Architectural and Media studies report

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In order to make a dense building but most of all an interactive building between inhabitants of student housing for the Hyperbody Studio, the first thing to do was gaining information about how to create an architectural space where the main activity in the public space is people interacting with each other. The following questions arose: how to support the sharing of facilities between inhabitants and keeping the privacy they need, how to design spaces where people can interact on different occasions, and the most important one, which elements/architectural space is needed to form an inviting atmosphere from the public entrance to the private rooms. Before trying to translate those requirements into a three-dimensional form, a database of all options of spaces/forms, to create the public to private gradient and interacting to separately spaces, was assembled. The things that came out of this database were shared facilities in-between rooms, where rooms of students could be changing into bigger or smaller spaces. Shared facilities, as work spaces and meeting places, which people can use outside their actual room. Last of all, the circulation space should be a place where multiple actions and interactions between inhabitants could happen.

From this point on there were studies into different outcomes or options for the circulation space, which will be described further. It started with using growth algorithms in grasshopper to create a 3D form for the circulation space of the building. Further the implementation of L-systems will be discussed, which even can inform the computational design in a multi-layered design strategy where the designer can inform the algorithm and vice versa.

To make a computational framework for growth possible in grasshopper, research into growth systems was first needed. And with this research a lot of options came out to deal with in the design process. Which actors should be the most depending in the whole system and on what should it be based, where the big questions. 'Growing' something in an architectural strategy often means a repetition of some forms, which will eventually together create other forms. So in order to make this growth possible, a grid structure was taken. With the grid structure and growth the principle of cellular automata could be used to form the circular routing of the building. Cellular automate is a collection of "colored" cells on a grid. The cells can have the state of dead or alive, or 0 and 1 in binary language. The status is dependent on the neighbourhood of the cell and with a certain ruleset cells are alive or dead. (Wolfram, 2002) In 3D this can be transformed to a cell which exist and is filled space, or not exist and is thereby open space. With this method a 3D structure could be created to form the path inside the building, by the existing or non-existing cells. But because it is based on a binary ruleset given to the structure the outcome is always the same with the same rule and generations. Only where in this system does the designer get involved with the design problems? The problematics of the purely formalist approaches can be addressed in the contemporary efforts to integrate computation with some level of reality trough physical/material production, as told by Zeynep Mennan (Bier, 2014).

This reality brought the computational strategy back to a simple curve. A curve forming the circulation path and will transform into a continuous slope through the building. Multiple options were tested, curves with shortest paths to specific locations on site could be combined together

and give an interesting gathering of paths and spaces where interaction or no interaction between inhabitants could happen. However, where shortest paths combine lines together to form a smooth transformation, crossings can bring two different atmospheres together directly and interfere with each other.

A next version of the different studies were made into branching structures of a path. Where it could start with one path which can be divided into more, can come to an end or brought together again to create a loop. This can be done with a loop structure to create more and more random parting of the path and build it further in three-dimensional space. However, a more broad option is the use of L-systems. Aristid Lindenmayer proposed a string-rewriting algorithm in the late 1960's, based on formal grammar theory which can model plants and their growth process (Hansmeyer). This theory is known as L-systems. More recently with the contemprorary technologies of modelling and visualisations, Michael Hansmeyer explored the possibilities for using the L-systems in architecture. Turtle graphics are used to draw lines in space. With multiple formulas it creates a certain path, which can be (partly) fixed or random. With branching the path interesting crossings could be made, dead ends, or paths could be brought back togethers after a loop, for an amount of generations. In this principle of drawing paths in multiple generations Hansmeyer did a study how to use this in architectural forms. Where he didn't use only one line to create a form, but in-build loops where a path could be extended along other paths, which creates 3D forms between specific borders. This can be done randomly or use the algorithm to produce every time the same path. However, in comparison to the growing systems, you can only see one result of the computational question at the end of the process. Whereas in the research of Han Feng he explains how a quantum design paradigm advocates an interactive design system setup that includes both: design algorithm and human designer as indispensable parties within the same structure. Where the designer can participate interactively in the computational design making process while the in-between stages can stay the same and final options can be chosen differently.

The research itself was an experiment in how a circular path could be formed out of an algorithm in the computational strategy of the project. During this research I came to conclusions that some of the options hadn't had enough design input in the computational intelligence in a way during the process the designer could still have a lot of influence in the form output, or decisions on multiple output options could be made. This is where the research of Han Feng was interesting in considering to have more feedback of the designer in the computational process. Or the questioning of Zeynep Mennan where the estrangement due to the numerical representations need to be made more real with materialisation and building. There need to be found a way where the hierarchy of the computational system and the designers input is more on the same level then in a computational strategy where the algorithm has the leading edge.

References

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