

GRADUATION PROJECT REFLECTION

Graduation Studio -- Hyperbody

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Research and Design

The architecture design is a comprehensive process which is essentially connected with the social environment, material and construction technique, culture, also the climate condition, which will affect the architecture program, volume, gesture and space. At the same time, the general architecture in a certain period will reflect the specific characteristic of the epoch, which will always keep developing and changing during the time. Thus, in order to catch up with the epoch and its zeitgeist, the research is necessary for architecture design to find something new, technologically or theoretically and as a guidance or method for design to satisfy the requirement and characteristic of the epoch. It will also help us to more clearly understand our society environment, people's life and their specific need and help us as the architects to find out our position in the design process. The outcome of the research will decide how we are going to deal with the reality, which generates different thinking logic, observation angle and focus point about the architecture design.

Graduation Project and The Method of Hyperbody

The topic of my graduation project is the intervention of Urban Village in China. It's a village which is surrounded and isolated from the city, and characterized by the extremely density and hybridity. There are different kinds of people living inside with different social class. Various of functions are required because of the requirements from the different group of people. Several types of economic activities generate special network. Due to the high density, the physical condition in the urban village is worse than the average requirement of human living, bad daylight condition, almost no radiation, especially in winter. The specific social, urban, politic and economic condition leads to a lot of complexity and conflict. Thus, the unique social behavior and requirements of people who living and working there is my main concern for my project.

As I have mentioned before the architecture will reflect a certain period and exist as an outcome of that period, the urban and architecture environment in urban village, built many years ago, can't satisfy the different requirements and bring all different life together in nowadays, which will cause the conflict between the urban and architecture environment and social requirements. In order to find a respond to this conflict, the Symbiosis is the main theme I found for my project. Kisho Kurokawa have said: " Symbiosis refer to a relationship between two or more organisms that is not only advantageous but necessary to both. It does not only encompasses harmony or peace, but also opposition and competition. So as to achieving the Symbiosis, one of the crucial key is approaching through both the bottom-up and top-down method.

As a student in Hyperbody Studio, the parametric design strategy is the normal way we will apply in our design process, which based on algorithmic thinking that enables the expression of parameters and rules that, together, define, encode and clarify the relationship between design intent and design response. If we use the same logic to do the comparison between the parametric design strategy and the relation between architecture or urban space property and social behavior, we can find that this relationship is also a kind of parametric algorithm. The social behavior and requirements are the parameter and the property of the architecture or urban space is the outcome of the algorithm. Through an information-based and data-drive algorithm system, I am trying to combine the top-down and bottom-up design directions to achieve a well developed symbiosis system.

First, I need to find a way to transform those information in the research design space to a numerical-based data as an input for the computational scrip. Obviously, some characteristic of the space are originally kinds of quantitative properties, such as distance, radiation value and so on. But the others, like the privacy, order, accessibility, these kinda of qualitative properties need to be represented by numerical level in a proper way. When I read about the space syntax theory of Bill Hillier, I was inspiring by him. Based on the notion of topology, he subtract the urban or architecture space from its geometry shape into a interrelationship within condition like symmetry or asymmetry, distributed or non-distributed, in order to obtain the justified graph showing the topological steps how far a single is away from another one within the system. depending on this topological distance, Bill proposed several qualitative properties of the architecture or urban space, like the depth of a space to the outer environment, the relative asymmetry value, the measure of interaction, the measure of control or the integration value, which reflects whether a space tends to integrate the system or to be segregated from the system. The higher integration value means the shallower average distance to all other nodes. However in a real design project, this kind of abstract theory without considering the space dimension and distance is not proper enough. So, based on his computing structure, I increase the physical dimension into the computing process. As a result, finally, I obtain the several numerical-based data of the research design space: the daylight factor, the radiation value, the privacy, the accessibility of inner village, the accessibility of outer city, the space-space distance and so on.

After having the input parameters, I should know which exactly logic or functions I should use to obtain our result. Generally, there are three types of computational method involve: 1. Recursive Search in a data field 2. Particle, Force Based systems 3. Complex systems: Agent based models. These three methods have their own advantages and proper implemented conditions. The recursion method is a step by step process which is based on a well enough

data field with a clear destination and operation role, it fits better in the condition which already has an abundant context. The Particle, Force Based systems is a dynamic system which try to find a stable state after we have set each forces, attraction or repulsion, between each items in the system. This type of method is more suitable when the items in the system is limited and the relationship between each terms is clear. The agent based method is about the groups of agents which represents different objects influence by the value of cohesion, separation and alignment, and the result will be determined after running a simulation of a swarm behaviour of different agents approaching the site. The agent based method fits more in the situation that, there are a plenty of items in the complexity, and I could set the relationship between the group to group, and between the items in each group. All of these three method is not independent from each other, they can be combined with each other, or embedded into the others depending on our project logic and goal. In my situation, from a bottom-up view, I decide to use the Particle, Force Based systems to obtain the inter-network between different functions in order to find out the Symbiosis among different social class, different groups of people, different life which will be constructed and improved by creating and intensifying the connections and communications between people, life and functions. From a top-down view I am going to use the Recursive Search Method in a data field to determine the program relationship and distribution in urban village to achieve the Symbiosis between the intervention and origin, between the new and tradition, which encompasses opposition and contradiction.

During the form finding process, from a top-down view, it will be affected by the structure, daylight factor, radiation and public space quality. From a bottom-up view, it will be affected by the flow, circulation and view of people, which are the input parameters for the form finding algorithm. Zoom in into a building scale, the boundary between different elements, spaces or functions is defined as interface. It directly influences the relationship in the symbiotic system and determined the quality of the system. The interface doesn't work as a boundary like a wall or normal facade, but as an extension of the function or the space. As the mutual penetration and mutual understanding of two different elements proceeds, the interface of the intermediary reveals the life in the symbiotic system. For example, the interface between indoor and outdoor could be the semi-open space, the interface between private and public could be the semi-private space, which will be given specific functions by the space quality and form. The original old building and orthogonal structure will gradually transit into a new and free form building in stead of connecting with a sharp clear boundary. Thanks for the parametric controlling and the data-based form finding process, all the requirements and design goal I have mentioned above can be integrated and considered together simultaneously and finally lead to a well-developed Symbiosis system.

Another theme in my studio is the robotic production, which try to integrated the robotic production technique into the design process. This integration does not only mean that the architecture design could connect with the architecture producing and construction process directly because of the data and digital based design result can be directly send to the CNC or robotic production equipment, but also the diversity and highly customized production method can affect our idea and ways of design. In my graduation project, my research focus point about the robotic production is about the hybridity of the material and the producing method. We know that different materials have different properties, and also the different treatment on the same material will generate different properties too. And also the different ways of producing, like milling, 3D printing, cutting, will lead to different form result, and each of them fits different material. For example, the combination of EPS and concrete, the Combination of EPS, wood or 3D printing material, both of them will have different logic of producing and different result properties.

As a conclusion, I think in my project, the research and method of my studio is the most crucial part to help me to achieve my design concept. The both top-down and bottom-up method applying through the whole process from the research to design, from urban scale to building scale, together with the data-base computational design method working as a powerful tool to deal with the extremely complex condition to obtain a well integrated symbiosis solution. Finally, I have two direction to research, one is from the macro-scale, a computational method, one is from the micro-scale, a robotic producing method. they both orient to same point from different direction, and eventually influence and shape my project together.

The Social Value and Potential Application

Considering the project itself, it directly faces the social and urban conflict in the mega-city in China. Instead of breaking down and reconstructing new building, I am trying to find a new way of urban renovation. Because of the extremely complex condition in urban village, the most easy and efficient way is reconstruction. However it will cause a lot of conflict and generate the problems in the future. Thus the computational parametric design method provide us with a new design way to solve the problem and what's more important is it also brings an idea of adaptability which makes the building undergoing the permanent changes and the design becoming adjusted accordingly as if it updates itself in the changing society and urban environment. There would be no final result as there is no spot for a solid solution in a dynamic context. The design produced in computer is based on a parametric framework which is set up to feed the process from the online or real-time monitored database through internet and application of sensor

technologies. The parameter constraints and rules within the system make an autonomous and bottom-up and top-down design process to meet the fitness criteria. The overall benefits of the method of an integrated design and fabrication process through application of robotic technologies was to find flexibility of such approach for a data-driven and parametric design.