## Project Description

<table>
<thead>
<tr>
<th>Graduation Project</th>
<th>Matas Ubarevicius; 4120825; de Vlouw 22, 2611EZ, Delft, The Netherlands; <a href="mailto:m.ubarevicius@gmail.com">m.ubarevicius@gmail.com</a>; 0622380164</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Title</td>
<td>Complexity &amp; Urban Agriculture</td>
</tr>
<tr>
<td>Location</td>
<td>New York City, East River Waterfront</td>
</tr>
<tr>
<td>Contents</td>
<td>Creating artificial ecosystem is a challenge like no other. To integrate agricultural and densely populated urban environments together demands knowledge in biology, city planning, engineering, computation and automation. These areas help understand and model various forms of parametric interactions between abstracted entities, which can lead to multiple layers of collective structure and organization. This project will thus formalize some basic ideas of complex systems theory in a field of non-standard and interactive architecture through modern object oriented programming and scripting methodologies. While specifically designing active urban agricultural environment with functions of food production, education, research and service, project will focus on adaptation to local energy and material resources, existing socio-economic and functional city fabric. The aim is to create scalable, symbiotically working architectural project, which effectively uses opportunities and resources, embedded in East River Waterfront area of New York City in order to supply the local community and site visitors with high quality food, agricultural education and enriching experience. The value of the project in a wider scientific and socio-cultural context should be evident not only by observing or analyzing finished design, but when understanding deeper methodological research and development aspects. Project tries to provide a practical example on how computation can be used when designing buildings and when using them. Such digitally enriched architecture should also provide the basis for future development and research in the field of non-</td>
</tr>
</tbody>
</table>
standard and interactive architecture. Experience gathered when integrally solving conceptual, technical, computational or structural problems could provide additional value in the fields of Building Technology and Architectural Engineering.

Qualitative and quantitative analysis methods will be employed when researching existing situation in East River Waterfront at New York City and when building a knowledge base on agricultural environments (biological aspects of plant growth, most important parameters that influence crop metabolism and photosynthesis, etc.). Technical aspects of greenhouses, their structural and architectural solutions, control and automation systems will be investigated. Various computation and simulation techniques, like agent based modeling, conceptually related with complexity science will have to be used to optimize and test the design concepts. Object oriented programming in C++ and parametric scripting in Rhino Grasshopper will serve as tools for creating a virtual architectural model, which will be used to test its prototypes. Under supervision and consultation of external Building Technology teacher, additional structural analysis, simulation and optimization tools might be empowered after P2 presentation.

**Problem statement**

Existing agricultural settings of the world are separated from cities by creating many problems related to logistics, resource and energy waste. Complexity of agricultural environments and densely populated urban areas may suggest means of integration where resources and energy are shared in more efficient ways. Such parametric relationships for non-standard and interactive architecture can now be created by using new kinds of computational methodologies, some of which are borrowed and adapted from other fields of science.

This project also tries to exemplify how early stage of design can be affected by different kinds of simulations increasing efficiency and decreasing various costs of the building in all the phases of the building’s manufacturing, assembly and operation processes. The fact that majority of practicing architects are still lacking sound methodologies to work with
computational helper tools is a big problem when trying to create self-sustaining environments.

Research question(s)

Main question:
How self-sustaining agricultural system can be implemented in dense urban environment by creating mutually beneficial parametric relationships?

Conceptual-theoretical question:
Why agent based modeling and complexity science are beneficial when creating non-standard & interactive architectural projects of highly complex systems?

Scientific-technological question:
Which building technologies and engineering methods could make the best use of natural energy and material resources, existing around East River Waterfront, for urban agriculture?

Methodological and procedural questions:
How integrated design and simulation approach can be used when making design decisions throughout various scales and time phases of the project?

How complex architectural systems of urban agriculture can be modeled by using agent based computation and object oriented programming?

Design Assignment

Design assignment asks to investigate possible ways in which usually rural typologies of agriculture could be transformed and used in densely populated cities. East River Waterfront in New York City is selected as a case site for the assignment. Computational methodologies are supposed to be very useful when fulfilling design assignment and answering research question. These methodologies can create interactive behaviors of the agricultural system driven by complex sets of parametric material and semiotic variables. Assignment suggests that urban agriculture is not limited to the scope of functions that are used directly in food production. Distribution, consumption and educational aspects in one way or another should be touched upon. Innovative sustainable solutions have to be researched in philosophical as well as technical dimensions. Design and systems thinking are essential skills to be developed when trying to solve the assignment
The goal of the design is to give a case model of non-standard & interactive architecture for urban agriculture in densely populated East River Waterfront area of New York City. Model should expose quantifiable benefits of food production facility implemented in existing urban fabric. Through analysis of complex parametric environment, simulation for generative formations will be set up, which will allow to create and test design alternatives iteratively. Formal and functional approach should be highly scalable and possibly reconfigurable when demands for the building change or when parts of the building need to be optimized for different circumstances, renewed and fixed. Network science and research on philosophical ideas surrounding the computational concepts of parametric architecture will form a basis of theoretical framework for the project. This will allow selecting methodologies best suited for mentioned design goals at each step of the design.

Date (20/06/13)