Introduction

This document is a reflection at the end of the design stage of a graduation project. It summarizes researched materials, design decisions and findings. It concludes by answering initial research questions.

Keywords

Continuous variation, demand, flexible space, gradient of choices, genom, genotype, in-formation, interactive user platform (IUP), meta-design, trans-formation.
Design Brief and Initial Research

Hyperbody graduation lab's theme for the academic year 2014-2015 is transformation of Marconi Towers in Rotterdam.

Ever Changing Conditions

Marconi towers represent economic optimism of the mid 70's of last century. At the same time they indicate limits of such economic model based on industrialism and its principles of growth.

As many places around Europe, the Netherlands suffers from millions of square meters of vacant spaces in older office buildings. This is caused by physical and moral aging but also by the stock policy of the banking industry.

The city of Rotterdam plans transformation of postindustrial Merwe-Vierhaven area into a civic district. It is clear that to change the character of the area would need more than its promotion by poetic slogans and imposing creative activities on the site. This approach used to be applied in the post-war situation of industrial age. However now the top-down approaches seem not to have great impact on very pluralist, information society.

Recent transformations of office buildings in the Netherlands were studied. The most successful ones after crisis in 2008 use people's freedom and creativity as a driving force for activation of the building and the surrounding area as well both economically and socially.

Design in Social Context

This project aims to accommodate emergent, ever changing space demand and its use. The metropolitan city should have a strategy for migrating students, researchers and working nomads. Also, for starting families the necessity to buy the large property since the very beginning can be very inconvenient. Starting a family today often inevitably leads to taking a mortgage lasting for decades, binding the people unwillingly to certain lifestyle that does not necessarily suit them.

The design tries to provide affordable spaces. Not by diminishing the initial costs per square meter but by introducing the flexible use the space. The spaces can be divided or merge one to another on users' demand and therefore react on economical and social situation of the users.

The design approach to renovation of the Marconi towers — as well as to the reactivation of the surrounding area — is to inhabit vacant spaces gradually, with a constant adaptability of the vacant spaces to demand of their users such as growing or shrinking families, startups or established companies.

Voordt, Theo van der, et al., Transformatie van Kantoorgebouwen: Thema’s, actoren, instrumenten en projecten (Rotterdam: Nai010 Uitgevers, 2007)
Relation to the Graduation Lab

Hyperbody design studio introduced two main theoretical concepts:

Continuous variation that enhances a gradient of activities, depending on user demand during different time scales: daily, monthly and yearly periods.

The second concept is scalable porosity. Porosity treats relations between inside/outside or between volume/space. The porosity is called scalable because it occurs in the whole range of scales. Micro porosity refers to material scale and serves as the basis for a meso porosity formations. Meso porosity is more of architectural scale and that gradually forms a macro (urban) scale.

These concepts were the basis for the Scalable Porosity Workshop organized by Hyperbody and took place in the first quarter of this academic year. Scalable porosity tested on urban furniture. The concepts were discussed, design digitally evaluated and finally the prototype was robotically produced by use of an industrial robotic arm, depositing clay (Fig.1).

Fig.1 Scalable Porosity Workshop results


Design: Informing Trans-formations

The graduation project addresses those two concepts by two main designs. First, is a space distribution generative algorithm in-formed by the users and second, trans-formable geometry that is configurable in time.

In-forming by Users

User needs are gathered and processed into information such as positions, length of residence and number of co-users of the same space. Based on that information the algorithm distributes vacant spaces among users by keeping generic rules. For those rules a generative algorithm was developed, following cellular automaton principles. This algorithm negotiates users' positions in time, establishes certain degree of public space and provides natural lighting within the building, even if the users demand changes.

For that an interactive users platform (IUP) is proposed (Fig.2)

Fig.2 Indicative design of IUP gathering information from users and processing them according to the design rules (see also Fig.8)
Trans-formable Geometry

To carry the conceptual meta-design obtained from generative algorithm to architectural scale, it was necessary to come up with a geometry and materialization that is flexible enough to take different transformations and in the same time is affordable and realistic to be built in a scale of a high rise tower. Resulting geometry should take different spatial transformations at different time. That ability would enable users to change size of their residence, divide it for rental or give it away to another users.

Transformable geometries (genoms) are organized in such a way that they form spaces that can continuously merge one into another. Fig.3 Prototype of trans-formative geometry based on parametric model.

Fig.4 Basic element for each genotype. In the initial stage this was considered for a meso scale, later this element was tested also in micro scale and then again in meso scale, but with varied sizes.
Answering Research Questions

1. How can an architect develop a strategy that would facilitate the development more dependently on actual needs of the users and updated information.
   Meta-design facilitates environment by providing generic rules, not imposing concrete shapes or ideas. In this case the rules treat spacial growth and density. The rules should be simple to maintain their transparency but well considered, to be effective. This approach seems more than superimposing forms or determining the programme before the users pronounce their needs. Such strategy can be effectively applied by means of information technology (generative algorithms, applications collecting user data, online distribution and communication of information amongst users).

2. What would be the role of a user on the development process in that case
   User makes choices from the beginning. He picks the position and determines desired area of the space that he/she intends to use, within the available vacant spaces of the existing building. He can actively contribute on the emerging neighborhood by informing other users about his/hers intentions. The user is still following the basic rules established for everyone, yet he/she can also see how those rules work (through interactive users platform) and suggest changes. By that, a feedback loop between user and designer is established.

3. How this approach can be interpreted in architectural scales (micro-meso-macro).
   The generative algorithm is prone to solve space more conceptually, therefore it is used for macro scale (the scenarios of use in time, possible configurations based on users need and situation).
   For the transformable geometry a parametric model was designed, that shows the interior in different stages of use, and its spatial effects.

Conclusions and Further Development

The research focused on non-conventional design strategies within contemporary cultural, social and economical situation in the Netherlands, and plan for Rotterdam’s Merwe-Vierhaven area.

Two main computational design tools were developed: generative and parametric, and a connection between those was established. Generative tools concern larger scale design (macro), whereas parametric ones are more concrete and therefore were used for designing in smaller scale (meso and micro).

Both tools could be developed in more detail. User interactive Platform could lead to a mobile application. The geometry could accommodate integration of sensors, light indicators and magnets. Also, the information of climate, acoustics and statics could inform the geometry in more elaborate way and reinforce its functionality.

The design focus was put on establishing the connection between scales (macro-meso-micro) through computational means. Overall, the basic framework has been established and the architectural design is following mentioned principles.