Bottom-up and Top-down Approaches in Design

Computational design tools and generative processes are vital elements of architecture nowadays. Swarm/network intelligence systems are among one of the most investigated and applied strategies. Swarm intelligence is based on neighbourhood negotiation and self organisation. Working with these tools changes some of the fundamental design ideas. With a multi-agent system, the architect is not the author of the output anymore, but the author of the process[1]. The paradigm change between top-down to bottom-up processes shows itself clearly at this point.

In November 2016, Game, Set and Match 3 Symposium organized by Hyperbody, took place in TU Delft. One of the speakers was Martyn Dade-Robertson from Newcastle University. Dade-Robertson is working on a project called Computational Colloids which proposes[2] a system of synthetic bio bacterias to strengthen the soil below the building to support the loads which a foundation would. To achieve this, the research is going through a multi-disciplinary process in which bacterias are analyzed and genetically manipulated to sense pressure and react to the mechanical changes in the soil. The work of Dade-Robertson is using multi-agent system of bacterias as constructor. The design process is changing from drawing and calculating the foundation to manipulating pressure genes of bacterias and predicting their behaviours.

Main differences between two different approach can be summarized by citing Francois Roche[3]. The first approach is designing the output in Newtonian sense, where all elements of the design are “fixed, predictable and redacted”. Whereas the second approach is considering the complex system as endless transition between equilibrium and disequilibrium as thermodynamic and consists of “uncertainties, permanent adaptations and reactive mutation according to the inputs within and around the system”.

On the other hand, it is unclear if the pure bottom-up strategies would be able to create a better design outputs or built environments. The author of “Out of Control” Kevin Kelly questions the abilities of such strategies in his article “The bottom is not enough”[4]. He suggests that a level of top-down control and guidance is needed while working with bottom. He further argues that there is a limit to the amount of top-down and too much is unnecessary. The frontier envisioned by him is investigating new ways to combine bottom-up strategies with different levels of top-down control.

It would be necessary, at this point, to think about specific situations. If we go back to the research of Martyn Dade-Robertson, we realize that instead of creating/editing the framework/ruleset of multi-agent system, he takes actual, living cells to work with as his swarm intelligence. Then the biologically manipulated pressure genes are delimiting the system inputs and provide control and predictability of the system. Which comes with the benefit of not using concrete for the foundation and results in optimized, adaptive performance of the soil supporting the building loads. One can argue that in this case, the

desired output is completely functional and does not have contradictory inputs and needs or even the social aspects or intuitive qualities which are much more difficult to quantify and integrate in such a process. This may be the reason, that this project is so successful with its aims and in the same time, for some people it can be considered outside of architectural research area. It is crucial to evaluate each situation with its conditions.

In Fall semester of 2016 of Hyperbody, the subject of the MSc1 studio project is designing a student housing of 3000 m^2. Obviously, design of a building is not a homogeneous process, it consists of different layers and requires different sensitivities. In every phase of the design, just as planning our time, defining our design method and approach was important. Trying to find the balance as between bottom-up and top-down as Kevin Kelly puts it. The given parameters of the design problem influences these decisions very closely. For instance, smaller scale can be argued to respond better to “crafted” solutions and intuitive design approaches, whereas bigger scales may require different methods as swarm intelligence considering the complexity the scale brings. Same thing can be suggested for location of the project, connectivity of the location, functional program, structural characteristics etc.

The challenge, in our specific studio in my opinion is, finding a way to work with the bottom-up systems without sacrificing or leaving out any aspect of the design. This is a really difficult issue considering our lack of experience in the necessary tools and overall idea about such processes. The other layer to this is the limited time which is almost in the nature of all design works. Another view would be to accept the fact that learning to work with complex systems, you need to start small and integrate some aspects only after feeling more comfortable with what you are doing.

The other question comes up with the aesthetic preferences. Aesthetics is a concept very vague to discuss about. But in the sake of this argument, it still may be important to raise the question; do the models that are successfully informed with all the quantitative inputs guarantee a pleasant aesthetics, even at least for its designers? Or is aesthetics an outdated and out-of-topic term in this discussion? Which is the path that leads a computer to recognize the spatial qualities which are perceived by people. The computational design and generative systems are basically objective approaches to design, how can we integrate subjective inputs to this process?

When being deconstructed, it becomes clear that even the things which seem to be the most subjective, have quantitative attributes to them that influences our appreciations of them. For instance, the food have chemical attributes such as temperature or ph values, the smell has again similar chemical attributes. The taste is something calculable according to these scientific properties. Investigating new ways of integrating the design intuition is a valuable area of research in my opinion.

To conclude, working on combining these two seemingly different approaches and finding the balance between them, designers should keep their eyes on the result and

qualities they want to achieve. Embracing tools or strategies as the driving forces of the design and research will not help bridging the gap. The technology in our reach today opens doors which were not available to us before. Building the future, we should remember the inseparable relation between making and thinking, suggested by Richard Sennett[5].

Yagiz Soylev
4604156

References

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