Reflection

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Theory of the Design

The architectural design process is essentially affected by many environmental and social factors such as climate, culture, fashion, obligations, values, policies and norms which are varying during the time. The building as if it seeks to be sustained, is acquired to perform with respect to the changes in all aforementioned factors. Otherwise, there would be gaps and disconnections created between what the architecture is, and what the context requires. Several buildings which are built during the 70's and are abandoned now can be great evidences of these gaps. The building needs to be reconsidered and changed in all terms of structure, materials and spatial properties due to the new situations and needs to fill the gaps. Hence, an ideal of adaptability should be described, which makes the building undergoing the permanent changes and the design becoming adjusted accordingly as if it updates itself in line with global factor's alterations. A metastable architecture which is constantly in transition between an infinite design process and an appropriate outcome for the related theme. 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 design process to meet the fitness criteria. As a result, the gaps induced between the built environment and the factor conditions of the time will be avoided.

The main feature that marks this flexible design is that, the spatial and material porosity of the building from identifiable urban and human scale to the materiality varies continuously due to the adaptation. In other words, an 'Adaptable Porosity' which becomes explicit through application of robotic fabrication techniques. In this way, through implementing an on-site digital construction platform, it is possible to add, subtract or assemble any building component which is required to adapt.

Design & Research

In order to achieve the goals for the design, I performed researches upon computational strategies to perform accurate simulations and making a parametric scheme for the bottom-up approach of form finding based on the input essential parameters of the design, from program to structure. The chosen location for the design was the SOM (Europoint) towers in Marwevireheaven, an industrial and harbor area situated between Schiedam and Rotterdam. The towers are located in Marconiplein on the north east part of the area. It is one of the main transportation hubs in the city of Rotterdam and is very easily accessible by all transportation means. Yet, nearly a quarter of the whole office towers area is vacant currently, the M4H itself regardless of many important business activities going on in the area, is a Gotham city during the night as it only inhabits not more than 20 people in it.

However, The amount of industrial and harbor related activities in the area has been reduced during the recent years which is due to the Rotterdam municipality revitalizing plans for such important area.
It is mainly concerning the creative activities, dwellings, retails and educational areas to be replaced with former functions. My design site, not segregated from these vast changes in the area, requires some interventions for regulating the performance in terms of social and environmental. Hence, The aim was to redesign the towers as to cure the current situations caused by aforementioned issues. As taking part in Nonstandard and Interactive architecture studio by Hyperbody, the aim is to investigate possibilities for solutions from computational methods for design and realization strategies. In order to achieve the goals for the design, I conducted researches upon computational strategies to perform accurate simulations and making a parametric scheme for the bottom-up approach to find proper solutions for the existing conditions. The solutions are generated within the parametric model which is capable to be evaluated to extract the desired solutions based on the fitness criteria. Following the context research and extraction of key parameters, the design starts with a reprogramming of the current buildings to choose the proper functions in a bottom-up way through application of “Preferential Attachment” algorithm.

Through mapping the current functional parameters of the site and its surrounding, the desired program of the building is selected. This process can continue while more parts of the towers become vacant in the future. As a result the reprogramming strategy is the key feature of the on-going design process for a metastable building. Further on, thorough an Agent Based Model (ABM) for program positioning simulation the main functional layout of the building was generated. The agents are informed through global and local parameters, and spatial studies based on each program needs. Such as spatial relations, levels of privacy, and the possibilities of each space becoming a hub in the network of functions. Following the ABM, the circulation model was established and then optimized through Wooly Path simulation to find the shortest walk ways. Later on, the schematic body of the design was emerged based on tracing the stress patterns of the optimized topology based on the load conditions of the 3D layouts of different program and circulation model.

Realization

Through computational means it is possible to have the 3D generated geometries translated into robotic motions for the digital fabrication process. A file to factory strategy which brings possibilities for a quicker, cleaner, less energy consuming and cheaper building operation. To this end, different tests and researches upon the feasibility of the method was crucial. Hence, Hyperbody studio provided a lecture series and workshops. In the context of workshops, called “Scalable Porosity” produced by means of a customized robotic design-to-fabrication process, students investigated the integration of systems at different scales. from urban relations to structural and environmental integrity and from local ergonomic conditions to overall material deposition. Furthermore, different studies of material performance and densities was conducted in order to lead in to an integrated multi-material production method. An approach which also feeds back the design process and controls the amount of different material depositions based on the simulations and structural analysis.

Benefits

The overall benefits of the method of an integrated design and fabrication process through application of robotic technologies was to find flexibilities of such approach for a data-driven and parametric design. In line with the studio theme and according to my design theory, an architectural design based on parametric logic, requires a certain level of flexibility as the essential design parameters changing
during the time and lead into the design alterations. As a result this flexibility should also reflect in the construction phase in order to keep the balance between the building and the ever changing global parameters. In this way, through computer simulations and other research tools, the unpredictability of the conditions is studied. Hence, the proper results are selected for the different situations by an evaluation system which is embedded within the design process and can be sent to the fabrication.