Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences
Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

<table>
<thead>
<tr>
<th><strong>Personal information</strong></th>
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<tbody>
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<th><strong>Studio</strong></th>
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<tr>
<td>Name/theme</td>
<td>Explore Lab</td>
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<tr>
<td>Teachers / tutors</td>
<td>Main mentor: Prof. Ir. Thijs Asselbergs</td>
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<td>Second Mentor: Ir. Ype Cuperus</td>
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<td>Third Mentor: Ir. Pieter Stoutjesdijk</td>
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**Argumentation of choice of studio**

During the past few years I have witnessed the benefits of digital fabrication. During the minor Advanced Prototyping, my exchange abroad at the Massachusetts Institute of Technology Boston and Eidgenössische Technische Hochschule Zürich, I acquired the skills to combine digital and rapid prototyping techniques in the design process, as inspiring interchange between the virtual and real. Thanks to the ability to turn my ideas into physical designs, I experience now a freedom like I never had before.

While performing multiple extracurricular activities, I was exposed to the actual practice of our profession. I was struck by its inefficiency due to the limitations of budget and collaborative affairs related to these projects. Being a little dissatisfied by reality I thought; ‘How can the innovative skills I have mastered be applied in the practice?’ Although it clearly has potential to improve our practice, it seems hard to make these applicable due to various reasons. It raises my question: ‘Technology is here, but what do we do with it?’

The freedom the Explore-Lab studio is offering, allows me to excel on this field of interest and stimulates me to position myself in the architectural debate.
Graduation project

| Title of the graduation project | Heterogeneity in the Making – the mass-customization of urban housing |

Goal

| Location: | The Western Metropolis – Hembrugterrein, Amsterdam/Zaandam |

| The posed problem, | The world’s population is becoming increasingly urban; it’s thought that 54% of the world’s population lives in cities – and it’s expected to reach 66% by 2050 (Collyer, 2015). Scientists and experts are speaking of an ‘urban age’: the era of the metropolis, in which social and economical events will grow to focus on these large urban agglomerations. However, several impactful problems relating to the housing process are caused by this phenomenon of urbanization. Firstly, the overall growth of the urban population has a rapid densification as a result. In the Netherlands, about three quarters of the population lives in urban areas and most people work there. The largest metropolitan areas also show the strongest population growth. These cities grow in four ways: through the natural growth of the city’s population; individualization; (inter)national migration; and the reclassification of nearby non-urban districts. This trend will also continue in the future (PBL, 2016).

Secondly, there is a growing cultural variety creating a demand for more diversity in housing types. It is the influence of urban-life accompanied by the velocity of technological advancements that change the patterns of contemporary daily-life. The inertia of the housing process in dense metropolitan areas causes difficulties to adapt to these cultural changes. It is of importance that both our existing and future housing are able to respond to this diversity in an adaptive and sustainable manner.

Besides feeding our direct human needs, another urgent matter is our planet which is impacted by climate change. The increasing world’s population combined with increasing living standards results in great exploitation of the world’s limited resources. In addition, the way these resources are consumed, add greatly to the phenomenon of global warming. The rising temperature on our planet has disastrous effects, of which the building sector is the main contributor (EIO, 2016). As our society is urbanizing and more housing is required, its construction will continue to add to its (self-)devastation. Since the effects will be most prominent at these urban settlements, society continues to become more vulnerable due
to its own activities. However, it is in these cities that great strides towards sustainability can be made; housing in this case.

research questions and

The latter describes the difficult challenges that the housing process, in a growing urban context, is facing. Most stock is created by the government, developers and corporations (CSA, 2016). Are these still (or were they ever) able to accommodate society according to the comprehensive needs and wants of the modern household?

A possible solution to challenge the densification and comprehensive demand in a sustainable way, would be to provide the opportunity for users themselves to be involved in the development of their living environment. When committed, consumers can directly shape their habitat to their needs, themselves; customized housing. The over-complexity in (pre)construction processes and conservative mind-sets of real-estate developers and construction firms hinder any level of participation with the actual user. New forms of initiative in combination with technological advancements in design and production seem promising means to realize the customized dwelling in the Western metropolis. To further discover its potential, the following research question is formulated:

**How can user-involvement add to the realization of customized housing in the Western Metropolis?**

The overall research question can be divided into multiple sub-questions related to both theoretical research (user-involvement & mass-customization) and design.

**Theoretical research**

**User-involvement**

- *How and by who are current urban housing development processes initiated, controlled and executed?*
- *What are the advantages and limitations related to current housing development?*
- *What is the relevance of applying user-involvement in urban housing development?*
- *What are precedent projects incorporating user-involvement and how do these relate to criteria as level of participation, freedom of customisation, costs and lead time; its feasibility?*
Mass-customization

• What are the definitions, advantages and limitations of product mass-customization strategies?
• For what target groups and typologies is customization relevant?
• How can these strategies be translated and scaled from product development to house building?
• What is the role of and the relation between the architect, customer and other actors in these processes?
• How can the customer be intrinsically linked to the design and manufacturing process?
• How can cultural and environmental qualities be maintained, even stimulated in customized housing?

Design

• What role do actors, mostly the architect and customer, play in what part of the process of a customizable dwelling?
• How is the process including its information flows, organized and managed?
• What building elements or layers are preferred to be customized in the design by the specified target group?
• In what degree are customers able to customize different building elements or layers of the design?
• How can the design and fabrication processes maintain efficiency while varying in- and output?
• How can the fabrication and distribution transcend the notion of customizable housing in the urban context?
The thesis, subjecting the potential of user-involvement in the realization of customized housing in the Western Metropolis, is divided into two parts; theoretical research and applied design case. The theoretical research will start with the description of the problems related to the ‘urban age’, its relevance and formulate the research objective. In the following part, the potential for mass-customization of housing is investigated by studying current developing processes and how user participation contributes current and future housing problems. Subsequently, the principle of (mass-)customization is introduced and complemented by a thorough discussion on the applicability in the process, design and production of urban housing. These outcomes will be summarized and will be used to formulate viable strategies for the mass-customization of urban housing.

The findings of the theoretical research will be implemented in a design concept that subjects an architectural method enabling inhabitants to get involved in the development of their habitat in an urban context. This concept embraces the comprehensive fields of process, design and production.

- Process: a digital data-management tool to process the various preferences of inhabitants serving as an interface for the freedom offered by the customizable design;
- Design: focuses on the main activities of the dweller; the small scale, eventually leading to the overall arrangement of its dwellings, shared/public spaces, circulatory connection, context and vista’s; the large scale. Its embodiment consists out of two hierarchical elements; the individual infill’s and their supporting structure.
- Production: a distribution strategy to supply mass-customized housing for inhabitants of the Western Metropolis on a local and global scale. As a site, the ‘Hembrugterrein’ is chosen to serve as a plant thanks to its strategic location related to the Dutch metropolis; Amsterdam, and the potential for transport thanks to its connection to (inter)national waters.

Ultimately, the design will be technically developed into a completely realizable product. The prototype will be completed during the final weeks of the graduation and accomplished in a complementary period after graduation.
Process

Method description

After the latter description of the problem, its relevance and the relating research objective, the following will describe the roadmap including the methods applied to generate this research. Various methods are used to gain knowledge, analyze and deduct conclusions.

The first domain of research focusses on precedent theory and projects implementing user-involvement. Literature provides the necessary background information of relevant architectural theory on Structuralism and Metabolism. Case studies will be performed on multiple co-creational housing projects. To gain further insight on different forms of housing development, interviews will be conducted with various actors involved in the development of speculative, or either self-built, or a combination of both. Ultimately, the different forms will be analyzed, and assessed on the applicability in the specified context.

In the second domain, the potential principle of (mass-)customization is introduced and complemented by a thorough discussion on the applicability in the process, design and production of urban housing. Literature research is performed to gain insight in the different definitions, advantages and limitations of (mass-)customization. It contains case studies on different industries that apply customization. Interviews with various experts were held, forming the basis for a complementary discussion on the applicability of (mass-)customization in the process, design and production of urban housing.

In addition, these studies will be rated towards various criteria as the desired level of customization, the amount of user-involvement necessary, lead-time and cost for different strategies, etc. These results will be finally used to conclude a matching combination translated into an applicable strategy suiting the specified target group and context that forms the basis for the design concept.

Literature and general practical preference

Sources related to the academic research in general:


Merle, A., Chandon, J. L., Roux, E., & Alizon, F. (2010). *Perceived value of the mass-


Reflection

Relevance

This project is a new-age variant that leans on the Structuralism’s credo that links the user-involvement to the development of housing in the urban context by the means of digital fabrication. Firstly, user-involvement is a long sought desire that has rarely been fulfilled on the large scale in the field of architecture. Studying these precedents helps to gain a better understanding of the relevance of user-involvement in housing development and its deficiencies. In addition, the technologies that digital fabrication seeks for new ways to be applied on the large scale; in architecture for example. It are the beneficial properties of these technologies that seem suited to resolve the deficiencies of user-involvement in housing. This project strives, like its predecessors of the Structuralism movement, to contribute to a more humanitarian architecture by investigating the potential on mass-customization of housing in the urban context.

Time planning

No other ECT’s have to be obtained, other than this graduation project. The planning of the project is visualized on the following page.