Design Loop during Digital-Driven Design Process

ARCHITECTURAL AND MEDIA STUDIES

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I. Design Loop

"Architecture is recasting itself, becoming in part an experimental- investigation of topological geometries, partly a computational orchestration of robotic material production and partly a generative, kinematic sculpting of space" – Peter Zellner in Hybrid Space

Digital-driven design is characterized by open-ended and unpredictable structures. Unlike traditional fixed-ended project, digital design or say parametric design is dynamic and capable to adapt to different context and can also be giving rise to new possibilities. This attributed to that prototype was perceived as an apparatus, which can be used as a generator of architectural solutions. In order to acquire a prototype that can satisfy previous conditions, a design loop need to be adopted during the digital-driven design process. The loop emerging after the design logic has been set by the designer, consists of experiments for design idea and back to modifying as well as the adjusting of inhabitants' behavior.

1. Digital Design in general

In general, students of the Hyperbody studio need to learn how to design a digital building no matter which specific topic we chose, as there are three topics for us to get involved with for this semester- Next Generation Building, Robotic Building and S.M.A.R.T. Environments.

New digital architecture is emerging from the digital revolution and have found their expression in highly complex. Digital designs are offered by the present-day science and technology, which makes it inseparable with new methods of design, regarding to both method system and digital tools. Before getting to know digital-driven architecture, it is easy to be misled by the idea that digital architecture means a complicated and emotional form. As a matter of fact, digital-driven design can be the most practical design which is facilitated but not limited by computational skills.

2. Method system

Architects are a lot like craftsman who combines the mind work and hand work together. It involves a loop that from the initial idea to a drawing, from a drawing to experiment and the back to modifying the idea again. Same as mentioned before, digital-driven design acts as a loop that architects set up a logic cautiously and then to realize it. During this process, experiments are required. During these many test, designer can found out whether their logic work as they thought or not. If it does not, then started again with a new experiment. This loop is formed by formulating one after another hypothesis and going back over to refine the design and so on. During this process, designers can narrow the circle and exclude several unsuitable way of doing the project.

In my case, after I set up my logic that finding the optimist way to divided living cells and connect them to other spaces, I started to do experiments of different digital tools which can help to realize it, such as grasshopper plugins Perlin noise, Boid, Quelea etc.

3. Computational tools and techniques

The experiments inevitable need the help of computational tools and techniques which are having a strong impact on architectural design. Using tools is also a necessary skill for a craftsman, it cultivates a direct relationship between ideal visualization and the ultimate model. The designer is the one deciding how to implement design with the help of computational tools. It is also his choice to decide which parameters are the priority for his designs and which are not.

In other words, digital tools are increasingly being used not as a representational tool for

visualization but as a generative tool, with which help the form can be developed logically. Hence, students are required to embed digital methods into the design process, exploring the new possibilities and challenges that occur.
The most used computational tools in my project is grasshopper with many plug-ins. Those scripting components help me to go through the morphogenetic process. Thus, translation of abstract thought into the computationally enriched architectural typology and demographic morphologies can be implemented.

II. Design Project

Among three themes that the students of Hyperbody studio could choose. The focus that our group took was about a topology interactive architecture, which involves both Next Generation Building and S.M.A.R.T. Environments. By adjusting to the behavior of the inhabitants, in our case are students, the architecture can really be practical and sustainable at the same time.

1. Design goals

With the mentioned goal in mind, we began with background research as the basement for our further design. We were interested in diverse demographic types of students nowadays. Compared to earlier student's type, there are more types of students emerging in this generation, in terms of traditional type of single students who has no financial income and new type of coupled master, PhD students who lives with their own families. This change happened between inhabitants leads not only to different requirements for house, but also different needs about social networks. In other words, instead of having a traditional dormitory for traditional students, a new topology student house that can accommodate all different types of inhabitants is required.

2. Experiments with computational tools

With the aforementioned computational tools, I started articulate the project's internal generative logical in a range of possibilities. First, I set up 70 living cells (pink buttons) for both single and coupled students, 10 equipped kitchen area (yellow buttons) and 5 gardens (blue buttons). Fig 1. All the statistics are based on the previous research. Then, place the public kitchen area as well as the garden based on the sunlight conditions. In this step, the computational tool (lady bug) helped to optimize the location of those spaces. Then comes the main structural logic of how to group a cluster that has living cells, facilities as well as the garden. Ideally, 3-7 cells share one kitchen well all the residence can enjoy a green view. Staggered living spaces embedded with landscape would emerge. With the help of scripting, the living cells can be divided by the distance to the public facilities, so as facilities grouped by the distance to gardens. Beside, more connections between same functional spaces have been established as well. After attempt to mimic swarm behavior using plugins as Boid and Quelea, I decided to go with the most direct way of bridging those spaces with a grasshopper component named shortest walk. The component can find out the shortest way from settled paths, in this case the networks among living cells, facilities and gardens. See Fig 2-4.

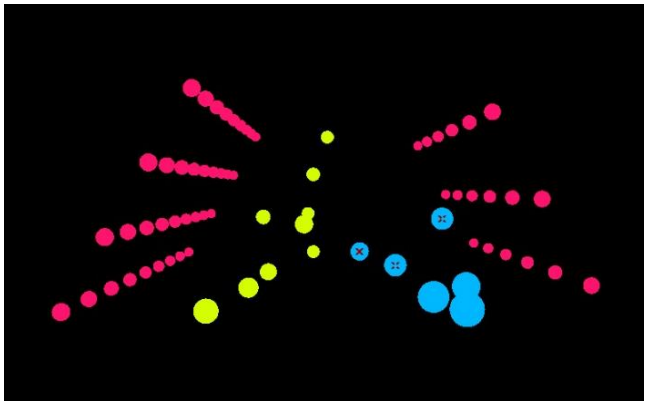

Fig. 1 living cells-pink, facilities- yellow, gardens- blue

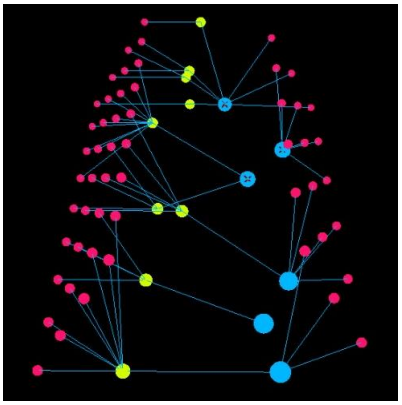

Fig. 2 grouping spaces by distance

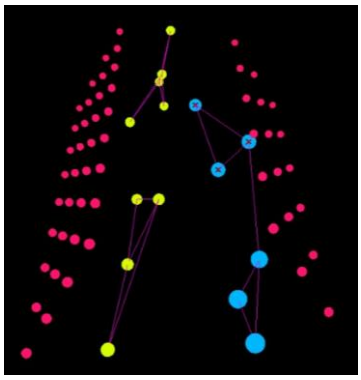

Fig. 3 connection between same functional spaces

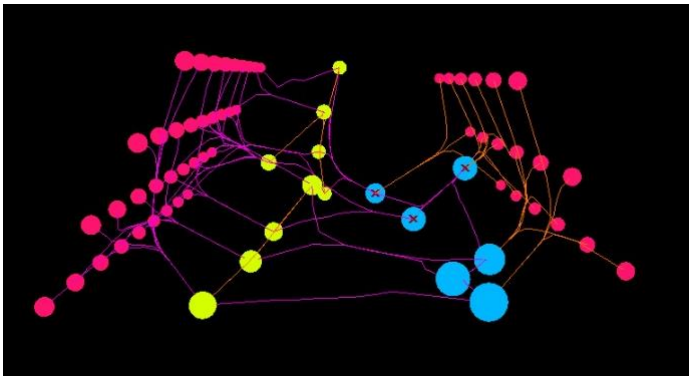

Fig. 4 final routine

Further design will continue with the design of different living cells for single and coupled students and the way they stagger.

III. Conclusion

The most fascinating part for me about digital-generated forms are the representation of precise logic, practical use and the combination of subject emotional expression. Unlike conventional buildings, parametric design that I learned from Hyperbody adapted a new workflow of design. Everything is calculated by the chosen generative computational method. As for the interactive buildings, realizing the existing design loop is important. Design is adjusted to the behavior of the inhabitants and effect inhabitants at the same time. In the end, the use and interpretation of the design prototype shows variable possibilities of architecture if the context changes as well as the interest of the designer.

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