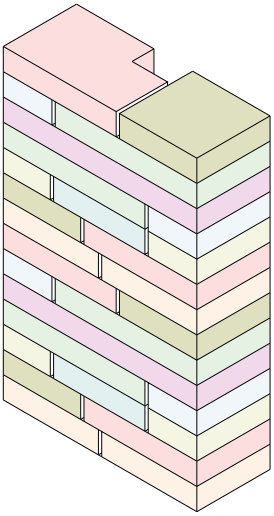
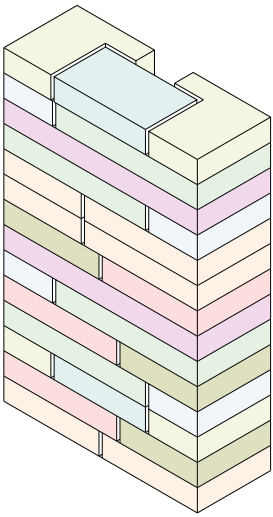
A new building typology for the changing society.

The usage of modular architecture and mixed buildings to aid the Dutch housing shortage





Reflection Report

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1.What is the relation between your graduation project topic, your master track (Ar, Ur, BT, LA, MBE), and your master programme (MSc AUBS)?

My graduation project topic, which is affordability and modularity/flexibility, is a topic that is not discussed enough in our current bachelor's or master's program at TU Delft. It's a topic that can bring massive innovation towards architecture and the perspective in which we think as architects. Our graduation track focuses on mixing production with living and creating an inclusive urban typology. My topic of affordability and modularity fits nicely with these topics, as affordability is one of the aspects determining inclusivity. In the Netherlands, more and more households are shut off from the housing market.

2.How did your research influence your design/recommendations and how did the design/recommendations influence your research?

My research has tremendously influenced my design and recommendations on the following aspects: the concept of modularity, mixing production with living, the Dutch housing shortage, and contemporary living needs.

Concept of modularity

First, I started with the thought of modularity as a way to quickly create buildings that can be transported. I looked into using unused shippingcontainers as a material for modules. These could be stacked and transported. But after researching and getting critical questions from my tutors, I realized this type of building has some limitations. After this, the concept of modularity for my project moved towards units built off-site that can be stacked together to create a whole. And if needed, the units can be changed to other units later down the line. After this, my research tutor gave me the recommendation to analyze Bremer Punkt. In my P2 retake, I extensively analyzed Bremer Punkt, which functioned as the primary reference for my project. This project shifted my concept of modularity towards the flexibility portion, where modular building techniques will be used to create more affordable and quicker housing than traditional building practices. This concept of modularity will facilitate flexible floor plans that can be altered on-site or per location. In the figure below, the concept of flexibility can be seen.

Figure 1: Starting with a main form that can fit multiple combinations of different typologies. One example of the buildings in my graduation project. (Lemnawar, 2023)

Mixing production with living

Later on, it helped answer how production can be mixed with living on our plot in Keilerhaven and in the future. It gave us some design handles we can use as designers to mix production with living. Nina Rappaport speaks about the Hybrid Factory and the need to create interaction between city residents and laborers in the factory. This is a concept that I have implemented in my project. The project tries to create a transparent factory with a shared courtyard and open factory façade. This makes the factory integral to the design instead of an extra feature that's just added because we have to.

My research tried to look into innovative ways of manufacturing as they mix better with living for various reasons, as stated in my research. 3D printing has been researched as a way of manufacturing, its benefits, and its spatial needs. This research has been extremely beneficial for my project, as there was not much research done on the spatial needs of this type of manufacturing. It helped me organize my manufacturing spaces programmatically. The ecosystem of 3d printing was analyzed, and the following figure abstractly shows this ecosystem

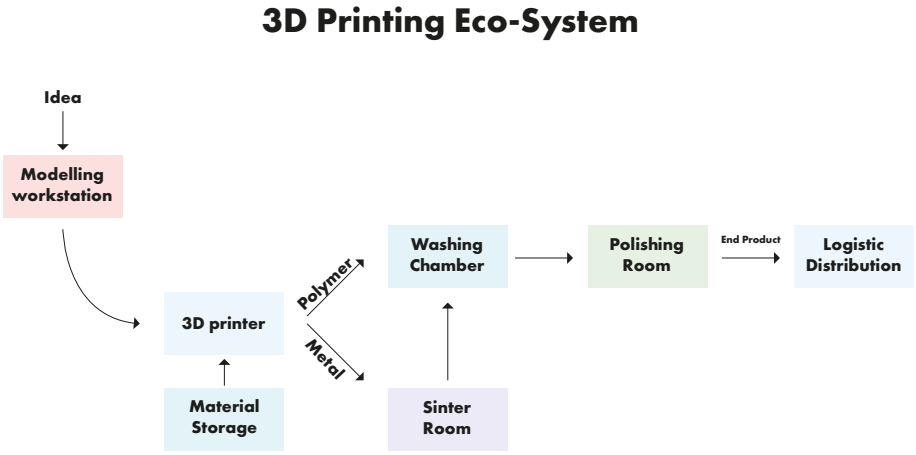

Figure 2: Showing the spatial configuration that is needed in the 3D printing production, which is used in the graduation project. (Lemnawar, 2023)

The Dutch housing crisis

As one of my goals for the research and project was to create a possible solution that can help solve the housing crisis, it was essential to understand the Dutch housing crisis. This crisis is partially caused by the inability to facilitate certain target groups, the inflexibility of the housing stock, and the capitalistic view of commodifying housing and land. From my research and the literature we have discussed in class, I determined that the ownership would be best as a cooperative and to focus mainly on starters, the elderly, and students. The analysis of the Dutch housing shortage showed me that modular housing could help solve this crisis but that there is still a way to go in innovation before we can utilize this tool efficiently.

Contemporary housing needs

After it was clear what target groups I wanted to design for in my project, it was essential to understand how these target groups lived. It was hard to find good information on this in the Netherlands. From my bachelor's, I learned about BPD which has performed market segmentation research in the Netherlands. This created a basis for understanding the target groups and their living needs. Combined with other literature about my target groups from the perspective of modular architecture (which appeared to be a bit shallow), these living needs were used to create different floor plans for my project. Ultimately, I think the research could have benefitted from interviews with the target groups.

3.How do you assess the value of your way of working (your approach, your used methods, used methodology)?

In this research literature review, case studies and manufacturers information for 3D printing were used to gain information.

Literature review

Literature on modular architecture that focuses on the architectural perspective and benefits was extremely hard to find. It was mostly focused on the historical, constructive, financial, and ecological perspectives. I would have liked more time to find more sources focusing on modularity's architectural side. Still, I also know that the space is relatively young, and in the future, more literature will be available focusing on modularity's architectural benefits. In my research, I tried to capture this perspective by analyzing Bremer Punkt. The documentation of Bremer Punkt also helped in seeing the architectural perspective of modularity. I also noticed that the competition held by GEWOBA had many architects that utilized modular architecture but lacked the proper documentation.

For mixing production with living and the Dutch housing market, much more literature was written by people who focused their entire careers on these subjects. Boelhouwer and van der Heijden work at TU Delft and have analyzed the Dutch housing market for years. Nina Rappaport, an architectural critic

and the director of the think tank Vertical Urban Factory, researches modern factories in terms of technology and the architectural issues that impact the city and its users. Their work has given my research and projects extensive insight into the problems and needed solutions.

Manufacturers for 3D printing

There was also not much information about the spatial needs for 3D printing. A creative solution for this was analysing and understanding the manufacturing process in 3D printing and combining it with the information from manufacturers who produce 3D printing machinery. Combining these 2 information sources helped me understand the 3D printing eco-system and its spatial needs.

Case Studies

I mainly used Bremer Punkt, Habitat 67 and Nagakin Capsule Towers for the case studies. I think I focussed on many different topics in my research/ project, which made it hard to fit all the content within the size limit we had for the thesis. I wish I had focussed on one topic throughout the thesis to include much more case studies from which we can learn when we want to implement modular architecture. Again it was tough to find buildings with enough documentation and an innovative concept of modularity like these 3 buildings.

4.How do you assess the academic and societal value, scope and implication of your graduation project, including ethical aspects?

My graduation project contributes to creating affordable and sustainable housing in the Netherlands, which can be modified to facilitate societal changes in living demands. My graduation project has societal value as it changes how we think about architecture; instead of having one static building built once and used for 50 years, we can build buildings with a flexible and modular nature. This makes it possible to adjust this typology for its context and change living demands affordably through standardized components.

The project can be a blueprint to create affordable housing mixed with new manufacturing methods. Due to the possibility of different combinations, my project can be placed and realized in multiple places in the city. This new

typology allows for dynamic housing through flexibility/modularity with standardized elements, which opens up the possibility of using automation in its building process.

In an academic sense, my project can be used as a starting point to develop this concept further and create a set of housing typologies that are more efficient and facilitate mixing with production. This building typology can be optimized further to include other manufacturing types than my project.

5.How do you assess the value of the transferability of your project results?

Implementing my graduation project on a larger scale has multiple benefits in multiple aspects. I will discuss the pros and cons of the following aspects: the residents, the city and the building industry.

The city

My Graduation project is a building typology that makes it easier for the city to provide affordable and qualitative housing while combining it with innovative manufacturing spaces. This building typology creates value for the city on a social and economic level. It gives the city a tool which they can utilize to help solve the housing shortage and provide opportunities for new living environments. It creates a breeding space for entrepreneurs and businesses who want to produce without promoting overconsumption and manufacture sustainably. Secondly, the building makes it possible to provide sustainable spaces as they are flexible and moveable.

Residents

My Graduation project is a building typology that adds value to the residents by providing affordable and suited housing for the target groups in dire need. It provides an inclusive living environment for different target groups due to its wide variation of living typologies. The building typology also allows residents to connect with a 3D print factory which can provide products they need on demand. The building typology also provides spaces for them to work from home or in a shared working space.

Building industry

My graduation project tries to show new ways to use modular or flexible architecture to create buildings that are built quicker and more sustainably. On top of that, a building can be used for a longer period of time due to its flexibility. Because this typology can be altered for its context and needed housing stock it makes the building process quicker and opens up the possibility for automation. Automation makes the building more affordable and sustainable. This new type of building can innovate the architectural industry. The cons of this typology is that there is need for innovation to make this automation work efficiently, and this needs an initial investment. After this investment, it becomes quicker and cheaper to build for society. The second con is that it needs time to create more typologies that fit this building type as there are many possibilities.