our water supplies and re-circulating the water that we use. According to the Merriam-Webster Dictionary, sustainability is defined as “the exploitation of natural resources without destroying the ecological balance of a particular area.”

Today, this has become the primary underlying principle for emerging designers, and has become an increasingly common topic in current architectural literature. The energy crisis in the 1970’s caused many people to take a strong interest in sustainable living, purely out of fear for the future. Since then many scientists, environmentalists, and designers have devoted their work to researching and developing technologies that endorse a highly sustainable lifestyle. This is imperative not only for future development, but for the survival of the human race. If we continue to deplete the Earth’s natural resources and produce excessive waste at our current rate, we are digging our own grave.

The world-renowned architect and designer, William McDonough, has been a leader in the sustainable design movement since its inception. Early in his career, he was strongly influenced by his travels abroad where he experienced the scarcity of necessary resources, such as food, soil, energy, and especially clean water. “Although there is not yet a water emergency in the first world, there always has been one in the rest of the world. It has been calculated that there, every eight seconds a child dies from use of contaminated water and annually, over five million people succumb for the same reason.”

McDonough became tired of working to be ‘less bad.’ He wanted to be involved in making buildings, even products, with completely positive intentions.


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18 [http://www.m-w.com/dictionary/sustainability](http://www.m-w.com/dictionary/sustainability)
1. **Insist on rights of humanity and nature to co-exist** in a healthy, supportive, diverse and sustainable condition.

2. **Recognize interdependence.** The elements of human design interact with and depend upon the natural world, with broad and diverse implications at every scale. Expand design considerations to recognizing even distant effects.

3. **Respect relationships between spirit and matter.** Consider all aspects of human settlement including community, dwelling, industry and trade in terms of existing and evolving connections between spiritual and material consciousness.

4. **Accept responsibility for the consequences of design** decisions upon human well-being, the viability of natural systems and their right to co-exist.

5. **Create safe objects of long-term value.** Do not burden future generations with requirements for maintenance or vigilant administration of potential danger due to the careless creation of products, processes or standards.

6. **Eliminate the concept of waste.** Evaluate and optimize the full life-cycle of products and processes, to approach the state of natural systems, in which there is no waste.

7. **Rely on natural energy flows.** Human designs should, like the living world, derive their creative forces from perpetual solar income. Incorporate this energy efficiently and safely for responsible use.

8. **Understand the limitations of design.** No human creation lasts forever and design does not solve all problems. Those who create and plan should practice humility in the face of nature. Treat nature as a model and mentor, not as an inconvenience to be evaded or controlled.

9. **Seek constant improvement by the sharing of knowledge.** Encourage direct and open communication between colleagues, patrons, manufacturers and users to link long term sustainable considerations with ethical responsibility, and re-establish the integral relationship between natural processes and human activity.\(^{20}\)

The guidelines begin with a statement regarding the importance of nature as the primary support to human life, while recognizing its vulnerability to degradation as the result of our way of life. This is precisely true regarding water. We cannot survive without it, yet our daily lives are putting its very existence in danger, and still we choose to ignore the entire situation. McDonough and Braungart also ask the designer to accept the responsibility for decisions that will affect human well-being, the viability of natural systems, and their right to co-exist. People pay no attention to the situation because they figure they will be long gone before it ever affects the population. Future generations should not be burdened with requirements for maintenance or vigilant administration of potential danger due to the careless creation of products, processes or standards.

of today.

The eco-effective philosophies and beliefs from *The Hannover Principles* are manifested and articulated in McDonough and Braungart’s most recent book *Cradle to Cradle*, published in 2002. *Cradle to Cradle* is a revolutionary book calling for the transformation of human industry through ecologically intelligent design. They focus on explaining how products can be designed from their conception, so that after their useful lives they can become nourishment for something new.\(^{21}\)

Currently, our industrial system is based on a linear, one-way, cradle-to-grave model, where products are developed, sold, used and eventually disposed of in a landfill or incinerator. In this cycle, you may be referred to as a consumer, but there is actually very little that you physically consume, foods and liquids. Everything else has been designed to eventually be thrown away when you are finished with it. But where is “away?”\(^{22}\)

By challenging the belief that human industry necessarily damages the natural world, McDonough and Braungart are looking toward nature and its systems as a model for making products, industrial systems, buildings, even regional plans that allow nature and commerce to fruitfully co-exist. McDonough and Braungart envision that the next industrial revolution will be founded on nature’s effective design principles, on human creativity and prosperity, and on respect, fair play, and goodwill. It has the power to transform both industry and environmentalism as we know them.\(^{23}\)

While the book does not focus on architecture or even water, its ideals are highly applicable to both topics. McDonough and Braungart ask new questions of architects, beyond the typical “how much energy does a building use?” They ask what is it made of, where did it come from, and where is it going? These are important issues that architects need to be thinking about and resolving while they are designing. McDonough and Braungart speak of nature as a whole and discuss its natural cycles, which include water and the water cycle, and therefore their principles are highly applicable to water and architecture.

The water cycle, also known as the hydrologic cycle, involves the continuous movement of water

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22 McDonough, William, and Michael Braungart. 2002. [p027]
23 McDonough, William, and Michael Braungart. 2002. [p154-156]
and around

on, above, and below the surface of the Earth. The water cycle has been working for billions of years, and everything else is depending on it to continue working. Without this constant cycling of water molecules the Earth would become a stagnant and stale place to live. Water can change states among liquid, vapor, and ice at various stages in the water cycle, which can occur in a matter of seconds or take millions of years. The balance of water on Earth remains fairly constant over time, however individual water molecules can come and go in a hurry. “The water in the apple you ate yesterday may have fallen as rain half-way around the world last year or could have been used 100 million years ago by mama dinosaur to give her baby a bath.”

A cycle is a sequence of events that are repeated again and again, having no starting or ending point, which is true of the water cycle. For the purpose of understanding the water cycle, let’s begin with the water storage in the oceans, since 97 percent of the Earth’s water is stored in oceans. The sun is the catalyst that drives the water cycle by heating the water in the oceans, rivers, and streams. Some of the water then evaporates as vapor into the air, and rising air currents carry the vapor into the atmosphere. Then the cooler temperatures cause the vapor to condense into clouds, which move around the globe. Cloud particles collide, grow, and fall out of the sky as precipitation. Most precipitation falls back into the oceans or onto land where gravity will carry it as runoff to streams, rivers, and lakes. But some will soak into the ground as infiltration to replenish aquifers and emerge as freshwater springs. And then the cycle begins again, or rather it continues.

When using water as an architectural design element, it is important to understand these natural cycles and concepts. This proposal does not condone the use of water as a completely separate and individual element, distinct of its environment. Nor is it suggesting that architecture be created with water through the use of utility pipes. However, this proposal is advocating the use of water within its natural setting to activate architecture. The significantly changing tide, precipitation and freezing temperatures of the Bay of Fundy provide a great deal of opportunities to incorporate water as a critical design element within the Saint John ferry terminal.

http://ga.water.usgs.gov/edu/mwater.html

Image 017.fog on Lake Chuzenjiko, Japan
Architects can discuss theory perpetually, but an idea does not become a reality until it is designed and built. In order to integrally design water and architecture, it is imperative to research and explore the possibilities and even the impossibilities in depth. Architects are taught to design buildings to keep water out and away from buildings, forcing them to design catchment and runoff systems to deal with the ‘evil’ water. The envelope of a building is designed to withstand all external elements and possible weather conditions. In specific climates, water can cause major problems in buildings by freezing and thawing properties. Water can carry dangerous acids, oxides, and other harmful chemicals that degrade and eat away at building materials. It is time to expand this traditional notion of thinking and to accept new ideas concerning the relationship of architecture and water.

When static, it presents a surface mirror in which to reflect the thin legs of projects by Oscar Niemeyer or the solids and voids of Mies Van Der Rohe. In motion, it can bestow a dizzy dynamic acceleration on a house imagined by Frank Lloyd Wright on a waterfall. Or again, it can assume a contemplative role in the Brion Tomb by Carlo Scarpa at Altivole; or become an element of bewilderment in the steam cloud by Diller and Scofidio. If the tap were suddenly turned off, these architectures would take on the features of ghost ships; without a breath of life in them, stranded in a perceptive desert.26

It is not important which qualities of water are emphasized, because architecture can accentuate any of its characteristics and draw attention to the minute details of water. The principal statement is that when the water is removed from these projects, the architecture suffers. That signifies a successful attempt at bringing conflicting matters together: water and architecture.

"And water, in its guises of ice and steam as well as its liquid state, tantalizes in its potential as a building material."27 Realms of Impossibility: Water, by CJ Lim, is one book in a series of three correlating texts that reference each other: air, ground, and water. The three books are merely one story told three times in different environments, which dovetail and interconnect to form a single picture. Lim believes that air, ground, and water form the building blocks of the man-made environment, making them fit themes for architectural investigation. This pictorial text showcases projects of two types: realized projects that "rode

the waves” and theoretical projects that “sank without a trace.”28 This text does not provide meaningful, in-depth answers to questions concerning architecture and water; it was designed to be used as a vehicle in searching and developing answers and promoting further research. Lim merely scratches the surface, allowing the architectural reader to dig deeper.

Lim has compiled projects, installations, and theories dealing with a multitude of the aspects of water, and also provides information for further research. He includes projects considering ice construction, water catchment, fog enclosure, running water, seafood, floating, rain, and purification. All are important facets that need to be explored concerning water and architecture. Typically, one of the goals of architecture is to repel water away from the building. The goal of this book is “to provoke ‘grown-up’ architecture to reassess and celebrate the impossible,” to celebrate water, in all its forms.29

The common factor that relates all of these projects are the emotions that water evokes. Water has a mesmerizing quality that is difficult to describe in words, and nearly impossible to capture in a photograph.

Familiar and simple, yet enchantingly complex, water is endlessly appealing. We are compelled to stare at a river flowing under a bridge, to feel water as it sheets over the marble rim of a fountain, and to sit for hours transfixed by the sound of a gurgling stream or waves at the beach. From lost tea gardens to overgrown Umbrian villas to glitzy hotel lobby fountains, we have persisted in using water in our built environment.30

While the Trevi Fountain and the Salk Institute are considered to be completely successful attempts at joining water and architecture, they do not represent the design limit concerning the tension between water and architecture. “Although water goes through architecture and embodies one of its main vital elements of functioning, it immediately becomes an element of disturbance when its presence comes out into the open, becomes three-dimensional and abandons the utility pipelines in which it is regimented. This is when the fluid element generates a vague sense of unrest. If it is true that no architect would ever refuse to establish a theatrical relationship with water, it is also true that most often this relationship will be sufficiently

28 Lim, C.J. [p007]
29 Lim, C.J. [p008]
30 Moore, Charles W. [p015]
distanced, controlled, and largely visual.” 31 These projects, and others like it, evoke an inspiration for the potential relationships of water and architecture, in the attempt to merge them into one.

Although quite different than the Salk Institute, the Blur Building, by Diller + Scofidio, also employs water as an integral design medium. The Blur Building was showcased in the 2002 Swiss Expo, on the south western end of Lake Neuchâtel. The building explored ephemeral architecture, by creating a vast cloud of mist hovering and drifting above the water’s surface, occasionally revealing its oil-rig-like structure, made of spars, blooms, platforms, and tensile wires. The structure was based on an experimental design by Buckminster Fuller that could not be constructed until now, because of its technical complexity. 32 In order to generate this artificial cloud, water from the lake is pumped through pipes and then expelled as a fine mist through nearly 30,000 high-pressure nozzles. It covers an area 300 feet wide, 200 feet deep, and 65 feet high. 33 Although the concept appears simple, it is actually controlled electronically by a built-in weather station. This computer controls the building’s thirteen zones, adjusting the water pressure and temperature according to shifting wind—direction, speed, and humidity.

But the Blur Building is about much more than the highly technical operating details. It is about the user experience of dematerialization. With each step on the bridge, towards the white cloud, the patrons lose more and more visual and acoustic references to which they are accustomed. The patrons are immersed in a visual whiteout, with only the white noise of the pulsating nozzles; they feel disoriented and isolated. This sensory deprivation actually stimulates a sensory heightening, forcing them to notice the density of the air, the lowered temperature, the sound of water spray, and the scent of atomized lake water. In an essay about the project, Diller states, “Entering Blur will be like walking into a habitable medium—one that is featureless, depthless, scaleless, spaceless, massless, surfaceless, and contextless. Disorientation is structured into the experience.” 34 The Blur Building also references larger topics than disorientation and dislocation, with the implication that something similar is occurring on a planetary scale. “If, through

34 Cramer, Ned. [p058]
fixed dynamic or fluid stability
technological recklessness, we can alter the weather inadvertently, then we can also alter it willfully."\textsuperscript{35}

This dread and fascination with weather stems from the possibility of actually controlling it. Meteorologists classify four basic cloud formations: cumulus, stratus, cirrus, and nimbus; however the Blur Building may actually qualify as a fifth: man-made.\textsuperscript{36}
The Kastrup Sea Bath, by White Arkitekter, was designed to provide seaside fun for all walks of life, from the young boy playfully splashing in the waves to the old woman taking a peaceful evening swim. The project consists of the main building on the water, the new beach and an adjoining service building with lavatories and a handicap changing room. The wooden pier extends out into the Oresund, the narrow channel separating Denmark from Sweden, about 100 meters before becoming a semicircular sculpture rising out of the sea. The crescent begins around a height of two and a half meters and as it curves around it ends at a height of eight meters, with a diving platform. “The bath is conceived as a sculptural dynamic form, which can be seen from the beach, the sea and the air. Its silhouette gradually changes as the beholder moves around it.” It is covered with a timber screen to shelter bathers from the wind and concentrate the sunlight, while enclosing a generous area of water. It opens up toward the beach to maintain a relationship with the land and to entice bathers.

fixed dynamic or fluid stability
The project consists of multiple level changes, through ramps and stairs, providing assorted platforms and benches which present convenient spots for sunbathing, diving, and general relaxing. Various stairs and ramps also lead down into the water, which fluctuates in depth from two to four meters. A continuous bench runs along one side of the pier, creating an additional rest and leisure area. Ramps and other special features allow less mobile visitors access to all parts of the site. “The bath is designed to be a rather untraditional framework for exercising sports activities.”

The Sea Bath stands on slender legs about a meter above the surface of the water, with load-bearing constructions exposed on the exterior. The entire structure is clad in thin strips of azobe wood because of its durability in sea water and its soft, tactile materiality. At night and during the long, dark off-season, lighting effects are used not only for safety, but also to enhance the structures dynamic appearance. Two lines of LED spots light the pier leading to a series of large uplights that light the interior side of the semicircular wall, all culminating in a dramatic blue light at the diving platforms. The Kastrup Sea Bath is a notable exemplar in unifying water, architecture, and the users, by exhibiting how an apparently simple structure can truly enhance the public realm, by playful means.

38 Kastrup Sea Bath. [p110]
Tides are often considered the heartbeat of the oceans of our planet. The changing tide is a natural phenomenon that forms unique interactions as the water is in constant flux. The tide is the cyclic rising and falling of the Earth’s ocean surface, which is caused by the tidal forces of the moon and sun acting on the Earth. Therefore the water is never still, because it is continuously shifting between high and low tide, reaching its crest twice a day. The average tidal range between high tide and low tide is six to ten feet, depending on the conditions. The most extreme tidal range for a given area is called a spring tide and occurs during the time of the full and new moons. Spring tides occur twice a month and are caused by the gravitational forces of the sun and the moon pulling in the same direction (new moon) or in the opposite directions (full moon). When the forces make a right angle at the Earth, it is known as a neap tide, and the tidal range is less significant.

The most significant tide change in the world takes place in the Bay of Fundy, located between New Brunswick and Nova Scotia, Canada. At the entrance to the bay the tide changes a mere eleven feet, while at the head of the bay in the Minas Basin the tide changes fifty-three feet.²⁹ Twice a day one hundred billion tons of water flows into and out of the bay, creating a drastically changing environment in just a few hours.⁴⁰ During low tide more than 620 square miles of the ocean floor lies unprotected and exposed to the atmosphere.⁴¹ This significant change is due to the bay’s unique funnel shape and prodigious depth, with the water moving back and forth in sync with the oceanic tides outside the bay. Along the coast of the bay the phenomenal tides have left evidence of their power and strength, in the forms of towering statues of red sandstone, sea caves, mudflats, and even causing rivers to reverse and flow upstream.

This unique change in water level is a remarkable opportunity to bring water and architecture together. The stable or fixed architecture can be juxtaposed with the fluid and dynamic water, while also allowing the two to influence and transform each other. During low tide, a person could conceivably walk out to a four-story building that would be completely underwater during high tide. The architecture has the opportunity to serve as a system for measuring and marking the vertical and horizontal transformation of

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changing tide

1. Rift valley formed about 300 million years ago.
2. Flooded by warm shallow sea.
3. Mountains ended. Igneous and sedimentary rocks formed 550 million years ago.
4. Fossil-bearing sandstone deposited in Cretaceous period 0.6 million years ago.
5. Land was eroded by weather, plants, and animals 2.8 million years ago.
6. Drainage changed as land tilted 15 million years ago.
7. Cliffs created the land one million years ago.
8. The present bay.
the tide. Portions of the architecture remain rigid, quantifying the change in tide, while other portions morph or change as the tide rises and lowers, emphasizing the dynamism of the water. It is important to have this juxtaposition, in order to fully appreciate both ends of the spectrum. As portions of the architecture shift vertically, a means for providing access to the multiple layers will be required. This transforming system, which allows people to move through the architecture via multi-layer walkways, will create a dynamic piece of architecture.

While these ideas are viable resolutions at joining water and architecture, it is also important to respect the intricate ecological system of the Bay of Fundy and the surrounding community. The bay is home to the largest concentration of whales, other sea-life and the single most important stopover point for migrating shorebirds along the entire eastern seaboard. At least eight species of whales have been found in the Bay of Fundy, including the minke, humpback, baleen and the endangered right whale. It has been estimated that between the Gulf of Maine and the Bay of Fundy, the whale population ranges between three and four hundred at any one time. Moving down the food chain, the bay is also home to dolphins, seals, several varieties of sharks, and a variety of fish, including shad, flounder, tuna, sea sturgeons, salmon, cod, herring, pollack, hake, haddock and halibut, as well as lobsters, crabs, scallops, shrimp and sea urchins. These smaller sea animals are drawn to the bay for the abundant supply of algae, plankton, and krill, which are the foundation of the biological chain. It is crucial to maintain this fragile ecosystem and to let nature maintain its dominant presence. After all, the bay itself is a natural phenomenon, and therefore should be allowed to continue its course and not be distressed through architectures involvement. While all design resolutions will utilize the environment and the changing tide, they will simultaneously respect and accommodate this fragile ecosystem.

Every year thousands of tourists flock to the Bay of Fundy to enjoy the many natural marvels that occur. The area appeals to a diverse range of people from historians to naturalists and even golfers. Tourism provides a significant amount of income to the surrounding bay towns, along with the fishing industry. The

42 http://www.bayoffundy.com/
43 http://www.bayoffundy.com/
bay fishing industry generates more than 200 million dollars annually, making it the most affluent fishery region in Atlantic Canada. When building in this region, it is essential to show consideration for both the locals and tourist, as they coexist. A significant project for the bay area, may promote tourism, bringing in more money, but it also needs to provide benefits to the local area and those who permanently reside around the bay.

The Bay of Fundy presents an intriguing design predicament, with multiple concerns including the natural phenomena, the critical ecosystem, the tourism industry, and the local residents. However, it also shows a very promising energy that will result in a prodigious resolution from the fusion of water and architecture.

The city of Saint John is located in New Brunswick on the north shore of the Bay of Fundy, where it experiences a tidal change of nearly thirty feet. Saint John is largely an industrial city, with numerous active seaports, and a rich history in ship building. After being discovered in 1603, the mouth of the Saint John River served as a refuge during wars, and provided a place for immigrants to settle. In 1785 Saint John became the first

http://www.bayoffundy.com/
incorporated city in Canada, and quickly grew into a major commercial and industrial seaport. During the middle of the nineteenth century Saint John became the province’s leading industrial center, fostering a shipbuilding trade that lasted until 2002. The shipbuilding industry was concentrated on the mudflats of the Courtney Bay, due to its location for railways, and it serviced the triangular trade between Canada, the Caribbean, and the United Kingdom. It ranked as the third-largest wood shipbuilding industry in the world, and the city was poised to be one of Canada’s leading urban centers. Unfortunately, by the late 1800’s steel vessels replaced those made of wood, and the economy of Saint John suffered. In the late nineteenth century the Port of Saint John functioned as the winter port for Montreal, when shipping was unable to traverse the sea ice in the Gulf of St. Lawrence and the St. Lawrence River. But by the mid 1900’s the St. Lawrence Seaway was opened with year-round icebreaker services, which caused the port at Saint John to fall into decline.

Today the harbor is lined with industrial ports including the Rodney Container Terminal, the Navy Island Forestry Products Terminal, and the Barrack Point Potash Terminal. This leaves little room for any commercial use or public enjoyment of the waterfront. The central business district only has a small connection to the harbor and the residential areas are all pulled back into the land, responding to the industry at the water’s edge. There is space available close to the central business district to dock cruise ships that frequent Saint John and on the lower Westside there is a ferry terminal that serves the cross-bay, Saint John-Digby Ferry. The city is in need of something to rejuvenate the waterfront and create a desire for the public to experience and interact with the water. The considerable change in tide, unique to the world, has become something ordinary, insignificant, and largely overlooked by the residents of Saint John. Successful architecture can stimulate and revitalize a portion of the waterfront, bringing focus to the astounding ebb and flow of the tide, which serves as a heartbeat to the industrial city.
The ferry terminal, located on the west side of the main harbor, provides an appealing site to rejuvenate by bringing water and architecture together. The ferry terminal is the first pier encountered upon entering the bay, allowing a prominent design to serve as a milestone for the city. Currently, the only visitors to the ferry terminal are those awaiting departure and those arriving from Digby. The proposal is to make the terminal itself and the surrounding area a place of destination, where people who are not traveling across the bay will want to visit. North of the existing ferry terminal is Crosby’s Molasses, an industrial site and terminal, which supplies sweeteners for both the retail and industrial markets. West of the site is largely residential, containing houses, schools, churches, and the national historic site of the Carleton Martello Tower, which dates from the War of 1812. Just south of the site is a small portion of unused coastline, which is rocky near the shore line, then turning into wild grass moving up the hill towards the parking lot of the ferry terminal. This portion of idle coastline will be utilized to provide a public outdoor area adjacent to the ferry terminal, which will enhance the addition of architecture to the water.

The existing site contains a parking lot, ticket office, storage garage and pier, all purely functional elements which reflect the minimum needed to operate a ferry service. The parking lot contains six lanes that serve as a holding area for vehicles waiting to board the ship, long term parking for trailers, visitor parking, staff parking, and a designated drop-off area. All of these amenities will need to remain available, however will be reconfigured in a more appropriate manner that coincides with the new ferry terminal design. The current ticket office is an aesthetically mundane, fifteen-foot, single story building, located at the edge of the land. It houses two ticket counters, three administrative desks, a waiting lounge, restrooms, and vending machines. These amenities will be included in the new ticket office design, which will be located along the pier, adjacent to the docked ship, in order to take advantage of the remarkable environment. The current maintenance and storage garages are white metal sheds ranging in height from ten to twenty feet, with several large rolling doors providing access to an open floor plan. These sheds are very important in the continual functioning of the ferry terminal; however they remain an eye-sore, by not speaking a consistent language with anything else on the site.
bringing water back
The current 900 foot long pier is not accessible to the public, which is a colossal disappointment. It is only used for cargo purposes and to dock and tie down the ship. In order to enter the ship a passenger must go through the ferry terminal building, head down a narrow enclosed hallway, enter the moveable gang plank and then board the ship. Aside from the substandard aesthetic, this movement sequence is the key flaw of the current terminal design. The passenger never experiences the pier, the ship exterior, or the surrounding environment. The current ferry terminal building has managed to completely disregard the eccentrically changing tide, severing any interaction that the passenger might have with the water. This notion of thought needs to be completely inverted, allowing the passenger to engage in the maximum exposure to the water, the pier, and the ship resulting in an experiential architecture.

By moving the terminal building out into the water, it forces the user to interact with the tide, and become aware of their surroundings. Each person will have to walk across a fixed boardwalk, over the water, in order to enter the terminal building. The site contains several thresholds that introduce new elements and experiences to the users as they proceed towards the ship. Judging the height of the tide against the boardwalk, will be the user’s first casual experience with the water. Looking forward, the user will again measure the height of the tide against the austere, yet considerable concrete wall that barricades the terminal building and the ship from the land. As the tide moves in and out along the concrete wall it will begin to grow remnants of the tide, such as moss and sea urchins, giving the wall a texture for which only nature can be responsible. This concrete enclosure is only penetrated to allow pedestrians access to the terminal building and to allow vehicles direct access to the bow of the ship. The pedestrian path will start in the public outdoor area, south of the site, and lead to the ship at an angle, providing glimpses of the terminal building and ship. However, the vehicular path will start at the northwest edge of the site and lead straight onto the bow of the ship, providing a direct route for a wide variety of vehicles including cars, trucks, tractor trailers, and motor coaches. These two access paths are kept separate, in order to protect the pedestrians, and provide catered experiences for each user group. Because the water will have a varying relationship with the concrete wall due to the movement of the tide, the floating ship will also have a varying relationship...
bringing water back

terminal building

pedestrian access

vehicular access

viewing dock
with the wall. At times nearly all of the ship will be hidden behind the wall, with only the smoke stack peeking above the top, and at other times most the ship will stand proud as it is exposed above the wall. This shifting will also produce a unique and captivating experience for those inside the terminal building, adjacent to the ship, as it is shifting at a perceptible rate.

Adjacent to the monolithic concrete wall is a public viewing deck. This is an outdoor space which floats on the water allowing it to move up and down with the tide, while remaining attached to the concrete wall. This viewing deck is only accessed through the terminal building, forcing visitors to walk through the building and experience the interior atrium. This viewing deck allows the public to have access to the entire length of the pier, providing views out to the bay and back into the harbor and the city.

While concerning various aspects of water, this proposal focuses on the ebb and flow of the tide, since that is visibly the most significant aspect of the water on the site. The tide is a powerful, natural force that human beings cannot control, but what can be controlled is the way in which the tide affects architecture, and how that architecture reacts. The tide does not just move in and out, or up and down. It is actually a volumetric exchange. A certain amount of water is displaced and forced to encroach upon the land, taking up three-dimensional space. As this significant volume of water flows in and out of the harbor it is also affecting the volume of space enclosed by the pier and the terminal.

Instead of placing the terminal building above the water, and striving desperately to keep water out of the building, which is traditionally done, the building will extend into the water and welcome it inside. Essentially, the bottom floor will be formed by the surface of the water, which will fluctuate according to the tide. This will result in a considerable volumetric change within the building, as nearly 400,000 cubic feet of water flow in and out with each tide. The main floor, containing the ticketing office, waiting lounge, and restrooms, will be fixed and remain above the highest tide, adjacent to the vast atrium, which reaches down to the water’s surface. An elongated ramp will transform inside the building, as the water height varies, providing shifting and dynamic views to the water below. Wrapping around the atrium, the ramps will provide access from the main floor to the floating, exterior viewing deck. Although nothing is designed for
bringing water back

image 045.ramp system diagram
bringing water back

low tide

high tide

image 046 view of atrium
the atrium space, it becomes the most important space, because it is void of everything but the water. Void of everything except for the sound of splashing waves, the taste of the salty air, the smell of the bay, and the view of light glistening on the surface. It is this moment that visitors will intimately experience the water and appreciate the rare encounter with the tide. It is through these elements, that people will reconnect themselves with water and develop an appreciation of its cultural, social, and spiritual qualities as well as its physical and emotional attributes.

By allowing the tide to enter the terminal building and to control the viewing deck and ramp system, this proposal brings water and architecture together in a remarkable way that has been disregarded in the past. The architecture of the proposal can no longer be described as fixed or stable, because it has now become a fluid and dynamic space, through the natural conditions of tidal water. The design does not exploit utility pipes and plumbing to create a shallow visual effect, it instead allows nature to transform and enliven it. This design would entirely lose its integrity without the water; the building would again become fixed and stable, proving that water has finally become a critical design element.

Any study of architecture and water has at its disposal a rich history of meaning and tradition as well as a foundation in mesmerizing physical and natural wonders. When the fusion of architecture and water is treated carefully and creatively, the potential for meaningful expression is practically limitless.45

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45 Moore, Charles W. [p022]


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