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Networked Systems

A food hub for Paris

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Problem statements

The project aims to deal with the problem of food production and transportation within big metropolitan areas, in this case the city of Paris. The main goal of the project is to develop a new model of urban agriculture capable of working both at a global and local scale. The idea is to integrate a model for the intensive production of food, such as the vertical farm, with a series of functions and devices that work at the local scale in a way in which it would be possible to involve the population into the project. In order to integrate the project's proposal with the existing dynamic metropolitan system it is necessary to develop a strategy capable of adapting and reacting to the continuous changes. The strategy aims to investigate some concepts directly derived from the field of NS&IA such as self-organization processes based on the swarm behavior logic.

Defined the main problems that I had to face the first step was to define a list of questions or problem statements in order to drive the whole process.

- What could be a possible solution for the integration of intensive food production system within the urban context of big metropolitan areas?
This point concerns the attempt to find out strategic and programmatic solutions for appropriate integration of intensive models of food production into the metropolis of Paris. These solutions requires a certain versatility to be adapted to various urban scenarios but at the same time global guidelines principles. The choice of Paris has been done because it could be seen as a general scenario for this kind of research.

- Which is a possible strategy that allows deriving a functional spatial organization capable of responding to the dynamic changes of the urban environment?
This point is interwoven with the ability of the process to satisfy the strategic and programmatic solutions with an architectural project capable of stimulating and involving the urban context on various aspects such as social, urban and climatic. In particular way this phase focus on the use of real time simulation and multi-agents systems to define an optimal spatial organization that answer to peculiarities of the surrounding.
Moreover this approach concerns the possibility to develop simulations and parametric strategies that define a bottom up process from the form-finding generation to the architectural details. This process has in fact to respond to the global requirements of the project's framework but also the different issues of the various architectural scales.

- Which is the most appropriate way to convert this functional spatial organization into an architectural form that is capable to establish a meaningful relationship with its urban tissue?
This part of the process concern the strategy that deals with the transformation of the simulation outputs into the various design scales that the project requires, trying to satisfy the local equilibrium of the new intervention within the global environment of the city.
In detail the first passage was to select the best output from the simulation based on architectonic qualities. This phase was advanced through the transformation of the point cloud obtained into effective spaces through the use of the metaball process. Thanks to a grasshopper definition the agents were converted into the basic spaces that should host the functions based on the amount of needed area and on the location within the building.

This approach represents the starting point of a morphological series of transformations of the metaball that concerns the usage of the space themselves. In particular way the design of the space responds directly to the peculiarities of the functions themselves that in this case are strictly connected with the food production and its harvesting and distribution.

Reflections

The topic of the Hyperbody graduation studio proposed this year was “the co-evolution of urban agriculture/integrated/experimental green strategies together with the comprehensive usage of computational design techniques”. Within this framework the project aims to use different computational techniques to integrate various green strategies both and the global scale of the city and at the local scale of the architectural artifact.
Paris was chosen as location for the project because it represents one of the biggest conurbation in Europe and also because it presents different local microclimates within the city. Moreover I have done vast researches on the food consumption and production within this town and the output was a clear shortage of both that offer the possibility to develop a new system of urban agriculture in order to overcome these deficiencies.
With the site selected next step was to analyze already existing models of urban agriculture in similar context. The comparison among them and the definition of their problematic brought to the idea of the design as a model of production and distribution capable of containing functions that could satisfy the local and the global scale. The idea of food production in the city need in fact to be mixed with other functions that can involve more actively the population and they should be more integrated in the building morphology generation and in its final structure.

Afterwards various analysis of the urban surrounding of the project's site were conducted in order to find out a set of external parameters of different nature (social, programmatic, climatic) that could possibly influence the project: in detail they represent the external parameters that affect the building generation. Along with these factors derived from the surrounding other issues connected with the programs itself were chosen and classified in order to have inner and outer peculiarities that could affect the process.
The main idea was to develop a simulation capable to find out the optimal allocation of the functions based on the program chosen and within the site.
This spatial configuration tool researcher was generated with a script in Processing through the use of a Multi-Agents System based on the swarm behavior principles. This system is regulated as already stated by the negotiation between inner aggregation logics and external influences. This real time simulation offers the possibility to define various spatial allocations of the functions depending on a selected set of influences that wants to be considered as relevant for the project.
The relevance of this approach is that this system could be applied to other location with different data set for the parameters. At the same time of course the system present some gap that to be filled need the intervention of the designer.

Subsequently the main focus was to find a coherent process capable of translating the data obtained from the simulation into a meaningful architectural form. Within the framework of Non Standard and Interactive Architecture different concepts were analyzed and considered in order to find the most suitable morphological process. The attention was put on the geometrical concept of "metaball" and on a sequence on morphological variations onto this concept in order to achieve different architectural spaces that could satisfy the project's requirements. In order to develop this process different parametric tools were used, keeping as guideline the idea of a bottom up form-finding approach were the input parameters like the cultivation type, light and climatic requirements and structural necessities define different formal output. Within this bottom up process, the designer had to make different choices that had a certain influence onto the whole process, specifically into the definition of the main parameters that will influence the design.

A particular effort was set into the definition of a strategy capable of use in a meaningful way different computational tools in order to generate optimized spaces for cultivation. The whole process tries to embed the idea of

"experimental green strategies" as guideline for the generation of non-standard spaces for cultivation that could have value both as architectural experiment and as productive entities. For instance the structure developed aims to change its thickness in relation to the amount of soil required for every specific cultivation, in order to accomplish both the functional and the aesthetic aspect. Another example is the creation of "shafts" within the slabs in order to allow the light passing in on one side and on the other side to let certain cultivation like trees passing through.

Moreover a particular emphasis was put on the skin of the building because it is a thematic really relevant within the panorama of sustainable architecture, and in specific within the typology of the vertical farm. Different environmental analysis (shadows, insulation, solar radiation) were done both on the structure and on the skin in order to create the most suitable climatic solutions for the different types of cultivation hosted in the tower. The main idea was to customize in terms of density and opacity every glass panel of the skin based on the light requirement of the cultivation. Each panel changes opacity according to its orientation and to the type of light that receives during the whole day. The attempt was to demolish the idea of a unique uniformed glass in order to provide customized and more efficient solutions. Of course this choice present some negative aspects, for instance in some part of the building the light received from certain panels changes a lot during the day, so it was difficult to define an opacity capable of perform on the whole day.

To some up these reflections the main outputs that the project aims to satisfy are related both to the social and on the scientific level. On the socio-cultural level there is the intention of trying to develop a model for the integration of the intensive production of food into the metropolitan areas applicable to various local conditions. Specifically related to this idea there is also the issue of the development of a real-time simulation system adjustable to the design statement of the project. On the scientific level, finally, there is the attempt to develop a process capable of translating the data of the simulation into an optimized topology in terms of structural and climatic issue.