The dilemma of ecology in architecture and the possible ways out

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Abstract:

Ecology is an important and unique part of architecture. Nowadays, more and more buildings are intended to prove their superiority in sustainability, however, still very few of them are derived from the idea of sustainability and ecology.[1] Instead considerations of aesthetics, urban relation, structure, and narrative characteristic are predominant. In this thesis, three main aspects of ecology in architecture are explored. The first is the role of ecology in architecture and the dilemma of ecology in architecture. It is widely acknowledged that the ecological analysis is mainly to prove that the design proposal is great, instead of influence design itself. In other words, there is little participation of ecology in architectural design. The second is what shall be done to enhance the importance and involvement of ecology in architecture. By my understanding of this research and study, ecology should be considered as a complete system in architecture instead of some independent techniques applied to architecture. The goal is to achieve a balanced relation of architecture with the surrounding environment throughout the whole life span of the building. Ecology consideration should influence the generating process of architecture. Last but not the least, promising areas to combine sustainability with the design and construction phase are also investigated.

1 Ceridwen Owen, Kim Dovey, Fields of sustainable architecture (The Journal of Architecture, Volume 13, 2008 – Issue 1), 9–21

Content:

The role of ecology in architecture is really interesting. On the one hand, most buildings all claim that much consideration is taken of ecology to make them more sustainable, more eco–friendly, and more efficient. One the other hand, very few architects that put their names in history declare that they conceive of proposals primarily from ecology, from the saving of energy. Neither do we judge buildings mainly from sustainability. There are many great architectural cases that are not sustainable or eco–friendly at all, but these disadvantages do not influence their greatness in architecture history. Good examples are Villa Savoye and Fallingwater, which are both made of reinforced concrete, not an eco–friendly material, and both of which had waterproof problems that caused their owners' sickness shortly after they were built. The owners even complained the these buildings were not suitable for living. But none of these unsustainable shortcomings damage the reputation of these buildings as milestone of modern architecture. If one lists his favourite architecture on a sheet of paper and thinks about the most exciting aspect of them, it is very possible that none of these is about ecology or sustainability. Ecological analysis nowadays is mainly to prove that the design proposal is great, and to help sell the proposals to the public, instead of influencing design itself. In other words, there is little participation of ecology in architectural design.

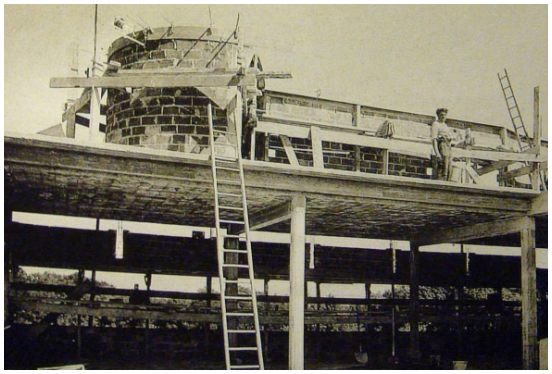

Figure 1 The material of Villa Savoye

First of all, we are required to figure out the ideal relation of ecology with other aspects in architecture to think of what else shall be done to enhance the importance of ecology in architecture. As a system in architecture, ecology should be treated as a complete system not affiliated to any other systems such as structure or circulation. Fusion and collaboration with other systems are necessary but a complete system of ecology itself is essential. This enables us to not just get some sustainable technologies applied to our design and claim that it is all about ecology, instead, to create a complete system with clear input, output, and interface to connect with other systems in architecture.

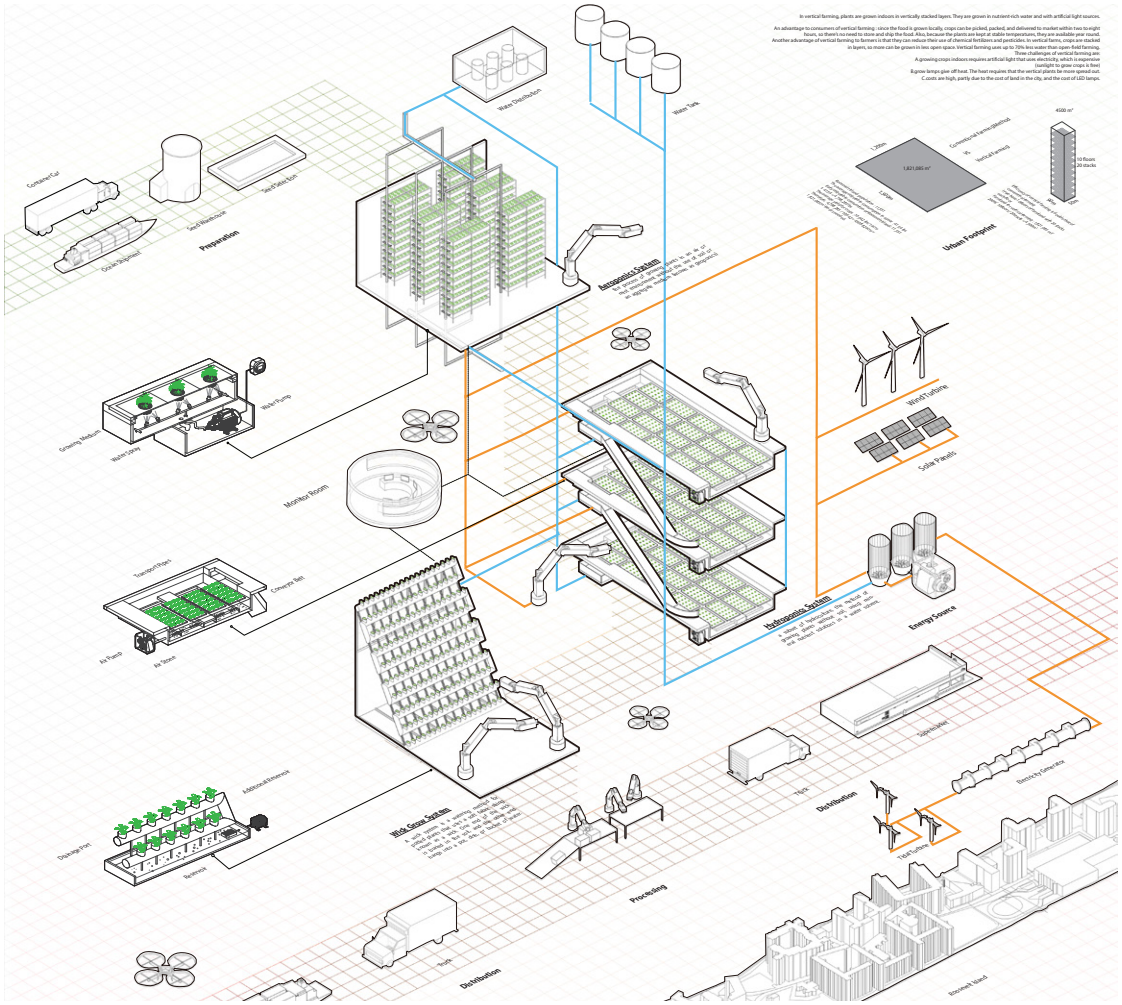

Figure 2 System of vertical farming from A+E

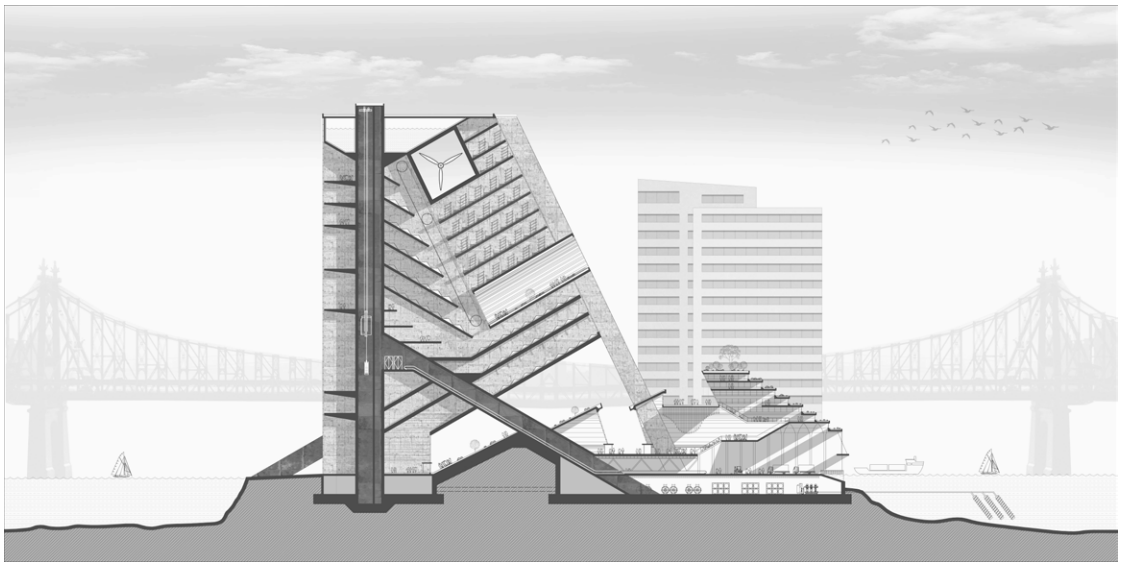

Figure 3 Section of vertical farming from A+E

During the summer semester, in A+E studio, we designed our vertical farming building with a complete sustainable system. In this project, we studied how vertical farming works, how the different life spans of different vegetables are put together with the most efficiency, how the water flow, energy flow, vegetation flow, logistics flow are blended into one. We studied the input and output of the system.

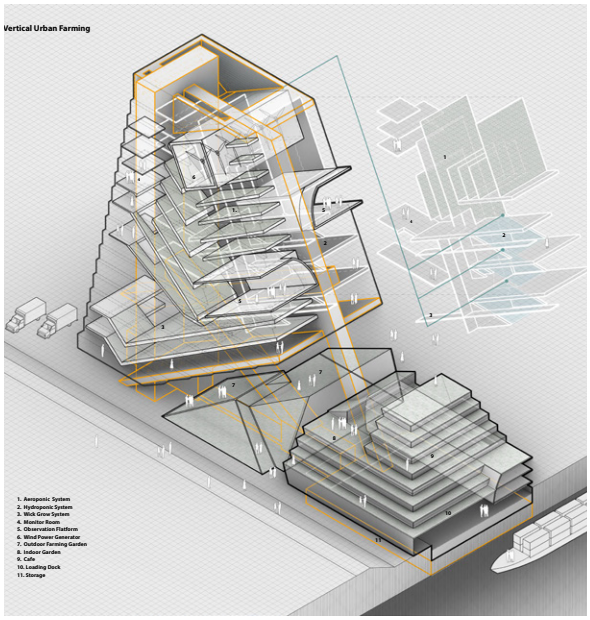

Figure 4 Axo of the building

We calculated how much scale the vertical farming is needed to produce enough food for the surrounding neighborhood. Finally, we derived our architectural design from the hydro flow of vertical farming, linking all the components in the system with water. There are three main parts of vertical farming growing space, aquaponics space, hydroponics space and

aeroponics space which are suitable for different vegetables and require different amount and kinds of water. Considering ecology as a complete system in architecture instead of some independent techniques applied to buildings can make ecology easier to affect the design, and to interact with other elements in architecture.[2]

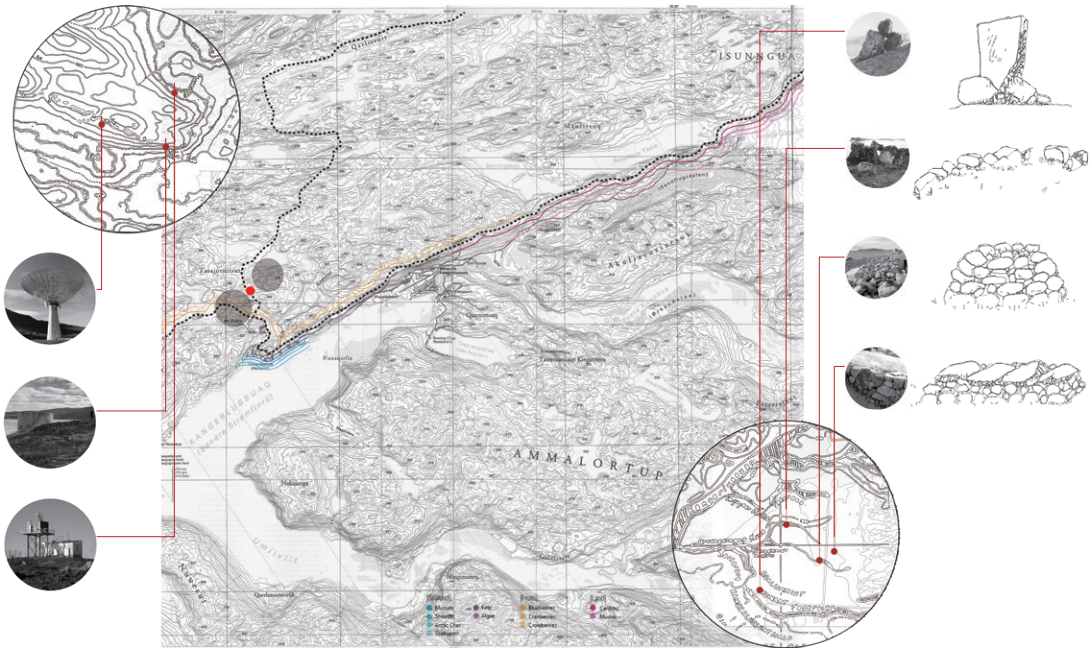

Figure 5 Ecological analysis of the site in Greenland

Ecology does not necessarily require high technology, but instead a balanced relation with the surrounding environment. During the fall semester, I participated in the Greenland optional studio, designing lodges in the wilderness of Greenland. In Greenland–a place where the most original of nature is preserved–there is nothing else except the undulating mountains, the steep glacier and the endless wilderness. Ecology there is a well–balanced but fragile condition. Any inappropriate external intervention will destroy the balance of the environment there. Under that primitive condition, any ecological means with complex techniques is inappropriate, because the transport and climatic conditions would make the installation, maintenance, and repair very difficult and unfriendly to the environment. The best strategy of ecology

2 Simon Guy, Graham Farmer, Reinterpreting Sustainable Architecture: The Place of Technology (Journal of Architectural Education, Volume 54, 2001 – Issue 3), 140–148

is passive ecological means with low technical content, which is easy to practice and maintain in remote areas with extreme conditions and is not harmful to the environment. With this understanding, we analyzed the natural resources around the site – the sun angle, the wind direction, the temperature change and the range of animal activities – and I developed my design of modest lodges with green houses, hovering above the slope. The green house will absorb solar heat during the day and release it during the night, keeping the indoor area warm. The hovering makes the lodges able to be adjusted according to different angles of the slope and the small footprint of just four columns touching the ground reduces the damage of the the vegetation on the ground to the minimum. In this project, my understanding of ecology goes further. Ecology is not just about giving consideration to all the possible technologies that can be applied to architecture to make the building consume less energy, create better interior condition, but also about thinking of the full

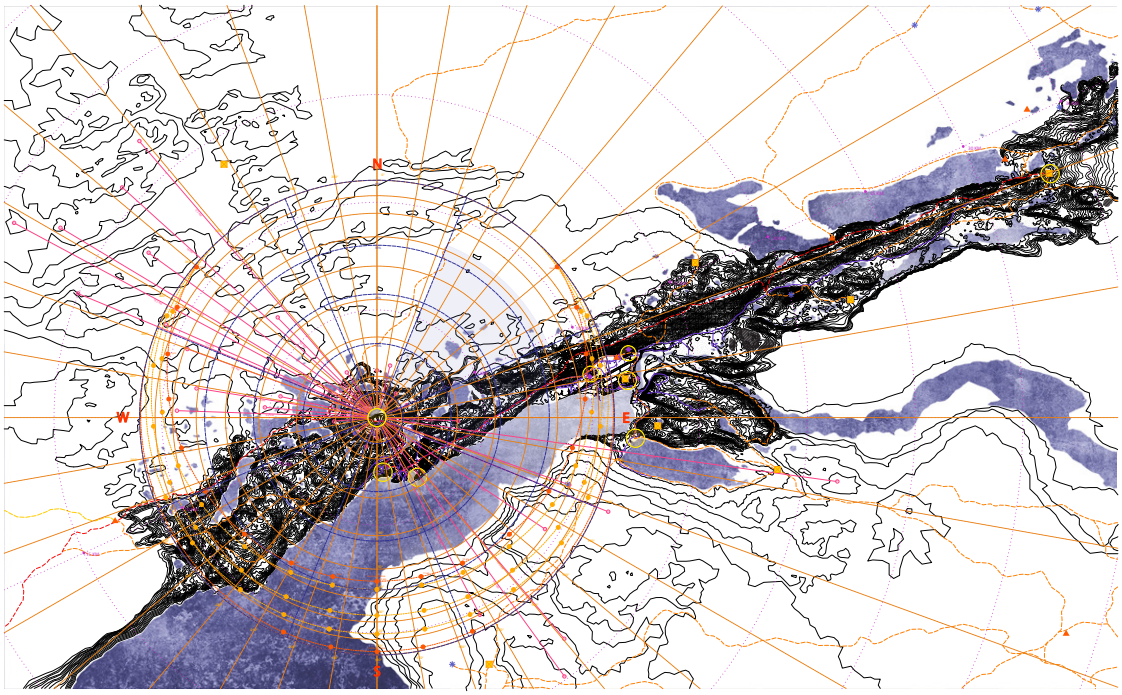

Figure 6 Natural condition of the site in Greenland

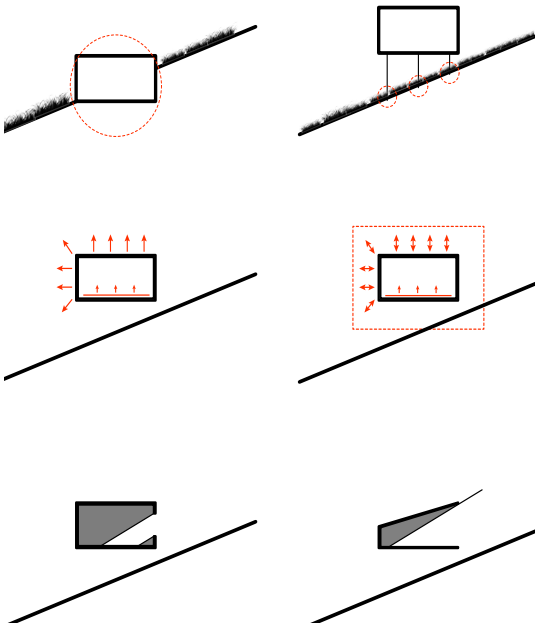

Figure 7 Relationship of the lodge with the site

lifecycle of the buildings. We should investigate comprehensively the cost of these technologies in the stage of installation, maintenance, and repair, whether they will make more benefits than the cost in their life spans and what influence they will make on not only the building itself but also the surrounding environment.

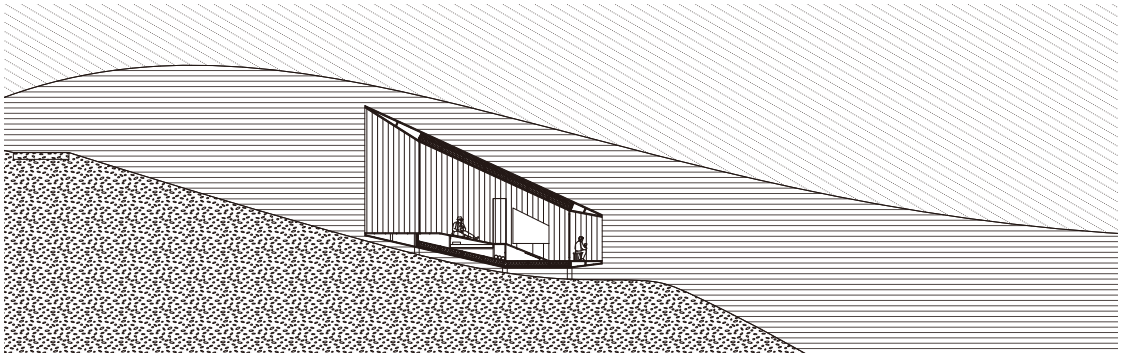

Figure 8 Section of the lodge

Figure 9 Rendering

Figure 10 Physical model photos

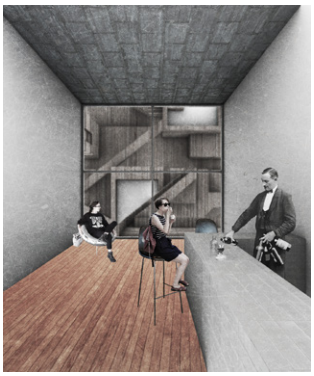

Figure 11 Exterior rendering

Figure 12 Interior rendering

Figure 13 Interior rendering

We should consider ecology not just as an evaluative tool, but as a design process. Nowadays, many buildings that claim to be ecological, take ecology as just an evaluative tool of the design, which is helpful to sell the proposal, but with very little consideration about how ecology can affect the proposal throughout the design process. In the spring semester, the ‘project zero’ studio made me think about ecology as a design tool instead of an evaluative tool and what can affect the profile and the internal layout of the building. By researching the natural condition, I came up with three main goals to achieve. One was preventing overheating in summer on the south facade. A second was getting

as much solar energy as possible on the roof. The third is a good condition for natural ventilation. To achieve these goals, the profile of the building changed accordingly. The south facade and the roof were all sloped, creating shadows on the south facade in summer when the sun is high and making the roof facing more directly to the sun in the south, collecting more solar energy than the flat roof. What's more, with two side glazing, the top floors will still have enough natural light. An atrium was created to get more natural ventilation in spring and fall. In this project, the generating process of the building combined both consideration of architectural idea and ecological sustainability together.

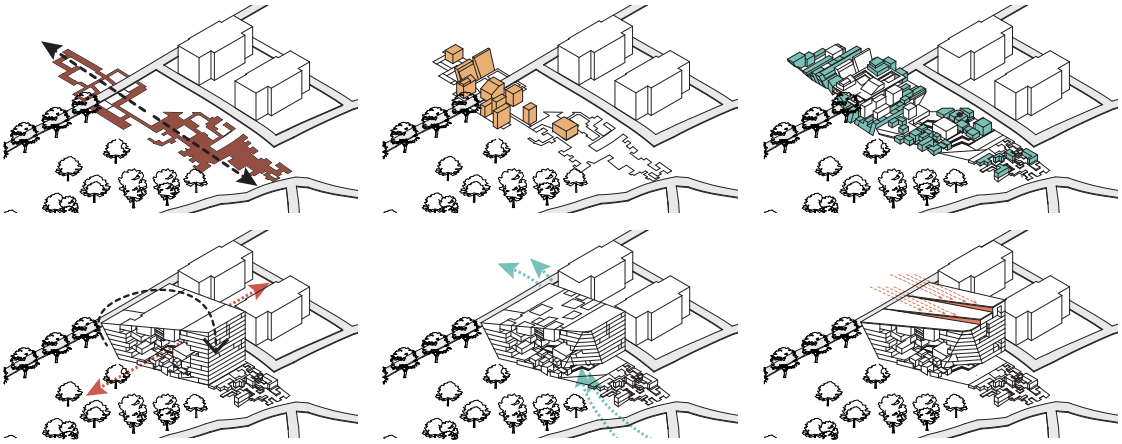

Figure 14　Generating process

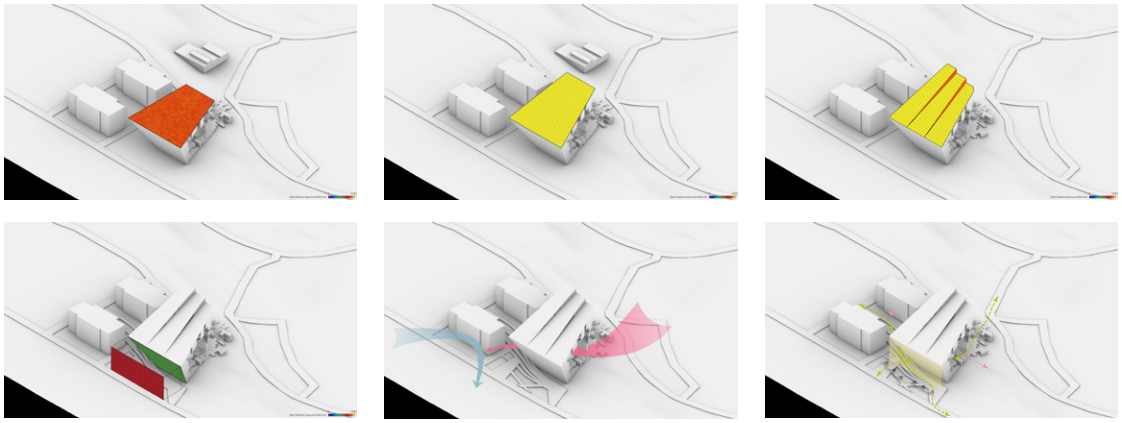

Figure 15　Ecology influncing the profile

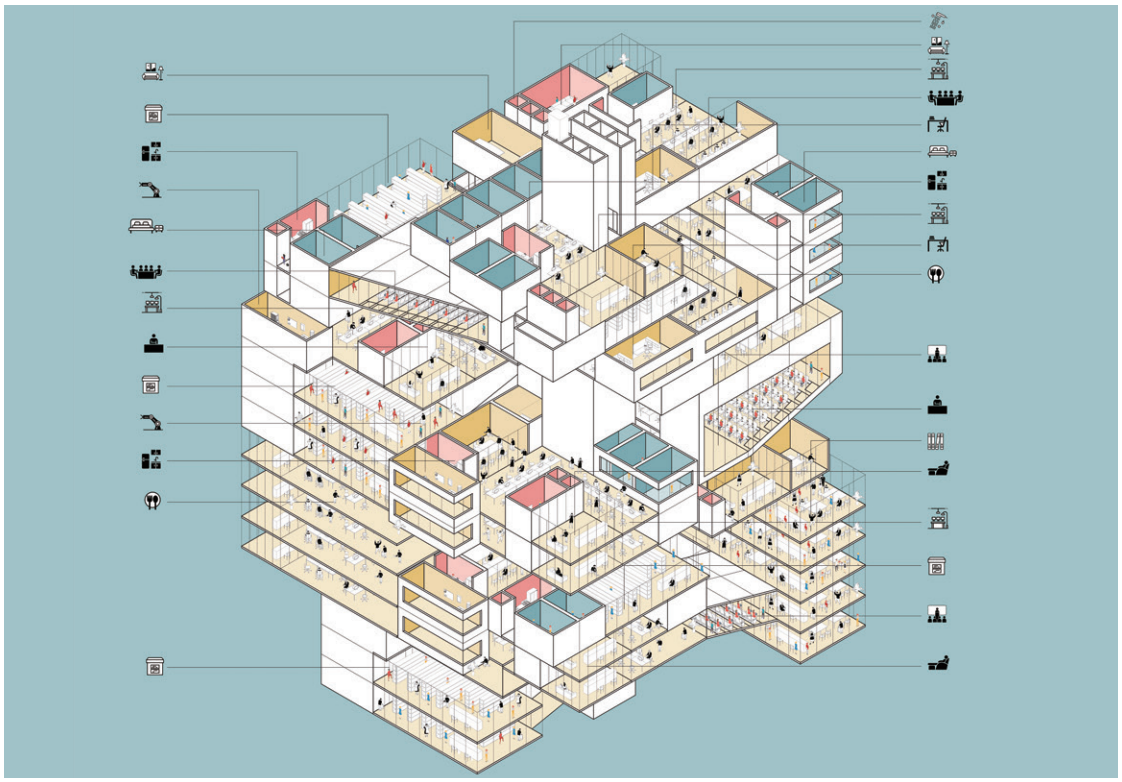

Figure 16 A way of combination of modules

Modular design can be a promising area in ecology design. Modular design and production has now been widely applied to streamline production of many industries and largely increased the production capacity. However, there is just 6% increase in productivity between 1947 and 2010. By modular design, each part of the building can be treated as an embeddable unit and the building owners are able to embed new units or dismantle old units to suit changing needs for not only ecology, but also lifestyle. In this project, we took the unique lifestyle of architects – that they can hardly distinguish between life and work – as an entry point. Then we developed multiple modules for living and working and finally combined them together. This modular design style can greatly enhance the efficiency of design and construction, and bring down the cost of buildings. The modules can be prefabricated in factories and are easy to replace and update with newer modules. What is more, the final design of

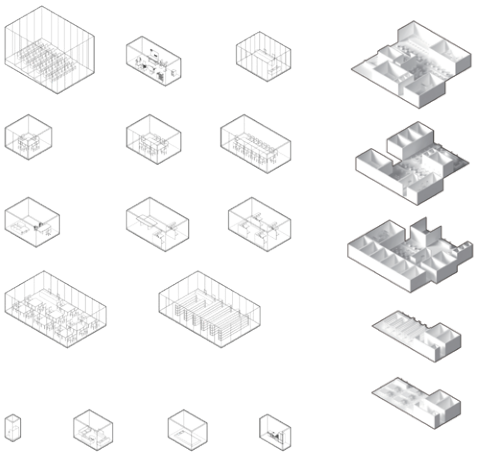

Figure 17 Modular design

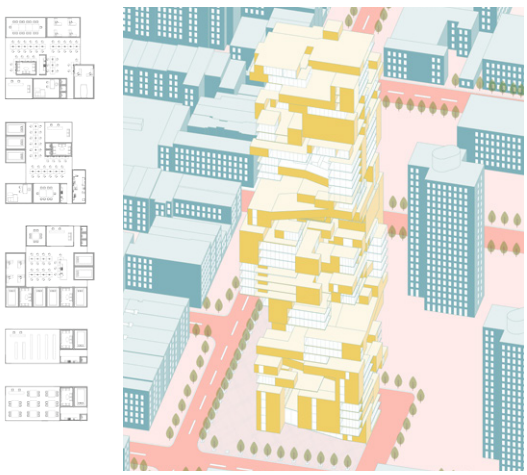

Figure 18 The design center

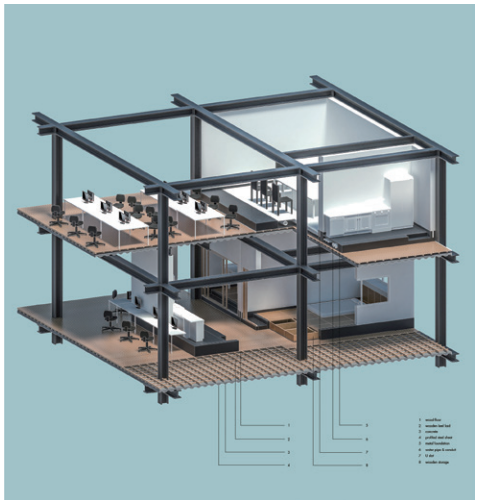

Figure 19 Modular structure

Figure 20 Physical model photos

the profile is not confined by the modules, for different clients will choose different modules and therefore will have different combinations, leading to various outward appearances of the buildings.

Nowadays, ecology is becoming a hot topic in architecture. However, more sustainable design styles and techniques are needed if any serious progress in ecology is to be made. It is up to us, the architects, to bring ecology from an evaluative tool to a design tool.

Bibliography

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