Living Geometries
Contemporary strategy for developing a housing community

*Living Geometries* researches a contemporary strategy for developing a housing community as an ever-growing urban environment. The goal of this project is to describe a system that allows for spaces to be continuously used and permanently active.

From the larger topic of Hyperbody Design Studio “Climatic Ecologies“ the subject of this project has been the investigation of strategies of combining micro-climate dependent ecologies with totally controlled agricultural environments embedded into urban housing.

The chosen site is in Rotterdam, Schiehaven dock, on Lloydpijer.

**How can city-integrated agriculture improve spatial and social demands of a city environment?**  
**How can a new urban way of life emerge from the synergy of the primary human activities: housing and gardening?**

The design assignment is the development of housing units that are self-sustaining, food-production-wise, and at the same time, meet the demands of open/shared/public space required by a highly dynamic and rapidly densifying city centre, especially within current *greenification* demands for Rotterdam (doubling of existing green spaces by 2040).

Around this general description of the system the research was focused on two major topics: site specific data gathering and using contemporary methods of production and fabrication in architecture.

The first part of this research was focused on in depth analysis and extracting data from the site.
Objective data gathered from environmental simulations concerning sun, wind and pollution and urban data (population, densities, vegetation and development) were analyzed and an urban/ecological housing design strategy was formulated.

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<th>HOUSING DENSIFICATION PLANNING LLOYDPIER</th>
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<td>SITE</td>
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<td>Mullerpier</td>
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<td>Lloyd Multiplex</td>
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All this, connected with, at the same time, mapping important subjective data (meaningful site qualities, emergent social patterns) gave rise to an integrated design strategy according to the ecological and computational design-oriented aims of the studio.

The main result of these studies in terms of design approach was that of adopting and developing ways to exploit local conditions. This is connected to, and inspired by, the Dutch ways of tackling the topics of housing and gardening (as far as all the forms of agricultural activities are concerned).
Regarding contemporary methods of production the chosen method of production to research on was 3d printing. This fabrication technique was regarded as one with enormous potential for future architectural components production. In this sense the design looked into: multiple material 3d Printing; different densities and porosities of the material; material performance correlated with its porosity. The chosen materials for this study are metal, transparent and semi-transparent raisins and different bio-degradable plastics.

The two topics of the research were merged together in a design strategy using computational methods that transformed the data (required square meters per activity, correlation between functions and sun intensities, prevalent wind directions and their impact on the built volume) into structural and environmental optimized geometries suited for 3d Printing manufacturing technique. The challenge was to define computationally different levels of porosity in the designed building.

From the point of view of the relationship between research and design the project offers an important variety of spatial configurations and is able to control selected parameter responsible in our view for improved living standards: spatial requirements, orientation, centrality within the city, innovative energy saving mechanisms, added value and the possibility of emerging characteristics to assist inhabitants from economic and social points of view.

Integration of all aspects of the design was a priority, from conceptual approach to materialization and fabrication. Design features such as Porosity (which creates self similarity of the design at multiple scales) were developed in order to create seamless transitions between public and private spaces of the community and between interior and exterior spaces.

At Medium scale: The transition between different materials is also seamless. The transition from totally transparent windows to opaque enclosed surfaces is made by a range of different porosities of the materials used.

At Micro scale: the interior of every 3d printed material has different porosities according to structural performance, insulation needs and transparency levels.
The relationship between the theme of the studio and the subject/case study:

Living experiments have always had a leading role in the development of urban strategies ad have frequently influenced the very nature of the city. Living Geometries is a project preoccupied with the development of such strategies and formal expressions.

The project was framed by and around the main theme of the studio: Climatic Ecologies. As stated in the previous paragraphs, integration of data gathered on site was critical for the success of the project. The data was compiled in such a way as to allow for architectural criteria to be analyzed and met from an ecological point of view. Parameters such as living/food production area requirements, orientation and sun exposure, dominant wind exposure became integral to, and shaped the design. From architectural and urban points of view and considering the innovation imperative stated above, the project succeeded in providing and informed view on novel ways of seeing and integrating housing in the city, today.

The relationship between the methodical line of approach of the studio and the method chosen by the student in this framework:

The aim was to generate complex geometries that at, different scales (urban and architectural – materialized through fabrication), have specific porosity requirements. Porosity is the characteristic that results when matter constraints and functional and structural necessities inform the design. Through porosity, materials expand on their emergent behaviors within through geometric affordances. The geometry and the way it manifests itself through topology is the only design component that can reflect material performance.

Living Geometries expand on the aims of the studio. It provided a complete design methodology for developing living spaces and is able to show how the boundary conditions of these spaces can potentially be fabricated.

The relationship between the project and the wider social context:

The project aims at creating an integrated design where alternations between spaces, functions and materials are seamless. This means that the transition between public and private, interior and exterior, structural and insulating materials, transparent and opaque, are solved seamlessly, into a fluid transition of different porosities.

Living Geometries helps coagulate a community in and around the spatial confines of its design. Geometrically but also socially, it succeeds at illustrating a way in which geometric patterns influence and shape the way a micro society through its inhabitants may manifest itself.

Student: Ana-Maria Anton
Tutors: Dr. Henriette Bier, Dr. Nimish Biloria, Dr. Ir. Karel Vollers