

Water-Infused design:

Two Contemporary Projects

1. Background

Water is the origin of life, and biology cannot survive without it. And we can see many water uses in architecture from ancient times to the present. In traditional garden of China, water is a very important element. For example, there are artificial streams, lakes, and waterfalls. All these are the parts of water layout in a traditional Chinese philosophy, Fengshui, which is a practical theory in ancient China which intends to choose the best place to construct architecture through investigating and reforming the local context. Outside China, there are also great uses of water in architecture. For example, one of the masters of modern architecture, Frank Lloyd Wright, designed Fallingwater House in 1939 (see Figure 1). He created harmony between the house and the waterfall successfully. I know about many modern uses of water, such as indoor and outdoor pools, indoor waterfalls, and fountains. I also know about many uses of natural water sources, such as artful rainwater design. Water also can be used as space, wall, and skylight. Additionally its sound and reflection can also be used in architecture. So, I want to analyze uses of water in two contemporary projects, National Theater of China and Jewel Changi Airport, and talk about how uses of water in these projects make the design better.

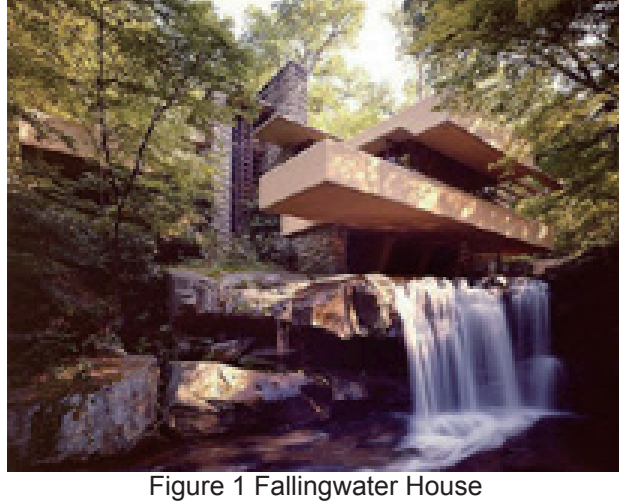


Figure 1 Fallingwater House
<https://www.archdaily.com/60022/ad-classics-fallingwater-frank-lloyd-wright>

2. National Theater of China

National Theater of China is in Beijing and designed by Paul Andreu. It is a curved building which is 149,500 square meters, and it has three performance auditoriums, an opera house, a concert hall and a theatre, as well as art and exhibition spaces. It looks like an egg in the water, so many people call it "the Boiled Egg" in China.

The use of water in this structure is an artificial lake surrounding the shell of this building. The water depth of the artificial lake is 40cm and 35,000 square meters. The whole pool is divided into 22 grids. The design is convenient for maintenance, water saving and safety. Each grid is relatively independent, but the appearance maintains the overall consistency. In order to ensure that the water in the pool does not freeze in winter and algae does not grow in summer, a water circulation system called "central liquid cold and heat source environmental system control" is adopted. This system uses ground source heat pump, which means using the shallow geothermal resources underground to provide heat and refrigeration.

In my opinion, this lake improves this building in three ways. Firstly, according to Fengshui culture, "a propitious place must have water". We can see this building is at the starting point of the central water system in Beijing. Normally, zigzag water complies with aesthetic taste of the public, but it can't be zigzag because it is in the starting point. This lake should be a source of Qi energy, so it is designed as a circle and is not a dead water. According to Fengshui doctrines, the most magic part of water layout rests with its rise and fall. So, the mysterious source of this lake with living water must be hidden very well. That's why we can't see the source of this lake. Secondly, when I visited the National Theatre of China, I could see that the water of the lake is like a clear mirror to the bottom. The wave light and reflection reflect each other to support the huge and crystal clear building in the center. The reflection of the building in the water and the building itself constitute the external landscape of the Grand Theatre (see Figure 2). Furthermore, the lake combines with the greenbelt to open up a large cultural and leisure square in the center of the city where citizens can go in and out freely and enjoy the peace in the noisy city. Last but not least, this lake creates a beautiful entrance passageway (see Figure 3). This underwater corridor is about 80 meters long and 24 meters wide, and its top is made of glass ceiling. Above the roof of the passageway, it is a thin layer of lake water. Sunlight passes through the sparkling lake to create a unique shadow. When I went through this passageway, I could hear the slight sound of running water which made me peaceful. I think it is a ritual space which can wash away people's impetuosity and let the audience appreciate art better.



Figure 2 National Theatre of China
http://www.chncpa.org/cgyl_278/yjy/

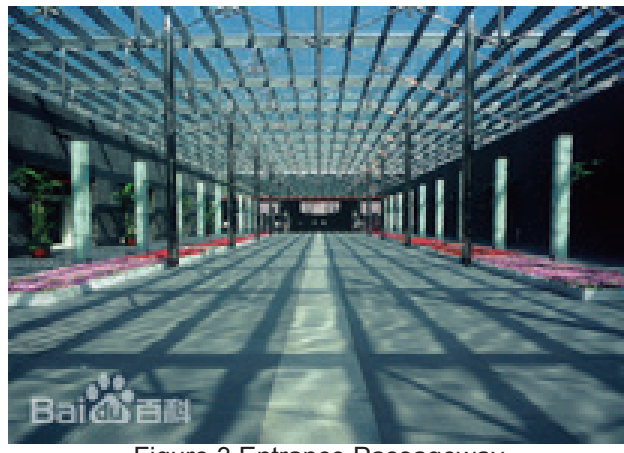


Figure 3 Entrance Passageway
<http://en.chncpa.org/aboutus/>

3. Jewel Changi Airport

Jewel Changi Airport is in Singapore and designed by Safdie Architects. It is a connected space with 135,700 square meters including many facilities such as landside airport operations, indoor gardens and leisure attractions. In this space, pedestrian bridges connect Terminal 1, 2, and 3. According to CNN travel, Singapore Changi Airport has for the eighth year in a row been crowned the "World's Best Airport" at the Skytrax World Airport Awards.

There are two uses of water in this building. The first one is the world's tallest indoor waterfall which is called the Rain Vortex (see Figure 4). The project was built with a torus-shaped glass dome which includes an oculus at its center. The waterfall showers down from an oculus in the domed roof to the center of the garden. During the region's frequent and powerful thunderstorms, recirculated, natural rainwater will flow at more than 10,000 gallons per minute. The second one is many water steps in the Forest Valley, a terraced indoor landscape (see Figure 5). The water steps feature is part of the landscape, and it also has the function of irrigating plants.

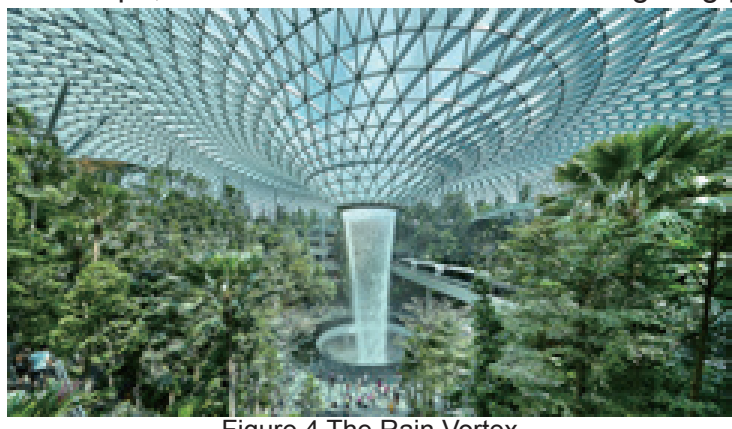


Figure 4 The Rain Vortex
<https://www.safdiearchitects.com/projects/jewel-changi-airportngi-airport>

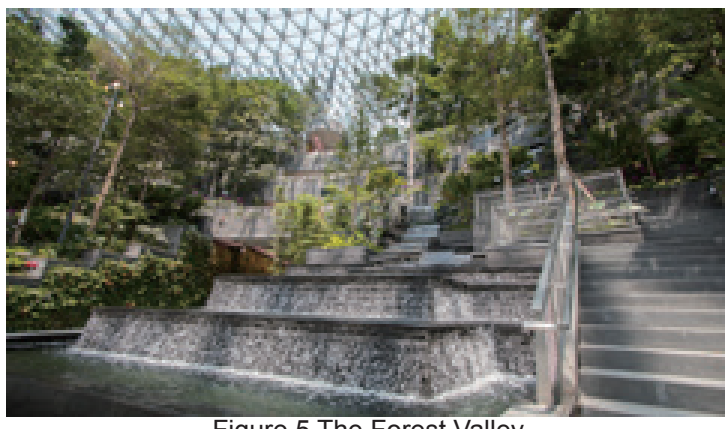


Figure 5 The Forest Valley
<https://www.safdiearchitects.com/projects/jewel-changi-airport-safdie-architects-el-changi-airport>

I find three ways that the system of water makes this building better. The first way is the function of sustainability. The whole system collects a lot of rainwater to be re-used in and around the architecture. The building utilizes rainwater as it's pumped through the waterfall and used throughout the airport for building services and landscape irrigation systems. It can save a lot of energy. Secondly, the world's tallest indoor waterfall and the water steps are beautiful landscape. Furthermore, the waterfall has nightly light shows that integrate sounds and projections from 360 degrees around the Vortex (see Figure 6). This unique technique creates a magical space where people can enjoy. The last approach is improving the environment and people's feelings. The oculus and flowing water also act as a passive cooling system which can bring coolness in the hot summer. At the same time, the system brings natural wind to people which made people feel like in the real natural environment. Water is the foundation of nature, when you bring water into the building, you can keep plants alive and make environment more like nature. According to the analysis of Ridder, the water element can really bring positive influence on humans, not only because water can make people cool or create beautiful landscape but also serve the nature and bring it to humans.



Figure 6 The Nightly Light Show
<https://www.safdiearchitects.com/projects/jewel-changi-airportngi-airport>

4. Conclusion

Water is a precious resource on the earth. The uses of water can be very important in the sustainable architecture such as by reusing the rainwater. At the same time, the sound and the reflection of water can make people peaceful and bring the feeling of nature to people. So, appropriate uses of water can really improve the quality of architecture. With the development of science and technology, I think more useful materials and technology will be invented. For example, more technology is going to be invented to be able to store more water which can solve the problem of using water in arid regions. Actually, now, there is a useful system named S.A.W.E.R. system which is being exhibited in the Czech Republic Pavilion of Expo 2020 Dubai (see Figure 7). This system is able to create humid environment which is better to humans. In the future, maybe uses of water can be used in more skyscrapers to solve the energy problem and bring nature into it such as Bosco Verticale designed by Stefano Boeri in Milan, Italy (see Figure 8). I can see that the steel forest of today will be integrated with nature in the future.



Figure 6 The Nightly Light Show
<https://www.safdiearchitects.com/projects/jewel-changi-airportngi-airport>



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5. Bibliography

1. Cai Ping, Wang Jiajia, "On Fengshui and Rockery and Water Layout," Journal of Landscape Research, 5(1-2) (2013): 68-70.
2. Adelyn Perez. "AD Classics: Fallingwater House / Frank Lloyd Wright" 14 May 2010. ArchDaily. Accessed 30 Jul 2020, <<https://www.archdaily.com/60022/ad-classics-fallingwater-frank-lloyd-wright>> ISSN 0719-8884.
3. Lilly Cao. "Innovative Uses of Water in Architecture" 01 Jan 2020. ArchDaily. Accessed 30 Jul 2020, <<https://www.archdaily.com/931070/innovative-uses-of-water-in-architecture>> ISSN 0719-8884.
4. Stuart Echols, Eliza Pennypacker, Artful Rainwater Design: Creative Ways to Manage Stormwater (Washington, DC, Island Press, 2015).
5. Nicole Ridder, "Cultivating the City: Establishing the Presence of Nature in Urban Architecture," (master's thesis, University of Cincinnati, 2015),30-35.
6. "National centre for the performing arts," Cemataxue, February 9, 2009, http://www.china.com.cn/travel/txt/2009-02/09/content_17246280_2.htm.
7. Cai Ping, Wang Jiajia, "On Fengshui," 69.
8. "Jewel Changi Airport / Safdie Architects" 24 Apr 2019. ArchDaily. Accessed 31 Jul 2020, <<https://www.archdaily.com/915688/jewel-changi-airport-safdie-architects>> ISSN 0719-8884.
9. "The world's best airports for 2020, according to Skytrax," Karla Cripps, CNN, last modified May 12, 2020, <https://edition.cnn.com/travel/article/skytrax-world-best-airports-2020/index.html>
10. Eric Baldwin. "Safdie Completes World's Tallest Indoor Waterfall in Singapore" 16 Apr 2019. ArchDaily. Accessed 2 Aug 2020. <<https://www.archdaily.com/915129/safdie-completes-worlds-tallest-indoor-waterfall-in-singapore>> ISSN 0719-8884
11. "Jewel Changi Airport," Safdie Architects, accessed August 2, 2020, <https://www.safdiearchitects.com/projects/jewel-changi-airport>
12. Ridder, "Cultivating the City," 68-69.
13. Christele Harrouk. "The Czech Republic Pavilion at Expo 2020 Dubai Reveals Desert Cultivation Technologies" 31 Mar 2020. ArchDaily. Accessed 2 Aug 2020. <<https://www.archdaily.com/936571/the-czech-republic-pavilion-at-expo-2020-dubai-reveals-desert-cultivation-technologies>> ISSN 0719-8884
14. "Bosco Verticale / Boeri Studio" 23 Nov 2015. ArchDaily. Accessed 2 Aug 2020. <<https://www.archdaily.com/777498/bosco-verticale-stefano-boeri-architeti>> ISSN 0719-8884