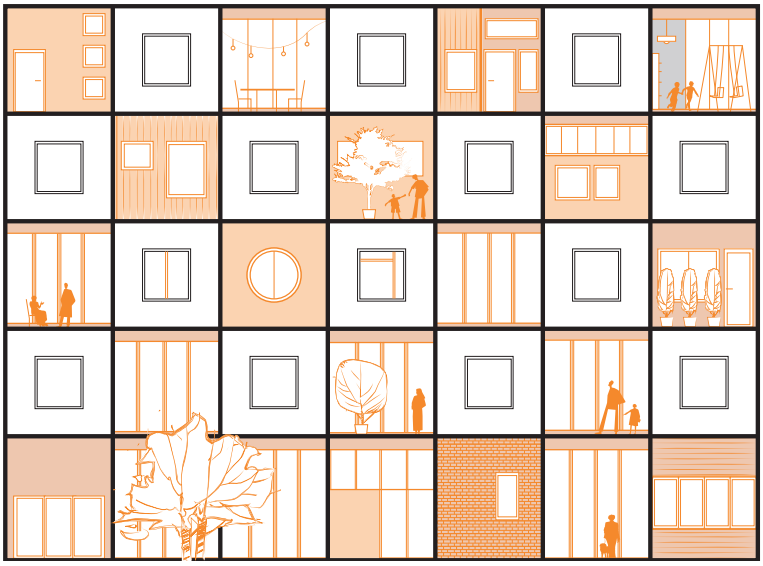

A Space for Growth

facilitating long-term housing conditions
through incremental expansion
and residential empowerment

Erik Lidén

Examiner: Ola Nylander
Supervisor: Anna Braide

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for taking some time of your day to read this.

Thank you!

A Space for Growth

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CHALMERS
UNIVERSITY OF TECHNOLOGY

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Direction of Housing
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Abstract

To have a stable long-term housing situation, such as a tenant owned apartment, is a financial security that makes it possible to establish connections with the local community and grow roots in the neighbourhood. This is sought-after by many in Sweden but will for most people take decades to achieve. First-time households most often begin with temporary housing situations like rental, which in Sweden usually offers few if any possibilities to customize their own living spaces, and in turn is what forces them to uproot and move away from their community to find a more appropriate housing situation when their living situation changes. The expensive housing market in Sweden is what has led to this situation, creating a barrier for the young and financially challenged to access this security. Apart from those with a privileged background, this segment of the population usually ends up moving between short period contracts or relying on government subsidies for a home. If left unchecked, it will lead down the road of increased segregation in our society.

This thesis aims to address this situation by developing a concept of affordable housing for first-time households, providing the possibility to have a permanent home from which they can become rooted in their communities, despite changing living situations. It theorizes affordable housing conditions that can be achieved through self-build methods where the residents are empowered to by themselves customize and adapt their home to their needs. It will explore how the possibility of long-term residence can be facilitated through incrementally expanded living spaces over a long time frame.

A theoretical framework is developed initially through a Research for Design-approach of primarily literature and relevant case studies on incremental and social housing examples, which is evaluated on feasibility in a Swedish context. Solutions for low-cost design is gathered along with information on potential subsidies and grants in Sweden to aid in developing the design strategies of the concept. This is then applied on a plot in Gothenburg that have a need for long-term residence-solutions in its housing stock, and through iterative sketch-phases and model making, different scenarios in residential adaptations are tested. The final goal of the thesis is to create a design proposal for an affordable and incrementally expandable building that inserts itself into the contemporary housing discourse and raise questions of what housing design can entail.

Key words

long-term residence, self-build, incremental housing, affordable housing, adaptability, resident empowerment

Contents

Student Background

Education

Chalmers University of Technology 2015 - 2018

Architecture, Bachelor's degree

TU Wien (Technische Universität Wien) 2020 - 2021

Architecture, Master's program exchange year

Hardware/Software

Cooperative housing for the 2000 Watt society

Emerging Fields in Architecture

Housing; in context

Chalmers University of Technology 2020 - 2022

Architecture, Master's program MPARC

Architecture and Urban Space Design

Master's Thesis

Work

White arkitekter, Uppsala 2018 - 2020

Architectural internship

Employment

1. Introduction

Background
Aim & Research questions
Delimitations
Methodology
Glossary
Reading instructions

Background

The housing market and first-time households

The housing market in Sweden is expensive and difficult to gain access to if you are without a certain amount of financial backing. The lack of affordable housing alternatives is becoming a problem with no real solution in sight, at least not from a local perspective. Its rigid demands of quality is excellent for developing good residential spaces, but less so to making them accessible to the wider audience without the use of subsidies. This have effectively skewed the market in favour of the older generations, who have already acquired capital and financial security over their work-life and thereby have several options when searching for a new residence. While making perfekt sense, after all they have the money to spend and the bigger families to house, it is detrimental and limiting in the housing options to those who have been unable to save up captial. For first-time households, such as young adults looking for something more permanent after concluded studies, and those generally on the lower income-spectra, there is few options available other than temporary housing solutions in form of rental and subleasing. There is nothing essentially wrong with this type of living, in fact a lot of people favour it as it doesn't require a big loan to afford it and offers a lot of flexibility that makes it easier to move between neighbourhoods and cities (Ungdomsbarometern, 2018). But it is not a solution that is desirable for all.

Changed living conditions and to stay and not move

Many prefer to find a place that they safely can call "their own" and develop a long-term connection to the area and community, becoming rooted into the context over time and customize their home according to personal taste and needs (TIP, 2018). Such people can greatly stabilize a neighbourhood due to the longer continuity of residents, reducing the anonymity by putting a face on the people you interact with daily (Habraken, 1972). The opposite can be seen in some socially vulnerable neighbourhoods which are heavily dominated by a rental housing stock; the high turn around of the apartments might not be the cause of the problem, but it certainly does not help. This is a big reason why municipalities favour increasing the amount of single family houses and other form of private-owned housing, such as tenant ownership (Swedish: "bostadsrätt"), as one of several methods to decrease unrest in socially vulnerable neighbourhoods (City of Gothenburg, 2021). Keeping a generational continuity is difficult in today's context however, since the current praxis of moving to a bigger and "better" space, after either the need or the appropriate capital "arrives", affect even those living in a long-term residential situation (Coulter & van Ham, 2013). To address this and prevent life to force-move the residents from their home, the homeowners should be able to change and adapt their living spaces to the rising needs (Braide, 2019). Not only as internal changes to the floor plans and room functions, but also in terms of the size of the dwelling. By allowing the residents to make incremental changes and extension over the course of decades, transforming and evolving the physical space along with the family constellations, socially sustainable communities can grow within the neighbourhoods.

Aim &
Research questions

This thesis aim is to explore different ways to create socially sustainable neighbourhoods in the form of long-term housing solutions, that are both affordable to first-time households and have the potential to grow and adapt to the residents' needs. It will encourage residential empowerment and facilitate possibilities of long-term residence, where the inhabitants can remain and become rooted at a home and community, despite any changes that may occur in their living situations. These goals will come together on an appropriate plot in Gothenburg, where long-term housing opportunities are sorely missing from the existing stock, in order to form a design proposal of a new, incrementally expanding housing typology.

How can adaptability and incremental growth of floor space be applied in a Swedish context to create affordable housing situations for first-time households?

How can design strategies facilitate long-term residence-potential within a building and community?

How can adaptable housing-solutions be made accessible to the residents?

Delimitations

The thesis touches on multiple topics and theories that are identified by its author as being linked to the research aim. To aid in the design phase literature and reference studies are used to form a common base of knowledge that contextualize the issues. Historical and contemporary sources have been acquired from both international and Swedish contexts to maintain a balanced relevance. Due to the limited time frame of this thesis it will focus on giving an insight into their current discourse, rather than in depth elaborations and examinations. Similarly, the search of literature and references in other neighbouring fields of knowledge and interdisciplinary questions will be limited in favour of reaching further in the discussions and design.

The feasibility of the design strategies and proposals will be in relation to its Swedish context regarding climate, building codes and its potential on the local housing market. Transgressions which break the current status quo are expected, but these will be motivated and evaluated based on research done in the first half of the thesis in the form of discussions. References and reasoning regarding general design strategies, rather than calculations based on specific metrics such as construction costs, will be relied on to assess its feasibility.

The target group of residents this thesis aim to design for are first-time households searching for a long-term housing situation. As time progresses the residents household-constellations will evolve and change over time to diversify its demographics, but on initial construction its residents will be primarily young adults around 25-35 in age.

Methodology

The thesis is built into three main phases; A theoretical Research for Design-approach in the first phase, an exploratory Research by Design-phase thereafter, and culminating in the third and final phase with design proposal.

In the first phase a theoretical base is created from literature studies on relevant topics regarding affordable housing, the Swedish housing context, residential empowerment, financial models and adaptable spatial solutions. These topics inform which reference projects are gathered and analysed in relation to corresponding fields. An in depth evaluation on incremental housing and a case study on two projects, Quinta Monroy and Däckshuset, are made to identify key elements possible to adapt for a feasible concept within a Swedish context. Based on the initial theoretical framework, some general principles are formed to guide the following design phase.

The second phase begins with the implementation of the relevant design elements and principles from the first phase and translate them into a rough prototype. This serves as a starting point for further explorations, where an iterative design process using sketches and digital models examine and develop its relationship to the identified design principles. Time and growth are important aspects of this thesis, so studies in how the design can adapt best to these topics will be in the foreground. Through shifting focus between the different design principles, an optimized solution for an incremental housing typology, which have taken all required aspects into consideration, can be formed.

This theoretical design concept is then adapted and implemented on a relevant plot in Gothenburg in the third and final phase. The proposal will show both its initial spatial configuration upon construction and how it would evolve and grow over time, as its residence reshape their dwellings and life begins to take a firm hold of it.

Glossary

Long-term residence
Residing in the same location over decades and generations.

Adaptability
The potential to make changes to the dwelling and influence the built environment.

Incremental growth
Increasing the internal volume by step-by-step expansions of the internal floor space.

First-time households
Non-students between 25-35 years old, searching for their first "own" apartment.

Divisibility
The potential of dividing a space, permanently or temporary.

Elasticity
Changes in apartment size from switching ownership of spaces between neighbours.

Self-build
Constructions and remodelling performed by the homeowners instead of contractors.

Expansion/Extension space
The allotted space into which the apartment can extend its internal space into.

Spatial configurations
How the building is organized in terms of apartment compositions and sizes.

Design strategies
Relates to the methods of designing and its implementation.

Tenant-owned apartment
In Swedish “bostadsrätt”, the most common form of apartment ownership.

Housing scheme
A grand strategy used by governments and developers to solve an issue with houses.

Reading instructions

Thesis in 6 parts:
1. Theory: themes and topics needed to understand and develop a design concept
3. Design process/concept: how to use and develop design strategies
4. Urban context: identifying an appropriate site
5. Design proposal: the result of the concept coming together on the site
6. Discussion: reflections regarding the outcome in relation to the research questions

2. Theory

The Swedish context
Affordable housing
Incremental housing
Self-build
Joint Building ventures
Adaptability
Feasibility
From Research to Design

The Swedish context

"Most expensive in Europe to build"

Why is the Swedish housing market moving in this direction of creating expensive housing that a big part of the population is unable to afford without financial support from parents or governmental subsidies? It is a complicated issue heavily debated and with no clear cut-answer, but a lot of voices in the industry are singling out high costs from land purchase and construction as driving the prices up to one of the highest in Europe (Crona, 2019).

A report from Sweden's Municipalities and Regions (2021) question this sentiment regarding the land price, which according to their studies only represent a minor part of the total expenses of developing a new house. The majority of expenses fall instead under the construction costs, which in turn is inflated a lot due to errors during the construction phase and potential damages that occur. There was a palpable difference between costs for rental and tenant owned properties, especially regarding the land, but this can be explained by general tendency to build rental housing in suburbs where the market value is low (SKB, 2021).

These expensive productions result in more expensive housing, which as already mentioned result in unequal housing opportunities and people forced into a temporary living situation. To adjust to a market where it is costly to build and the purchasing power is low, many developers aim to instead create smaller apartments of a lower quality to reduce prices (Arkitektur, 2014). The recent housing stock in Sweden since 2010 and onwards have shown an average decrease in size of ~ 7,5% compared to the existing stock , where the smallest and largest apartment sizes have had the biggest size reduction, between 10-20%, and those in the middle having the least change of in average 2% (SCB, 2021).

A big problem with building smaller is however that the "optimized" floor plan becomes very rigid and makes adaptations such as putting up walls or another bed very difficult (Habraken, 1972). For renting tenants, even being allowed to add or remove walls is something rare in the Swedish context, giving few options other than moving out or accepting a new overcrowded living situation due to increase in family size or similar (Braide, 2019). If living in a tenant owned apartment this is perhaps a bit easier since the possibility to make a profit which can cover some of the expenditures of purchasing a bigger space exist, but for renters they have to rely on their own personal savings to cover the difference.

As a way to combat high housing prices and create affordable housing, subsidized housing, or to more commonly used term "social housing", is used in a number of countries today and have also historically been a tool in Sweden's housing production

Affordable housing

In Sweden, Public housing have served the role that internationally usually refers to a social housing-programme. A big part of the Million Home Programme in 1966-75 was built as a public housing-scheme, where municipality-owned companies own and distribute the apartments. Furthermore, not quite social housing, but intended to create affordable private houses for the working class without land speculation, was the Own Home Movement (swedish: "Egnahemsrörelsen") which started in the late 1800's and reached its peak in the early 1900's. (TIP, 2018) Self-building solutions and long lease times on the government owned land cut down the price. In Gothenburg today a good existing example is Landala Egnahem.

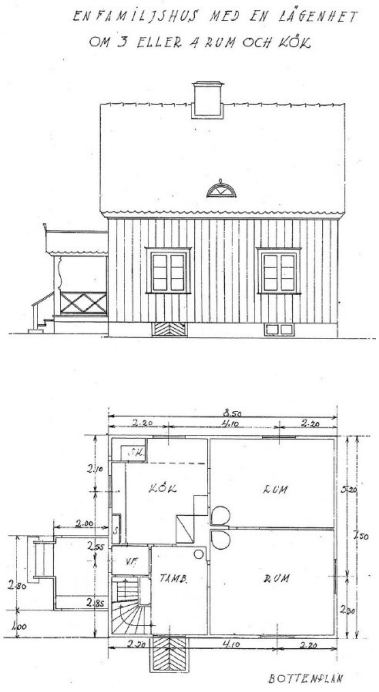


Fig 1. Own Home Movement - small villa (Wikimedia)

Today the term "social housing" have a connotation in Sweden of being poorly constructed housing units only for those with very low or non-existent income. These subsidized houses some fear would then act as a hindrance in escaping poverty for its residents, since if they would start earning more than the limit for qualifying into the scheme they end up in a state of limbo without government grants but unavailable to afford a non-subsidized houses (Boverket, 2021). This is a very limiting view on social housing and is not at all reflected in most of the international community, which uses social housing in several different ways and in different degrees of subsidization.

In Vienna for instance subsidized housing is today the most common way of getting a first-hand contract. The tenant have to qualify on a number of different points and live for many years consecutively in the city, but after that they can rent the apartment to a reduced rate, based on how much they choose to deposit upon signing the contract, and have the freedom to make changes to their homes while living there and not be evicted after increasing their salary (Blau, E.).

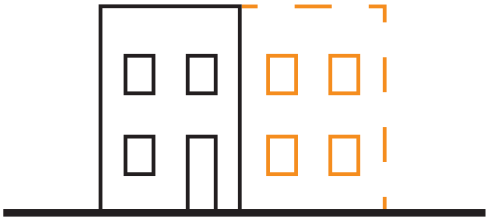
Fig 2. Karl-Marx Hof (© Bwag. 2015)

In Singapore they decided to go a somewhat different route and allowed people to get premature access to their state-run pension funds for the sole reason of buying a subsidized apartment. Reasoning was that home-ownership would be an investment into property which could be a financial asset and also decreasing government spending on retirement homes if the families had a home to take care of their older relatives. These apartments where intentionally made without any finishing and little to no amenities apart from plumbing and ventilation fixtures and instead focused on providing bigger space for each family (Housing & Development Board).

Fig 3. SkyVille @ Dawson (© Frashine, S. 2020)

In some developing countries, the term Incremental Housing is used in combination with social housing schemes. Next chapter will examine this concept further.

Incremental Housing

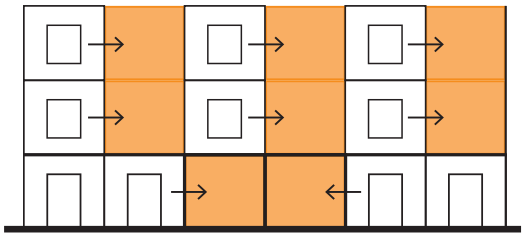


The concept of Incremental Housing is essentially a mixture of informal settlements and formal frameworks. It is based on the idea that the state finance, either completely or in parts heavily subsidized, the construction of a small, standardized housing unit, typically around 40 m^2. It can then be expanded further by the beneficiary family that received ownership of one entire unit, increasing its value over time. This scheme puts less of a financial burden on the government, as they effectively only need to pay for the construction of in average half of each house, which also considerably speeds up the construction phase, and housing can thus be provided faster to those in need (Marinovic, 2020). Apart from achieving cheaper dwellings in less time, they also allow the residents to customize their homes as they see fit (within set boundaries) in regards to room layout, materials, colours and functions, meaning each individual house will over time evolve differently and create a huge diversity of spatial configurations within the neighbourhoods (Carrasco & O'Brien, 2021).

This strategy have been used to great success in a number of development countries in South America, Asia and Africa as a government-subsidized scheme to create affordable housing for low-income households (Weiner et al., 2016). Chile in particular has used this scheme to great success, where notable architects such as the 2016 Pritzker prize winner Alejandro Aravena and his studio Elemental has designed a number of such solutions for the urban poor, the most famous being the "half-houses" in Quinta Monroy (Marinovic, 2020).

There is no denying that the different contexts (geographically and demographically) makes it impractical to just transplant the typology as a Swedish housing strategy. There is however a local reference that invoke similar concepts of incremental housing made in Gothenburg in the 1960s: Däckshuset (lit. The Deck House). By investigating it along with Quinta Monroy and studying its evolution over time, key design elements applicable to a contemporary Swedish context can be identified.

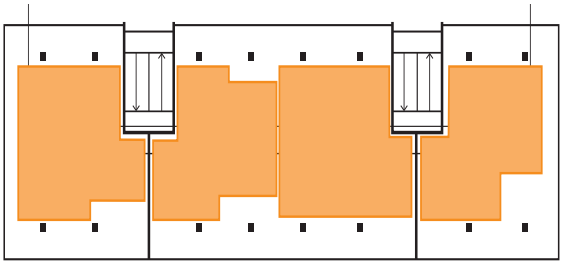
Fig 4. Quinta Monroy - initial house & five years later
(© Elemental)



Principle method of expansion in Quinta Monroy

Fig 5. Däckshuset exterior
(GP)

Fig 6. Däckshuset gable
(White Arkitekter. 2011)



Principle method of apartment layout in Däckshuset.

Conclusion of case studies: Quinta Monroy & Däckshuset
(see Appendix)

Different goals, similar results

In Quinta Monroy the incremental house was due to a necessity to create affordable and non-slum dwellings for the urban poor with little means, whereas in Däckshuset the decision to leave everything apart from the load bearing structure and plumbing was a design choice to give freedom to the residents and promote participatory design. Both times, the most complicated and costly elements (structure, plumbing, vertical communications) was decided beforehand by the architects and extensions where of a light-weight design to not overload the supports.

Reliance on self-build skills

Construction costs are significantly lower with an incremental approach, which while reducing entry prices also places a heavy burden on the residents instead. Governmental subsidies can assist, but most residents in social housing-schemes rely on their own construction skills to cut expenses.

Increased value

The invested time and money to the expansion and adaptation of the dwellings increase the value of the property, boosting the financial security of its residents.

Regulating quality vs freedom to customize

Clear guidelines and recommendations on construction from architect or property owners is helpful to maintain a decent quality of the extensions, but a more rigorous framework can limit the users customizability on their dwellings. The incentive of a raised property value can however raise the quality to a higher standard.

Enough room to expand

If the allowed space for expansion is not enough, it can create frustration and overextension on neighbouring spaces which were not intended for expansion, possibly resulting in worsened living conditions inside the dwellings. Both removing the possibility for such problematic extensions and allowing for homes to increase further over a longer time period should be addressed.

Self-building

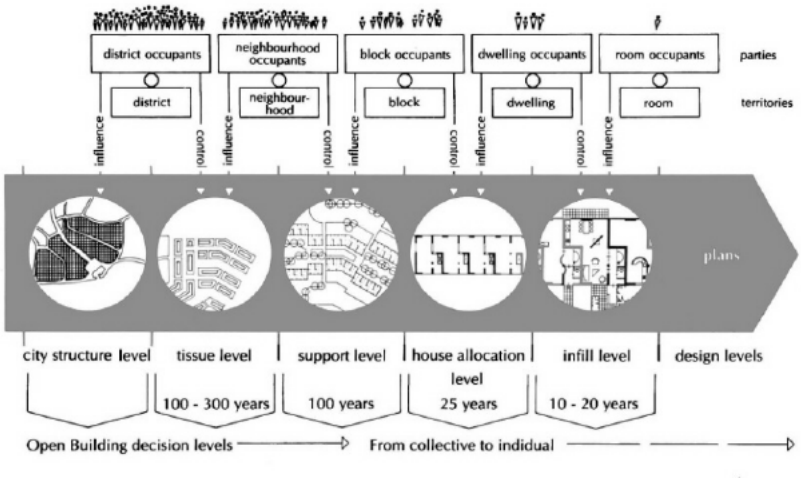


Fig 7. Open Building Theory
(© Habraken, J. 1961)

Open Building Theory

To relinquish control of the spaces by the architect and instead granting it to those that are using it is central to most self-building concepts, and is an important aspect of the Open Building theory. It is a concept meant to empower the residents to have a role in the housing process and the configuration of their own home, both in a in a suburban villa and a city apartment, where the complexity increases the further up the building reaches vertically. Developed originally by John Habraken in the 1970s in Netherlands, but coined a decade later (Council On Open Building, 2021), it is based on the idea of organizing a buildings elements into two categories depending on their rigidity in relation to the residents themselves. What is collectively shared among the residents and community, and decided top-down by architects and engineers, fell into the category *Supports,* which included structure, plumbing, circulation etc., but also refers to the urban scale and city planning. It creates a rigid framework for the *Infill,* which is everything left that could be decided on a bottom-up approach by the individual occupants (such as interior walls, surface finishes, room functions, floor plan layout etc.) and in turn sets the requirements for the *Supports* (Habraken, 1972).

RAW design concept

The incremental housing strategy previously seen in Quinta Monroy have a clear inspiration from Habrakens theories. So do two other projects as well, and they are a bit closer to home. Tila Housing, made in 2011 by the Finnish Talli Architecture and Design-studio in Helsinki, and the project it inspired recently in Sweden; RAW Rosendal by Johan Berg Arkitekter, have both adapted the principles of Open Building to a Nordic context (Berg, 2020). For the later, the term *RAW* was coined, which captures the essence of the design strategy to its core; a raw apartment is sold without any *Infill* such as surface finishes, interior walls or equipment, apart from a toilet (and kitchen in Sweden, per building code standards). Within the exterior shell the homeowners can complete the apartments as they see fit over time or pay extra to have contractors complete it all according to their specifications before moving in. If done later by the residents themselves however, building code regulations pertaining to room dimensions might not apply, but it is up to each individual municipality to make that distinction. This could potentially offer a considerable agency to the users in their spatial layout, deciding for themselves if they prefer for example a smaller bedroom in exchange for a larger living room (Berg, 2020).

A majority of apartments in both projects were made with double the ceiling height, to allow for a secondary floor to be installed entirely to the needs of the residents. This however doubled the initial selling price compared to the single floor apartments in Rosendal (RAW Property, 2022). To achieve a cheaper residence per m^2 compared to the contemporary surrounding alternatives, as the single floor apartments did successfully, the entire secondary floor have to be filled up (Hemnet, 2022), which negatively impact the spatial potential of a two-storey living space. This would make it less reliable as a strategy for creating affordable housing, but its flexibility towards its users is a powerful argument for its inclusion.

Fig 8. Duplex interior of Tila Housing
(© Bremer, S)

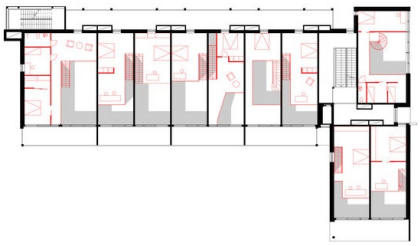


Fig 9. Tila Housing Mezzanine furnished
(Archtinic)

Fig 10. RAW image
(© RAW property)

Reduces costs?

Since the construction of the unbuilt expandable part of the house and the interior surfaces and walls are intended to be financed by the residents themselves in incremental social housing schemes (only in some cases the state would step in to cover some or all of the costs), a heavy reliance is put on a self-build culture and the capability among the residents (Carrasco & O'Brien, 2021). Historically such skills have been common among many beneficiaries of the housing schemes in developing countries, but it have been criticized as limiting the pool of recipients there and being discriminatory for shifting the financial responsibility from the state or developers to the residents themselves (Weiner et al., 2016). However, since they can do so at a pace which their own strained financial situation allows them to, many argues it as a fair bargain for the essentially free initial house they are granted by the state.

For a local application, estimations made by the National Board of Housing, Building and Planning (2004) in Sweden and by some contemporary architects (GP, 2019) would suggest that between 25-30% of the construction costs for single family houses can be saved by relying on self-build methods within the outer shell. For apartments with a RAW design concept, depending on the level of finishing, J. Berg (2020) estimates that at least a considerable portion of the construction costs, 10-15%, can be saved by not adding an additional surface layer and excluding all interior walls.

He is however doubtful if the private homeowner can purchase material to a similar price as a contractor. Without multiple residents going together to purchase material in bulk it might be less of a price reduction than anticipated, but the value of having greater control of the space should not be forgotten. Furthermore, the personal investment in ones own living space can aid in assuring quality and satisfaction for the resident over a longer time frame and reducing the need for investing in refurbishments (TIP, 2018).

However, in contrast to the residents of Quinta Monroy and the Own Home Movement a century ago, there is no self-building culture common today in Sweden (TIP, 2018). Additionally, since the building codes in Sweden regulate further than Chile how and what a private homeowner can modify in their own dwelling, contemporary self-builders have to rely on outside contractors for some of the more technical work such as electrics and plumbing. This decreases the savings in construction costs significantly for the residents themselves, possibly even resulting in an end product more expensive to the homeowners than if it would be completed by professionals, as Egnahemsbolaget (lit. "Own Home Company") (2020) discovered in an internal survey regarding the potential need for partially completed houses. How much that can be saved in a longer perspective, if any at all, is therefore difficult to answer since it depends on each individuals' skills and how much is left for the resident to complete.

While the reduced construction costs might not result in an over all decreased price tag for the homeowners, *the threshold for getting a permanent residence is lowered*, which greatly benefits first-time households. It can therefore be viewed in the similar vein of down payment on any expensive goods like a computer, car, even a house; those without funds to cover the complete cost at once are not denied access to said goods, they only have to pay some interest. And in the interest of this thesis, this is sufficient reason to pursue this approach.

Relevance to first-time households

A. Mayer (personal communication, May 3, 2022) from Egnahemsbolaget argues that its not uncommon in rural Swedish towns for a community of such qualified tradesmen willing to exchange work favours among its neighbours, but that such connections and the time it requires are scarcer in the cities and thus less suitable for self-building housing schemes. Especially among the younger demographics, as their recent internal survey found that their younger tenants preferred a completed house instead of a partially finished one (Egnahemsbolaget, 2020).

An alarming report, considering the target users of the design proposal in this thesis is exactly that demographic; first-time households. This is in stark contrast to other self-building projects, where younger people where very eager to customize their own homes, such as in RAW Rosendal and Tila Housing (J. Berg, personal communication, May 5, 2022) However, the contradiction also creates an opportunity to develop a self-building proposal suited for younger people. What this group lack in capital and time they could reasonably make up for in energy and creative solutions. They are also the audience with the most frequently changing life situations compared to those already retired, and so is in need for spaces that can change and evolve. By offering permanence and affordability to sweeten the deal, and not forcing any serious modification to be completed before moving in but rather when it becomes necessary, the target demographic might be more interested in an incremental housing project.

Summary Self-build

A building and apartment can be organized into different categories depending on how easy and accessible they are to change and adapt.

If the residents put up the interior walls themselves, they do not need to follow Swedish Building code standards.

Swedish building code have requirements what parts of a building the residents are allowed to work with by themselves.
Plumbing and electrics require specialized contractors.

Constructing an apartment house with a RAW material surface without any interior furnishing or walls can reduce the market price to around 10-15%.

Leaving parts of an upper floor unfurnished in a single family home can reduce the price by 25-30%.

Unfurnished duplex apartments have a big potential for internal customizability, but the initial cost is steep since you pay for the unbuilt mezzanine level.

Self-building methods as a way to reduce the price does not cut down the total costs, rather the opposite, but it lowers the threshold and gives people access to an otherwise out of reach housing market

First time households is a demographic which have both expressed interest and reluctance to enter a self-build reliant housing situation. Allowing self-building and incremental growth to occur at the residents own wishes, and not as a prerequisite for moving in, is vital.

-> Multiple different possibilities for self-building is desired, so the residents can do what they can when they have time, and to some degree have agency and use of the any extendable space allocated for incremental growth-

Joint building ventures

Joint building ventures, in Swedish referred to as “byggemenskaper”, is a way to organize and develop housing in a community-led fashion in which prospecting new homeowners group together to as a collective create a future “dream home” for themselves, often relying on self-building methods to keep within the limited budget. What level of collective living it results in after finished construction differs greatly and is based on how well the owners can collaborate with each other and what type of ownership and rental system the community decides to use. When implementing self-building methods into the JBV it is preferable if each resident own their homes instead of a collective rental system or the traditional tenant ownership (The National Board of Housing, Building and Planning, 2004)

The size of each individual apartment tend to be smaller in JBVs than their standard counterparts (SCB, 2022). This is largely acceptable by the residents due to a lot of shared and common spaces, which acts as compliment to the limited personal space and is of great importance in order to establish the social networks and relations that is vital for many JBVs to function properly (Westholm, 2019).

Fig 11. . Building together
(Coompanion)

Reflections on its potential & problems

Fig 12. Fællesbyg Køge Kyst.
(Vandkunsten)

Fig 13. Urbana villor
(Arkitekt)

Fig 14. Wohnprojekt Gleis 21
(© Hurnaus, H.)

Potential:
- Social sustainability (relationship to neighbours, social safety net)
- Resident agency (develop your own private home in dialogue with neighbours)
- less private space, more shared space = no wasted space
- personaly funded = focus on what the tenant finds important
- rental costs can be reduced to residents participating in maintenance tasks

Problems:
- Narrow demographic (usually older and retired people with capital saved, or people who are extremely like minded, which requires vetting and limits further)
- Requires a lot of invested unpaid personal time in the process = difficult for some
- Difficult to organize and come to a consensus the more involved (conflicts can arise)
- Long time from idea to finished product (need to spend a lot of capital early in the process and several years before able to move in, big financial risk)
- Many JBVs live and die on enthusiastic members that take charge and organize

Conclusions:
JBVs used today are an exclusive and inaccessible form of living for a narrow demographic, but the potential of the social connections and residential agency are powerful proponents for it.
In the context and aim of this thesis it is unlikely to be a successful method as it is used today, but inspiration can be taken and perhaps introduce a new way to organize JBVs in the future, which addresses some of these issues and makes it accessible to a wider market!

Adaptability

There are many ways to achieve an adaptable and flexible building. For who is it adaptable, residents or property owners, and in what capacity the modification is accessible or requires demolition and reconstruction to achieve, are necessary to examine and figure out to guide the design further. Within the context of residential architecture, adaptability could be categorized into two main areas depending on the impact and effort needed for changing the space.

Low-impact adaptability

This covers short-term adaptation methods which have a low threshold to implement and uses simple low-cost solutions which the residents can perform themselves (Habraken, 1972). Focused primarily on changes within the household, some of the more common methods used are general room sizes that have the possibilities to swap room functions within a dwelling, and affecting the amount of rooms and the configurations of floor plan through means such as installing or removing interior walls (Leupen, 2019).

High-impact adaptability

Deals primarily on a building scale where any adaptations are more long-term and costly, thus placing a higher demand on a technical level to the proposed adaptations. These can in turn have an impact on several dwellings simultaneously, such as changing the configurations of the apartments over time for a diversity in sizes, where for example smaller apartments “eat” neighbouring spaces to grow in size (Braide, 2019). The possibility of changing functions of the building itself from housing to for example offices places demands on the structure itself, which requires forward thinking from the architects and builders already in the design stage to make it possible to execute successfully (Beisi, 2006).

Rooms in rooms

A living room or main room with a size big enough where internal walls can be put up to create extra rooms within the apartment (for kids, office space or to take in an extra tenant) is good for a long-term flexibility (Braide, 2019). Appropriate placements of window posts and a neutral access to these extra rooms, or in close proximity to the entrance, should therefore be a priority. It is also relevant for first-time households and others with small financial means when the household grows unexpectedly. The same clientele would also benefit from a higher ceiling height than the contemporary norm. At least a height of 3m would make it possible for the residents to create a small mezzanine level for a raised sleeping situation or storage units, thereby utilizing the volume to the fullest to either keep the floor space free and open, or use it as a quick fix for extra bedrooms.

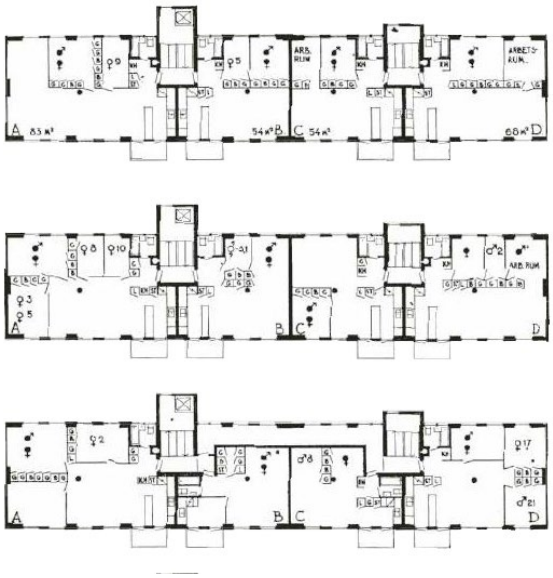


Fig 15. JFloor plans of Järnbrott
(Arkitektur. 2014)

Experimental house in Järnbrott

A relevant Swedish historical example with an Open Space-design and adaptable wall placement is that of the experimental house in Järnbrott, Gothenburg from the 1950s, where although it included finished surfaces were sold with no interior walls constructed. Instead it was up to the residents to use the included flexible and movable wall elements to design their own floor plan. Used to great effect by the initial residents to customize their dwellings, they unfortunately became difficult to re-position over time and the apartments have since lost some of its short-term flexibility. Today they are instead replaced with a permanent solution of on-site constructed interior walls, but placed in the desired positions of the individual tenants as a final compromise towards its original adaptable concept (Andersson et al., 1998).

Supporting facilities

There is a difficulty in maintaining flexibility and have adaptable systems last between tenants (Beisi, 1995). In order to make the residents knowledgeable and comfortable enough with the implemented flexible systems to actually use them, a place to communicate and inform about it is appropriate to have on the property. Tips such as which materials are best used where, appropriate wall placements for ease of furnishing and model showrooms of differently configured housing units are all identified as vital to make the adaptability more accessible and used. As seen in Järnbrott, if any modular elements are used, a method for replacing them when damaged, as well as store them in the building and being able to fit them in the elevator and through the front door, is necessary for the concept of flexibility to not fade away over time (Andersson et al., 1998).

Elasticity leads to diversity

Adaptability for residents is generally only focused on low-scale and short-term solutions today. However, pre-emptively designing for adaptivity in regards to changes in apartment sizes and ownership over time is necessary to establish a resilience, which can accommodate changing life situations where the people in a household not only increase but also decrease, such as children moving out or after a divorce. Having a diversity of apartment sizes within a building is therefore good for the long-term flexibility that spans over decades and increases the social sustainability, making internal moving chains possible for the residents and allows large and close-knit families to have multiple apartments near each other (TIP, 2018).

Similarly sized apartments can be adapted for diversity over time with appropriate plumbing fixtures and spatial configurations, as highlighted by A. Braide (2019) in her study of a classic Gothenburg housing typology in the project Landshövdingehuset. Here the owners over time changed the apartment configurations from a homogenic 2 room apartment layout to a diverse spread for different-sized households, where the multiple plumbing fixtures played a key role in realising its divisions.

This diversity can also quite easily be achieved by elastic spaces between neighbouring apartments, which can switch ownership among the floor levels or be its own independent dwelling (Braide, 2019). Introducing duplex apartments or elements in the spatial configuration, such as in SANAAs Gifu Kitagata Apartment Building, also makes it possible to have apartments extend vertically over time, which can be beneficial should the neighbours next-door not be interested in selling parts of their own dwellings.

The possibility of changing ownership of these in-between spaces over time establishes a fail safe to the incremental housing typology which is currently missing in regards to the appropriate amount of expandable space and led to bad extensions in the case of Quinta Monroy. If the allotted expandable space is not enough, purchasing part of the neighbours apartments could be viable option.

Structure set conditions for flexibility

A big, free-plan structure where only pillars, floor slabs and plumbing shafts are present make for a very flexible floor plan compared to an optimized apartment (see Däckshuset and Grundbau und Siedler). However, too much freedom can be detrimental, as could be seen in G&S where planning took a long time and was very complicated (Franke, 2014). Instead, a core apartment, ready to be moved into on completion, is more suitable for the target demographic. Still, the structural system of the free plan can be used as frames for the core apartments, guiding its shape with its placements. Keeping these pillars away from any internal apartment space will make sure that the interior is as flexible as possible.

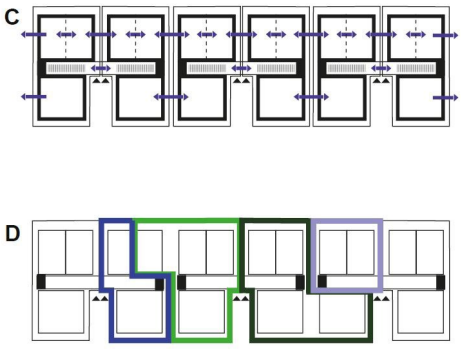


Fig 16. Spatial structure of Landshövdingehuset
(© Braide, A. 2019) Reprinted with permission.

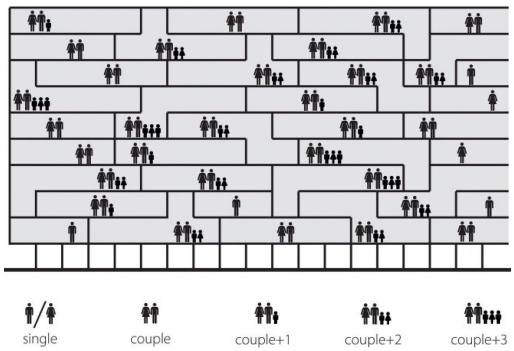


Fig 17. Gifu Kitagata Apa
(© SANAA)

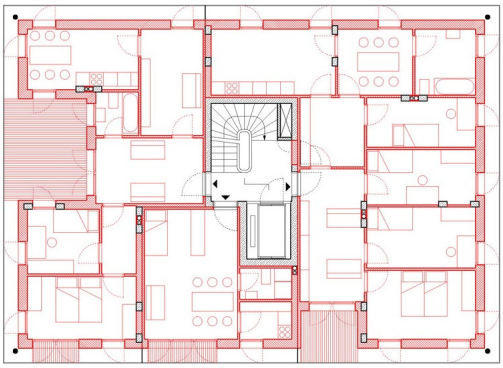


Fig 18. Grundbau und Siedler Self-Build Housing
(© BeL Architects. 2013)

Summary Adaptability

Low-cost solutions

Resident agency and accessibility are vital aspects when adapting ones own home, thereby design strategies should priorities adaptability solutions which requires low costs and skill-levels in its implementations. adaptability low cost adaptable solutions a priority to implement in a design:

General room sizes:
for switching programming and furnishing

Flexible internal wall placements:
dividing walls to partition rooms, create more bedrooms

Ceiling heights allowing mezzanine floors:
as extra storage or floor space for sleeping cubicles

Adaptability over time

Forum for ideas
It requires some form of information hub or forum where the residents can get help and feedback for their adaptations and explanations of what they are allowed to change.

Multiple plumbing fixtures and entrances:
Allows an apartment to be divided and adapting the apartment to construct extra bathrooms or kitchens is both possible and simpler.

Elastic spaces:
Flexible ownership of rooms between neighbours create apartment diversity and increases the growth potential for each household.

Modular wall-elements not suitable for interior use:
Difficult to maintain, requires service and storage for when not in use. Easier to just build the wall directly, because the modular walls did not make it considerably easier to change internal floor plan layout after initial placements.

Feasibility

Regulations & Subsidies

To offer an affordable housing alternative, the apartment should be ready to move in from day one, otherwise it falls into the same trap as the self-built JBVs, which requires one to have essentially two homes at the same time while one is under construction (Westholm, 2020). That requires the initial core apartment to include a bathroom and kitchen as per the Swedish building code (Boverket ["The National Board of Housing, Building and Planning"]) in order to be counted as a residence.

In Sweden it is required to send in a request and pay for a building permit when doing extensions and changes in the facade to an existing building (Boverket). However, if the property is that of a single family household of 1-2 stories, the homeowner can freely build an additional 30 m^2 on their property, a so called "Attefallshus", as long as its fulfilling all requirements stipulated in this exception. Similarly to Däckshuset it could be sold as a "vertical villa"-plot to facilitate the requirements to make such an extension possible in a multi-storey building? Either way, the contract should stipulate that the neighbours in the same building can't appeal the extensions to the Building Committee as long as it is performed within some set boundaries and quality.

Subsidies and tax-deductions exist in Sweden for doing extensions on your own home, and there are even some tailored specifically towards Joint Building Ventures or to extensions of a building. In contrast to how other nations where incremental housing is used, such as Chile, there is currently little-to no money to be received or tax to deduct if the work is carried out by the homeowner themselves (Boverket). There is a preposition in progress which would give grants to new construction for a rental form and collectively shared spaces within a property (Nordregio, 2020), but it has not yet been approved in the parliament.

Initial thoughts on Organization & Ownership

The property owners should be either the residents themselves, in a form of collective JBV or tenant ownership organization, since that will allow them to invest in their homes and make the necessary changes, as seen in the case studies. Alternatively that a separate developing firm, preferably publicly owned and run by the municipality, operate the structure, and where each homeowner own a part of the volume as their own "plot", similar to the Deck-House and how it is commonly done internationally.

Possibly the expandable space could be organized in the form of a "rent-to-buy" tenant scheme, where the homeowner buys the initial structure and rents the balcony, until such time as they decide to expand their home and build on it, in which case they purchase the portion of the balcony they construct on. Having different costs depending on how the expandable space is used (outside space loosely furnished, to unheated interior winter garden, to partially expanded or fully expanded into heated interior space) could be criteria which governs the monthly costs.

Reducing construction cost

In order to create affordable housing in Sweden, the quality of the construction and material is often neglected in favour of lowering the price. However, when building an incremental house with a RAW interior, a lot is already saved in the initial construction phase since the future costs have transferred to the residents instead (Berg, 2020). Any upgrades to the interior surfaces will be made by the residents at a later stage, creating a margin of profit for the developers, who instead can focus their investments on quality materials with low maintenance and a over-dimensioned structure capable of handling the future extra weight (Egnahemsbolaget, 2020).

Looking abroad, Lacaton & Vassal is a French architecture firm that have specialized in simple and cost effective solutions to refurbish or construct new buildings that create better living conditions for the residents. Common methods they use which are appropriate for this thesis are the use of inexpensive facade cladding like corrugated steel, big open floor plans for a flexible furnishing and following room partitioning, and (re)making balconies into semi-heated winter gardens for extra space.

It is important that the initial structure and housing units cover the costs of the most expensive elements in construction, which would be difficult for the residents themselves to do, such as the structure, plumbing, exterior shell, windows and the vertical circulation system. Access balconies and free plan-pillars are other good strategies often used in similar projects focused on affordability.

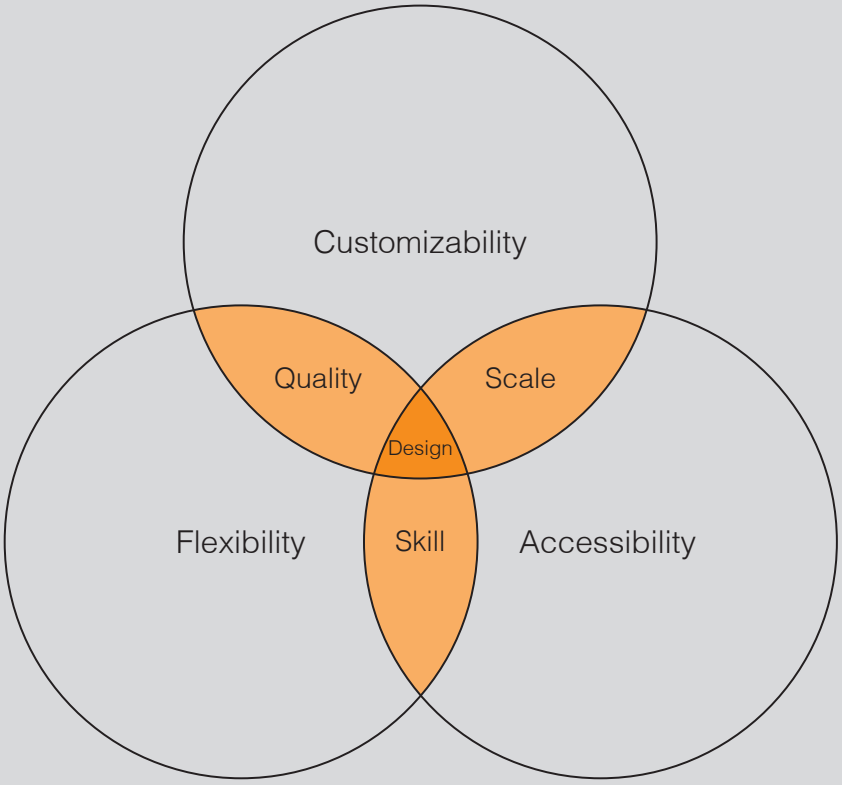
Using rational and simple design for the initial structure and core housing units and utilizing methods of pre-fabrication wherever possible could save a lot of costs (Svensson, 2014). Possibly the whole initial core unit can be pre-fabricated, like the temporary student housing “Snabba Hus” in Stockholm by AML Arkitekter, but that would be difficult to combine with duplex solutions and extensions. Regardless, a multi-storey apartment complex with several identical elements, either whole apartments or wall- & floor modules, is necessary for an industrial scale in pre-production to be financially feasible.

Fig 19. Brf Viva
(© Celander, U.)

Fig 20. Lacaton & Vassal
53 Housing Units, Sain-Nazaire
(© Rault, P.)

Fig 21. Snabba Hus pre-fabricated apartment

From Research to Design



Key aspects from theoretical studies

From the theoretical studies of literature and reference projects, a number of different design strategies and theories have been investigated and discussed, which have resulted in a pattern emerging of certain themes and points of conflict that relates back to the three research questions of the thesis. These have been identified as key aspects to consider when designing with the aim of creating affordable and long-term residential housing projects. The following design process have used these aspects as variables of requirements in the development of the proposal, relating and balancing the design strategies and principles between these three topics and their sometimes overlapping, but often opposing needs. The three variables are customizability, accessibility and flexibility.

Customizability

Relates to the level of agency the residents have themselves over the design and shape of any changes to their living spaces and how strict the framework is regarding for example the SCALE of the volumes and choice of materials to the extensions. As was seen in the example of Quinta Monroy, the relaxed regulations resulted in a diversity of colour and personality to the neighbourhood, connecting the residents to their homes, but at the expense of a worsened living environment and an antagonistic community as the expansions grew out of their initial boundaries. Therefore, while a homeowner which feels empowered and in control of their own dwelling will more likely stay for as long as possible, without appropriate restrictions any customizations might result in low-QUALITY extensions that are impractical, perhaps even unusable, when ownership eventually changes hands.

Accessibility

Relates to the affordability of the initial core apartment and the level of SKILL required to make any of the proposed adaptations and extensions. The size and level of finishing of the initial core apartment is the biggest and most efficient tools for keeping the price, and thereby the threshold, down to an appropriate level for the target demographic. Despite this, the core should be big enough to house at least two people somewhat comfortably, since any affordable expansion of the living space is unlikely to be possible with only one resident in the household due to time and budget constraints. The balance between the SCALE of the expandable space and the initial core should likewise also be maintained, as too big reliance on exterior expansion is equally impossible to afford for the intended users. A smaller SCALE of expandable space would also allows for simpler construction techniques, where re-used material from second-hand markets could cut costs further. For the overall structure itself, construction costs can be reduced by minimizing circulation and utilizing rational construction methods and prefabrication. The type of ownership and organization are also elements which can impact any subsidies or governmental funding already in place today.

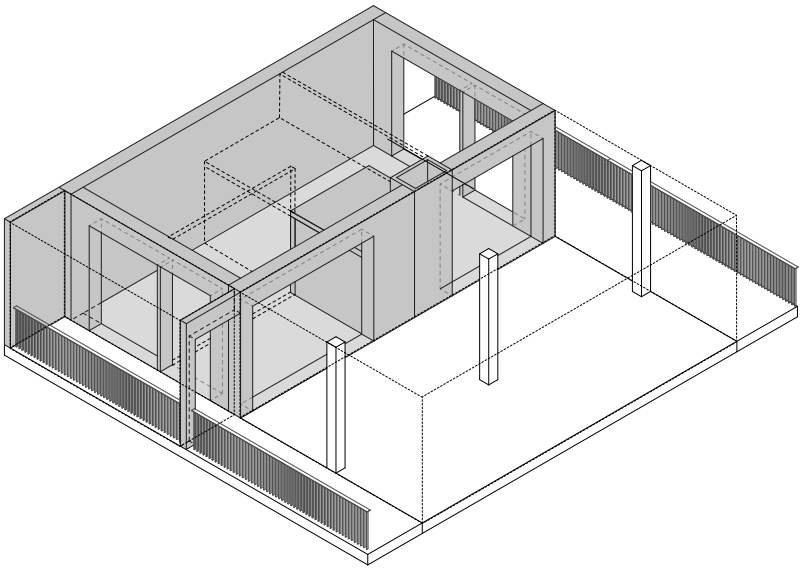
Flexibility

Relates to the level of adaptability possible within a dwelling and how they can grow and divide over a longer time frame, resulting in a higher demand for the QUALITY of the extensions and a high level of permanence in order to last throughout the buildings lifespan. Balancing that with an appropriate SKILL requirements without raising the threshold is however necessary for the flexible potential to be utilized. A low level of permanence to any of the internal adaptations is therefore desirable, since it allows for new changes to be made by the same or the next homeowner with little effort or cost, which promotes internal changes over external ones. The possibility to re-draw the dividing lines between the apartments and effect the diversity of sizes over time, both through growth and partitions, is important for the long-term residential potential. For that, the number of entrances and ways to connect the different apartments internally are key elements to implement.

3. Design process

Applied Research to Design
Concerning Prototype and Key Variables
Structural principles
Spatial configuration principles
Core unit principles
Extension principles
Internal adaptability principles

Applied Research to Design



Initial design prototype

As an initial step in the development of the design, a simple prototype was made that combined some of the different design strategies observed in the theoretical chapters from reference projects and literature studies. It consists of a small and narrow core apartment unit with daylight from two directions, in which the residents themselves can decide the surface materials and add internal dividing walls and mezzanine floors to their needs. With direct access to a big balcony space beside the apartment it can expand its floor space over time by building extensions and connecting them to the initial unit through demolishable wall-segments in the exterior walls. The core unit take care of all load-bearing labours which makes it entirely self-sufficient structurally. As it does not interact with its neighbours in any way, it is possible to produce it as a modular pre-fabricated unit and stack it to desired building height and length, only adding an access balcony for an affordable solution to the circulation.

In this early stage, no real emphasis was put towards balancing the previously mentioned Key Aspects. Instead the prototype was designed unrestricted of any hard criteria as a means to test and summarize my gained knowledge so far. This initial freedom helped in finding a starting point for my design, and extracting certain physical elements which would always be central to the design proposal when iteratively developing it further.

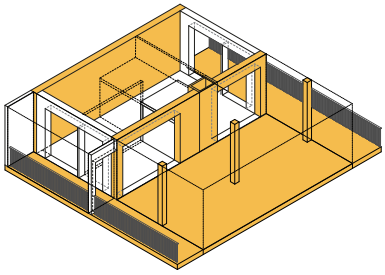
Many important aspects identified in previous chapters was however lost in the process. In order to improve the design in relation to the three categories of variables, and aid in the design process itself, the design elements from this prototype was grouped and categorized into five different areas, or principles, for deeper design studies: Structure, Spatial configuration, Core unit, Extension and Internal adaptability.

After the evaluation on the design in this prototype, these design principles was further development in the rest of the chapter.

Concerning Prototype and Key Variables

Structure

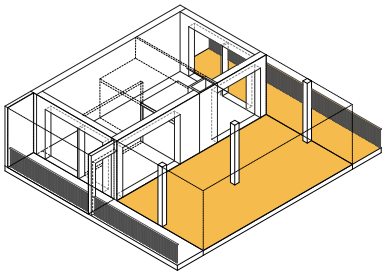
Load-bearing elements and plumbing fixtures which creates the framework for adaptability and growth.



Either incorporated to the core unit or as separate entities; which method is most suitable for incremental housing (CUSTOMIZATION), and what cuts down on the construction costs the most (ACCESSIBILITY)?

Spatial configuration

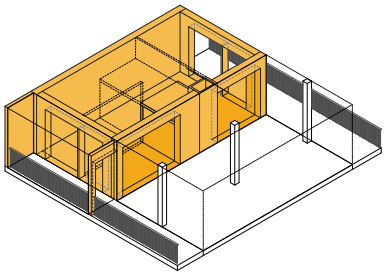
How to reach the apartments and their relationships to the neighbours.



An isolated apartment is limited in growth to its allotted extendable space, so complete separation from neighbours is detrimental for it longevity (FLEXIBILITY).

Core unit

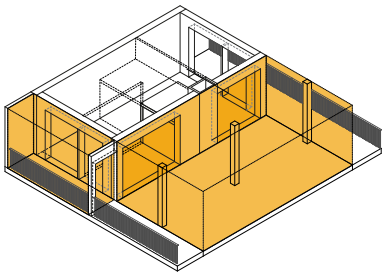
The original apartment for the first homeowners.



Initial size increase to suit two people, but be small enough to be affordable (ACCESSIBILITY). How would the interior space change and remain qualitative after extensions and partitions to the core apartment (FLEXIBILITY)?

Extension

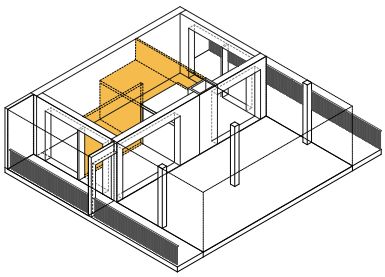
The space and methods of gaining additional floor space.



One big space for extensions limits incrementality and requires either large investments to make all at once (ACCESSIBILITY) or multiple exterior walls to be built that might obstruct long-term FLEXIBILITY. With a deep building some extensions will have little to no daylight, meaning a high price for unusable floor space.

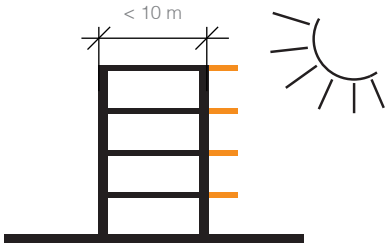
Internal adaptability

Possible room partitions and function of spaces.

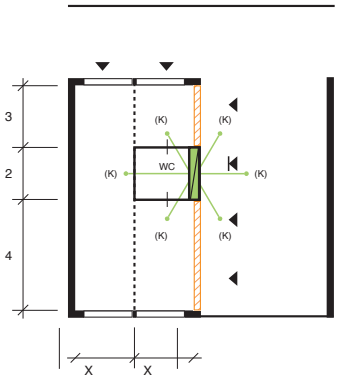


What dimensions to the core unit create the space with most potential to CUSTOMIZE initially? Narrow/wide, deep/thin, high/low? What happens to the function of the original rooms when the apartment grows (FLEXIBILITY)?

Structural principles



Access and depth



Plumbing fixtures and shaft placements

Fig 22. CLT & Glulam structures
Wood Innovation Design Centre
(© Michael Green Architecture)

A rational structure

A rational design approach is the most appropriate to keep costs down for the structure. A lamella of apartments next to each other and with external access balconies in front offers both protection from solar heating and multiple entrance points to the apartment (and any extension area adjacent to it). If the depth of the buildings main body is less than 10m, excluding the balconies, all apartments can reach both façades and have the best daylight conditions by avoids dark unusable zones in the extensions.

Plumbing location

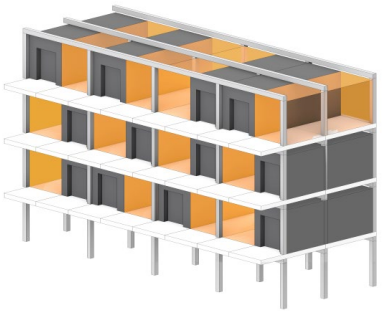
The vertical shafts for plumbing fixtures should be in a position that takes into account any potential extension at a later stage and placed with maximum reach within a fully expanded unit, so that in the future any extra bathroom or kitchen can be installed without too much difficulty. This is also appropriate if the homeowner at any point wishes to split up their apartment, as we could see in Landshövdingehuset where multiple plumbing fixture points was necessary for that kind of flexibility.

Choice of material?

The initial thought, influenced by the reference projects, was that the load-bearing structure needed to be of a durable material like concrete, capable of handling heavy loads and requires no coating to protect it from the climate. Despite this, when considering the current development in wood constructions for multi-storey buildings, especially with CLT (Cross Laminated Timber) and Glulam (Glued Laminated Timber), it seems like a potential alternative which align better with our time of climate change. With the concept of incremental expansion revolving around changing and moving the climate shell, any inevitable thermal bridges could be diminished if CLT/Glulam are used instead of concrete due to its better thermal conductivity (Träguiden). Some form of coating would be needed if the wood structure is exposed before extensions though, and for floor-slabs and the ground-floor concrete is more suitable for acoustic and durability reasons, so a combination of both materials is ideal.

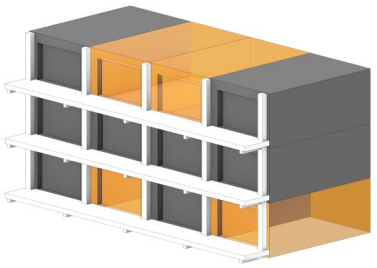
Structure: separate shelf or incorporated core?

A shelf-like load bearing structure with a free plan and pillars evenly interspersed like that in Däckshuset allows for the most customization on the individual apartment level (cores and extensions) since they do not need to relate to the neighbours. However, it requires extra insulation on both the floor and ceiling to avoid thermal bridges, resulting in a level-difference between the access balconies and inside of the apartments, which could be problematic given the Swedish building code standard of wheelchair accessible homes.



Shelf-structure upon the cores rest

A load bearing core apartment like the one in Quinta Monroy on the other hand, could be stacked in a way where the extendable space is always above and below a heated and insulated apartment. This ensures that any extensions require no additional insulation apart from the new floor coating on the previously exterior balcony space.

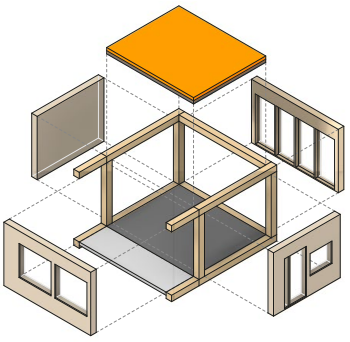


Stacked cores as load-bearing alternatives.

Pre-fabrication & a framework for modules

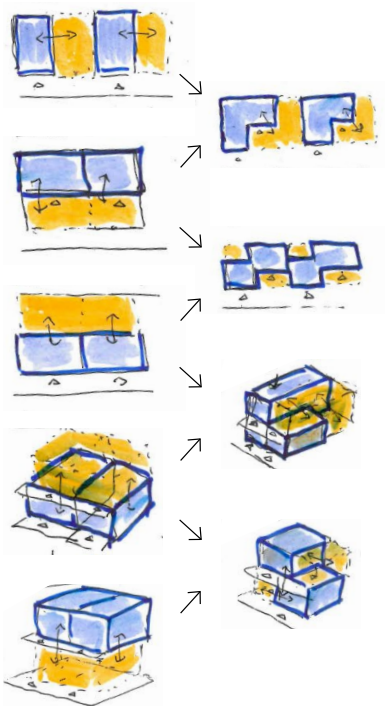
The load-bearing structure would be most suited for pre-fabrication, either as pillars and slabs placed on site or as core units shipped in its entirety. The latter would however be more limited in its initial size and choice of materials in order to fit inside the transport, which can become a problem when one aim in regards to the internal adaptability is a high ceiling to accommodate a small mezzanine level. Similarly any duplex apartments, such as those in RAW Rosendal, would be more complicated to transport and assemble as entire units.

Perhaps then it is preferable to divide the core apartment into smaller segments, which in turn can be pre-fabricated and installed on site. Through small variations in the design of the wall-modules it is possible to develop a toolbox of puzzle pieces which makes up a core apartment. For the sake of affordability these could then be assembled within a structural framework in a similar fashion throughout the building, while maintaining the potential of other spatial combinations to be applied in different housing projects with diverse outcomes.

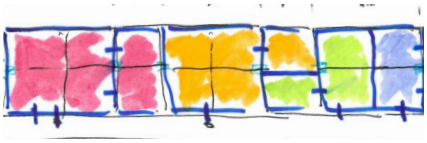


Framework with modular pre-fabricated infills to save costs?

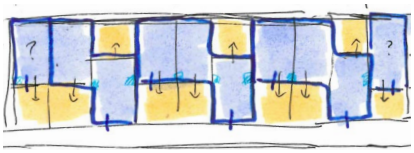
Spatial configuration principles



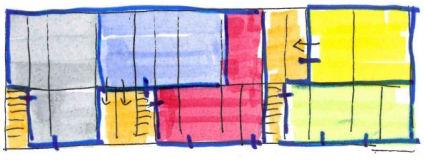
Expansion possibilities



Division and use of elastic space



Interesting, but alot of plumbing.



Entrance alcove apart from main circulation

Different ways to...

... expand

While the prototype only showed a sideways expansion like that of Quinta Monroy, any direction is entirely possible for the initial core to extend into. Horizontal extensions on the same floor is much simpler for the users to achieve, but depending on the structural configuration, an expansion onto itself on an upper floor can reduce some potential cold docks considerably.

... divide

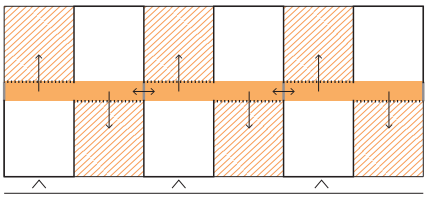
However, as was mentioned in the previous chapters, there is a great benefit, socially and for flexibility, to being able to divide up the apartments in different sizes in the future and create a diversity of dwellings for different clientele, but this requires neighbouring apartments to connect to each other, preferably upon construction so as to not depend on the residents to maintain this function with little oversight in their extensions.
Additionally, to have a smaller elastic space in-between them, which switches allegiance on each floor, is beneficial to the apartment diversity. If this intermediary space is a duplex unit connecting internally to the upper floor, it can also give rise to similarly interesting apartment constellation as that of SANAAS Gifu, but it comes with further complications and might not be suitable with the aim of affordability.

... enter

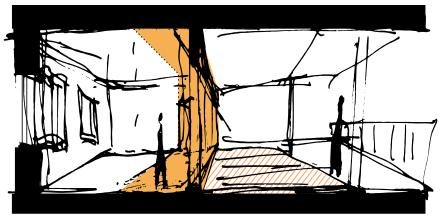
With entrance possibilities on the sides of the cores, either via the expandable space or by cutting the access balconies into the volume in certain locations, it would make it possible to divide the building on both axis's and create very small and wide apartments suitable for single households. Stretching the access balconies into the buildings can also make it possible for a more private entrance to the side of the apartment, creating a little alcove where the residents can store their bikes or strollers, in turn reducing the need for a wide access balcony and improving daylight conditions to the apartments.

Connected by an engawa

The potential of apartment diversity is therefore largely realised and maintained when the initial core units connect with each other. The expanded space should also be able to divide up between neighbours in the future and follow its core counterpart, restricting its volume and orientation to that of within a framework. By introducing an internal pathway in the middle of the buildings horizontal axis, which goes though neighbouring apartments but is left closed between core units initially through demolishable temporary walls, such a connection could always be guaranteed. Through this centre-line electrics can be drawn, and by connecting the core apartment and any extended spaces to this pathway, it would result in places where the internal circulation moves sometimes along the facade. Making these segments out of glazed panels that can be opened up for secondary enrances, the space created would blur the lines between outside and inside and resemble the outdoor circulations along a facade seen in the Japanese *engawa*, hence the title. After extensions this facade circulation would instead be a normal corridor in the centre of the building, with rooms towards each facade.



central internal connections and mulip-
le entrances and ectensions possible

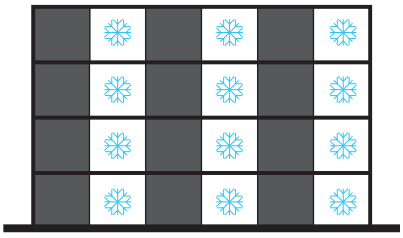


Section through engawa

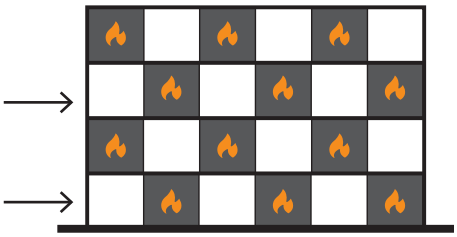
Vertical alignment and composition

As mentioned for the structural principles, the way the initial apartments are stacked could impact the floor level of the extensions, where being surrounded by heated units make for a more similar result to the initial core as it requires less insulation. This would make the buildings energy efficiency considerably worse upon construction, but would require less co-ordination among neighbours, which is good for the community (fewer chances of social friction occurring), and become an incentive to do the extensions which improves the efficiency to a certain degree.

Shifting or rotating the apartments around its plumbing axis on each floor makes for a more interesting facade composition and rhythm as it spreads out the weight more evenly.



Unstable and uneven facade:
Distributes loads unevenly,
unheated space to extensions



Shift core units every floor:
structure will be more stable
+ better for extensions

Core unit principles

rigid core

Indoor space,
controlled by
plumbing fixtures
and furniture

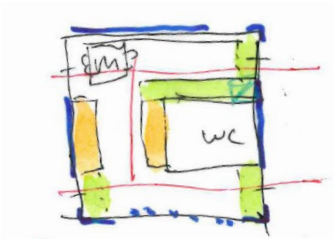
flexible core

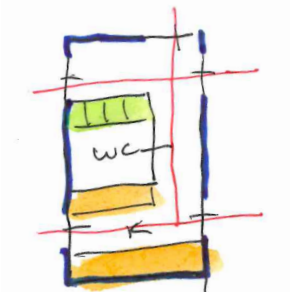
Indoor space,
open floor plan,
RAW interior,
users temporal needs

(expandable space)

Outdoor spaces,
convertible to indoor,
impacts its surroundings

different cores





optimized rigid cores

Division of core functions

The core apartment needs to be a number of different things. It should be small in order to be affordable, but big enough for at least two people, which means passing all of the Swedish building standards in proportion to such a size. It need to be able to expand in floor area to adjacent spaces for an appropriate amount, and have the internal flexibility to allow multiple different types of floor plan configurations in order to adapt to the residents future requirements.

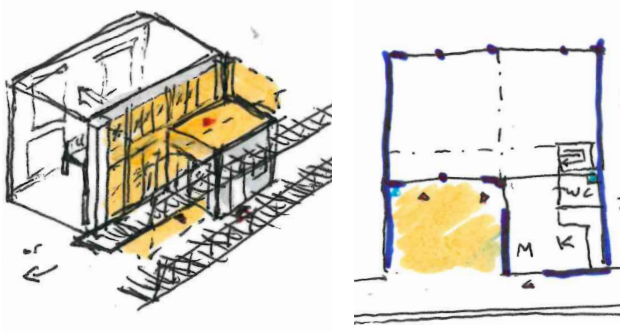
For this reason it was beneficial in the design process to divide the initial core apartment into separate volumes according to their functions, to more freely explore different spatial combinations. In accordance with the previously mentioned theory of different levels of flexibility (see *Open Building Theory*), one core would be less flexible to make the other internally adaptable.

Rigid core

The first one - *the rigid core* - have all the functions related to plumbing inside it (bathroom, kitchen, dining place) which are difficult to change and requires close proximity to one another. Since this would therefore be a more permanent space, it made sense to also include the entrance hallway into it and position it next to the access balconies. Its configuration is optimized to keep the size of this core down to its minimum and give more freedom to spatially explore to its counterpart.

Flexible core

The other functions of bedrooms and lounging areas were placed in the second one - *the flexible core*. As the name suggests, the residents would be able to change its internal room configurations by putting up dividing walls, installing internal mezzanine levels or connecting it to a self-built extension outside. When developing a design for a potential duplex core apartment, it made the most sense to double the height of this type, since it would have the more interesting spatial capabilities as seen in Tila Housing.

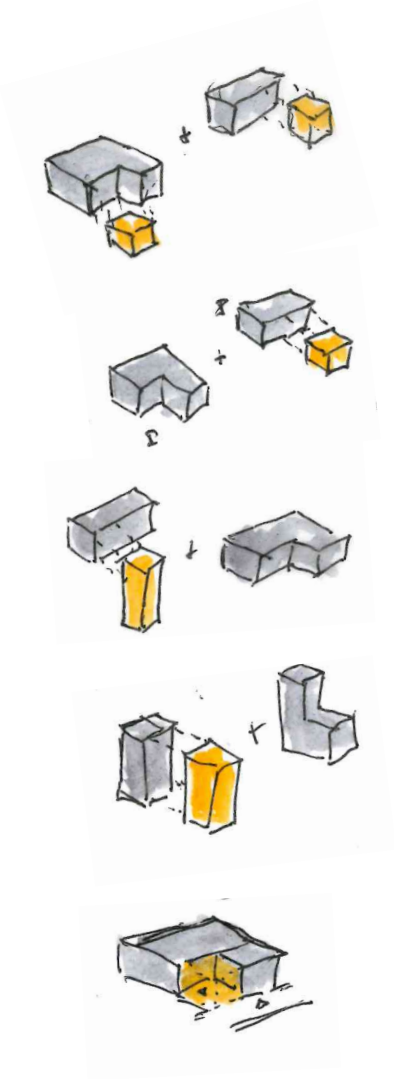


Extensions towards public space only?

Most suitable shape and orientation

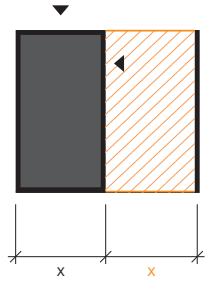
From the many volume studies it was determined that an L-shape for the orientation of the entire core is best suitable as it immediately connects to the neighbouring apartments. Furthermore, if the extension is done towards the access balconies it provides multiple entrance points and makes it much easier to construct them given the extra reach, as well as being able to rent out the space, built or not, when not in use.

For the duplex alternative, that is more adaptable on the interior and have some interesting spatial qualities and possibilities, it was difficult to keep down the size, just as examples from RAW Rosendal showed. This resulted initially in the need for a separate smaller solution, since a duplication on a single level flexible core became to big to be affordable. However, to accommodate the minimal requirements for a residence on the entrance level, it actually had to grow wider than the modular unit of the single apartments. The introduction of another measurement for the cores is despite everything actually beneficial to its neighbours, since rotating the entire duplex apartment's cores along their axis like its single floor-counterpart created problems of overlapping and extremely large spaces for extensions. Using these vertical apartment types as breaks in the facade rhythm or moving them next to other vertical elements, such as the staircase, is suitable to minimize the mess they bring.

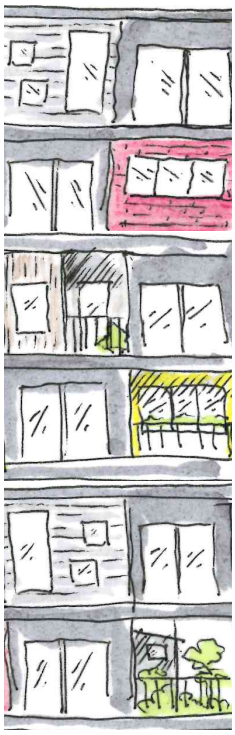


Extensions and partitions in duplex cores

Extension principles



Extension related to core



Customized facades with re-used materials

A framework for its size

The extensions should be linked to the core apartment, both physically and in their size. How much you invest in at the start determines the potential of your home, at least at the time of moving in. The potential to divide the apartments up will offer every resident the possibility to expand further as time goes on, which was one of the things missing in Quinta Monroy.

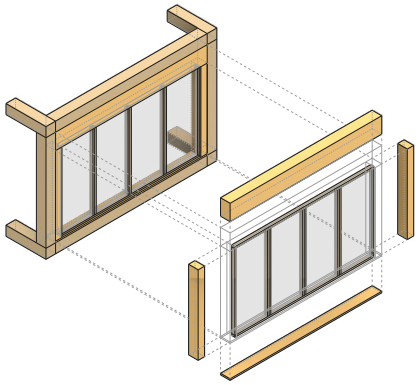
Any single extension space should however never exceed 30m^2, which is that of an Attefallshus. Both because the existing exemption to building permits caps it at that size, but also because the complexity and costs of an extension increases along with its size. A smaller size ensures a certain level of quality, while making it more accessible to the homeowners. If the sizes differ among the extension space they can also do it incrementally rather than all at once, depending on what is easiest at the time.

The dimensions of all of the expandable spaces should therefore be enough so that one big room or two smaller ones following the Swedish building standards could be made in each of the available extensions. Not only for making it easier to partition the apartment or rent the space out though, but also since those directives are made to accommodate a normative furnishing situation.

Materials

The extensions should be made out of light-weight walls and ceilings to not overload the supporting structure too much. These are simple to use and common in most other self-building projects, but also not too expensive if hiring a contractor to do it instead (Egnahemsbolaget, 2020).

Re-purposed materials from demolished buildings could be utilized wherever it is possible to find it. Because of the small scale it is a great opportunity to extend the life-cycle of materials and cut some expenses. It also doesn't require a lot of neighbours to co-ordinate and buy material together in bulk, meaning more potential of diverse designs. The lightweight glazed wall-segments of the engawa corridors should also be possible to repurposed into the extension facade to create a winter garden.



Designed for dissassembly towards extensions

Function & Organization

When not extended the leftover space functions similarly as a front- or backyard to a single family house. It could be used for storage, as an outdoor lounge area, gardening, playing area or a dog house. The neighbours could potentially go together and designate their own unused spaces for different activities which the entire floor could use, or keep it separate and fence in their little plots if they so choose.

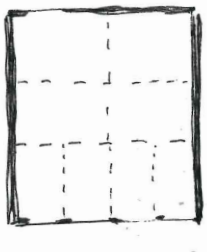
The same plots when completely built could also feasibly be sold or subleased to either a neighbour who require more space or outside tenants looking for a small room to rent. This gives a secondary income, and if the original homeowner does not value the possibility to design their own home, they could outsource that responsibility too, perhaps subletting the space for free for a certain amount of time in exchange for the neighbour to cover the construction costs.

With all of the possibilities of adapting and extending ones own home, a space where the residents can exchange ideas, trade materials and borrow tools should be available within the property. A collective workshop to not only help them build their own homes, but also their community, as we identified in the previous chapter of Adaptability as a necessary supplement to keep the concepts of flexibility alive. The ground floor would be a good location for such spaces

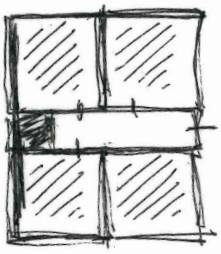
Shared functions on the ground floor

Internal adaptability principles

RAW interior



Flexible wall placement



General room size

Interior dimensions upon construction

The most appropriate depth and width for the initially constructed flexible core is one which allows it to be split in both axis's for rooms on each side. A total width of 5m is suitable to be able to make a small and big room while dividing lengthwise and switch functions between rooms seamlessly. For the depth, 5m is preferred, but at least 4m depth is necessary so that a minimum 3m deep room could be made while still retaining the possibility to put up a dividing wall along the *engawa* central corridor, or conversely two 2m rooms could be made if including the engawa-space into the room space.

While these dimensions result in tight rooms, they are big enough to be usable, and reflect the desired spaces created by the residents in projects like Järnbrott. After extensions the possibilities to make bigger rooms becomes available in great variety, but upon initial construction the residents have to manage with either tighter rooms or a big general room and sleeping cubicles in the open floor plan.

Changes from day one

A RAW interior from the modular wall elements can cut down on some costs and allow the residents to customize as they see fit. For dividing walls to be possible to place, thicker posts is needed in the middle of the bigger glazed engawa and duplex façades, which apartments also should have beams cut through the volume to make it easier to put up an extra floor slab and rest an internal staircase on.

Adaptability adjusted for future expansions

An increased apartment size makes the initially tightly dimensioned core, which had a dining space and kitchen dimensioned for a household of one or two people, unfit for a bigger family. When an expansion happen, the main dining area could potentially move to accommodate the larger household, perhaps along with the residents expanding the kitchen too. The original dining space should then be able to transform into another function such as a guest bedroom or small home office.

4. Site

Kortedala
Local context

Fig 23. Aerial photo of Gothenburg
(© Lantmäteriet. 2022)

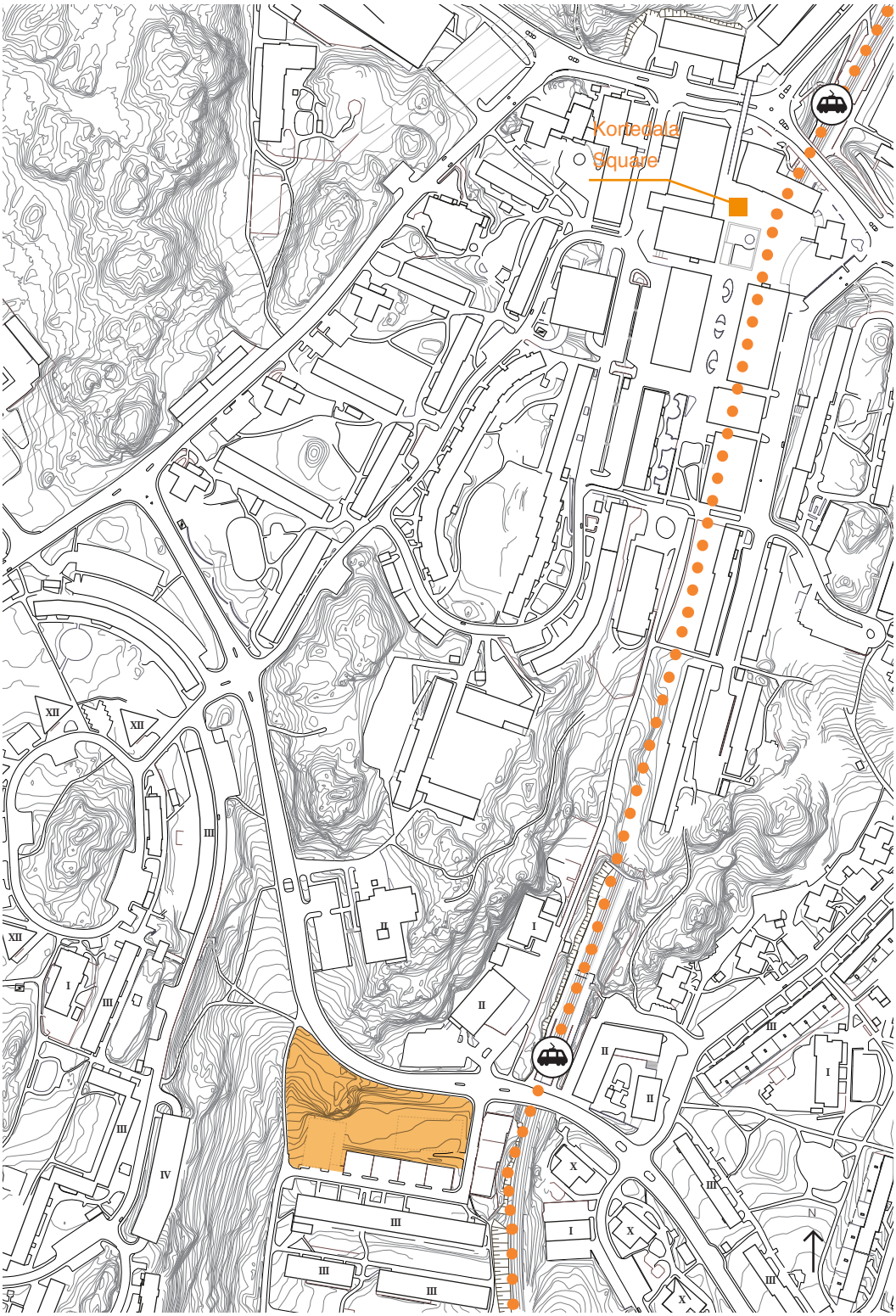
Kortedala

In order to choose a relevant site to implement the design proposal on, the existing housing stock in different residential areas in Gothenburg where examined to find places where the current housing stock was in need of more long-term housing solutions with other ownership forms than rental. These were found to exist throughout many of the city's suburbs and in the urban fringes, particularly those who had a majority of their development during the 60's as a part of Sweden's mass housing program "The Million Homes-program". Today many of these areas are socially segregated from the rest of Gothenburg, with many low-income households finding refuge there due to lower house prices than the city's average (Göteborgs stad, 2019).

One of these suburban areas is that of Kortedala. Situated north-east reatively close to the city centre, about 17min journey with the local tram, it is a neighbourhood with a modernistic and rationally built design, having plenty of greenery and open space between the spaciously placed houses, highly suitable for families with children, or households intending to grow over time. Almost two thirds of its housing stock is made out of rental apartments within the public domain, and the City of Gothenburg (Göteborgs stad, 2021) have even identified the area as a developing region in dire need of other ownership forms such as single family households or tenant ownership communities.

Its location and the fact that the current inhabitants have an average income of about SEK 100 000 below the Gothenburg average results in a low investment power for property developers and few new homes are constructed. Those that do get the funding are affordable in nature, average market price is about SEK 27.000/m^2 (Mäklarinfo), but they are not very adaptable and the area see a quite high traffic of residents leaving and moving away whenever possible (Göteborgs stad, 2019).

All of these aspects make it suitable area to implement the alternative housing solution developed in this thesis.



Site location in Kortedala (1:10 000)

Local context

The specific site in Southern Kortedala was chosen due to it being registered as a plot for developing houses years ago, but the process have taken a lot of time and there is currently no proposal in production, making it suitable for my thesis proposal.

Today the plot of about 7 000 m^2 is a small green space with trees, a dog exercise area and a parking house. It is sandwiched between a parking lot for the adjacent neighbourhood to the south, a steep tree-lined hill to the west, a curved road to its immediate north and a ravine east of its location for the tram line leading to the local city square, about 7 minutes walking distance by foot from the site.

Half of the plot is in a slight slope towards the northern road, and the north-western part have a rocky hill filled with trees which could be difficult to build on. Conditions are similar to those pointed out by Erik Friberger as ideal locations for his Däckshus, as the slope make single family household impractical in favour of multi-storey apartment buildings. The slightly complicated terrain should decrease the land price to a certain degree, but it might also increase construction costs, so can not be deemed a jackpot already.

The houses in its immediate vicinity are all quite low, around 3-4 levels high lamellas, but interspersed throughout the area are higher residential towers of 10-12 levels. Construction here should not be too hight to block of daylight to the existing neighbourhood, but creating a quiet space free from noise pollution from the adjacent road and tram-line requires some height and volume.

The parking lot the local municipality have desired to keep, but it might be possible to build houses stretching out over the parking spaces and resting on pillars only for the ground floor, providing the daylight to the existing houses is not negatively affected. The parking house however could be re-purposed into a shared facility for the residents, perhaps as the local workshop and information hub. Other facilities, commercial or shared, would benefit from being placed closer to the tram station.

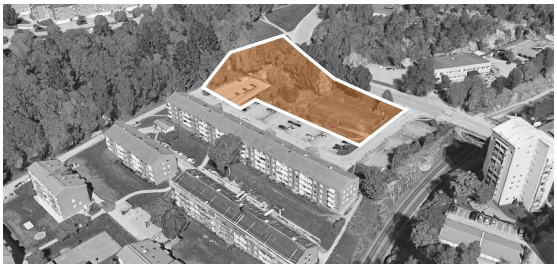


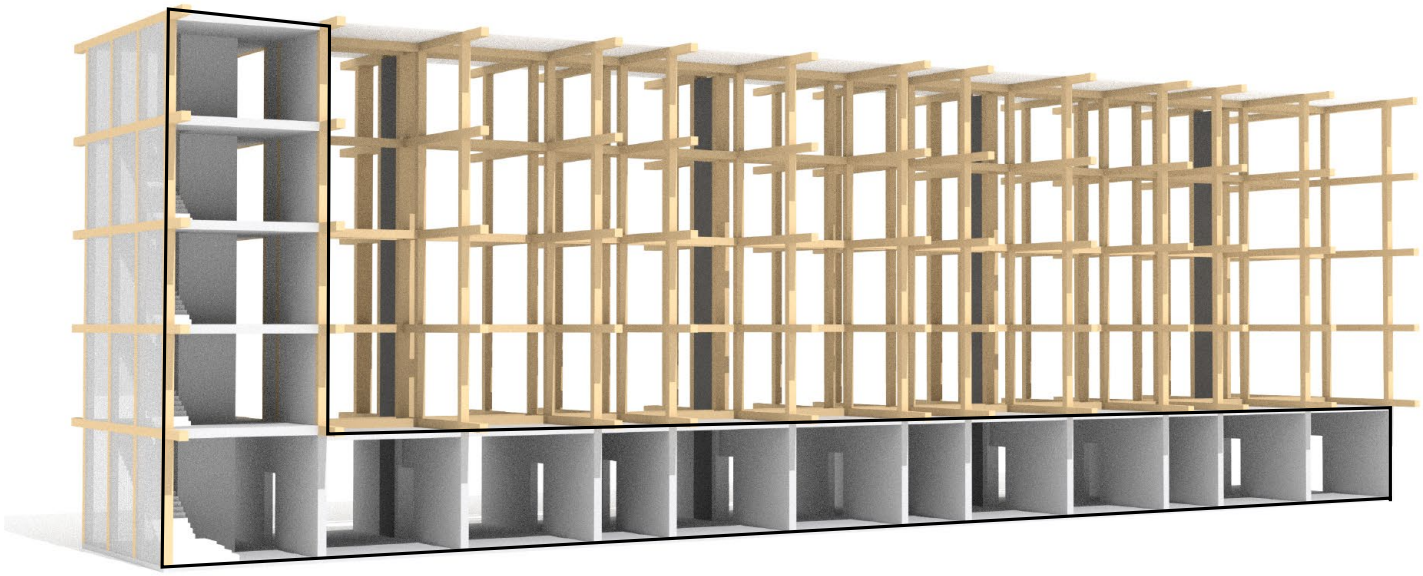
Fig 24.: 3D map and street view of site
(Google)

6. Design proposal

Initial typology
Structural concepts
Adapted to site
Floor plans
Spatial configurations
The Framework of life
Growth possibilities
Extended apartments

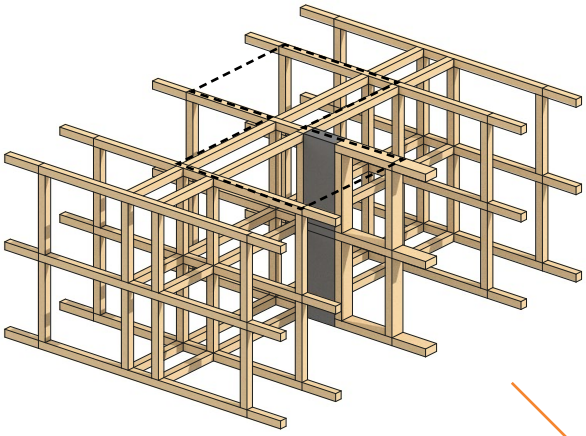
Initial typology

The incremental apartment building is upon its construction partially completed, with several spaces in the facade left to the residents themselves to fill up as they see fit. Its rational and discreet appearance makes it possible to fit in to a number of different contexts with little adaptations required to its basic structure, functioning essentially as a deconstructed and reconfigured variation of the lamella typology. The lamella is here a modest five stories high, but can increase or decrease in floors to generate desired amount of apartments, making it suitable for multiple scales of affordable housing projects. Its ground floor, which is left undeveloped upon construction, is also able to be programmed according to the needs of its inhabitants and the local context. Over time, the building will evolve and grow with its residents.



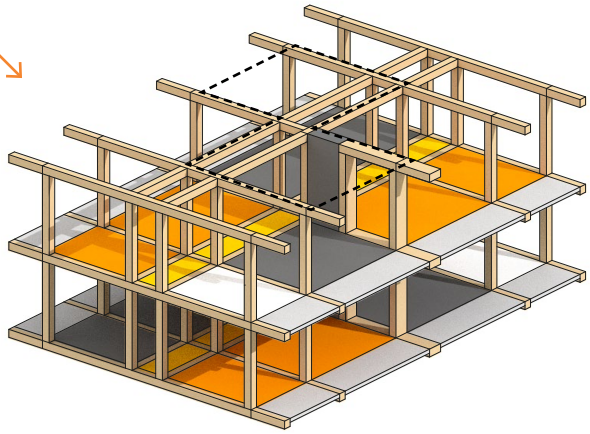
Structural concepts

The structural concept is inspired by the classic Landshövdingehus that exist in Gothenburg by making the ground floor a foundation of concrete wall and slab elements, upon which a structural framework of CLT and Glulam rests. The stairwell and elevator in concrete provide further stability towards sheering forces together with the evenly positioned plumbing fictures. Further stability is achieved after the modular elements to the core apartment and the access balconies are installed to the framework. The length of the building can be adjusted by removing or adding segments of the frames which hold these core apartments, forming larger housing complexes that can stretch and envelope a courtyard to form a closed block.



Wooden framework

Pillars and beams of CLT and Glulam along with the plumbing shafts create the framework to hold the apartments



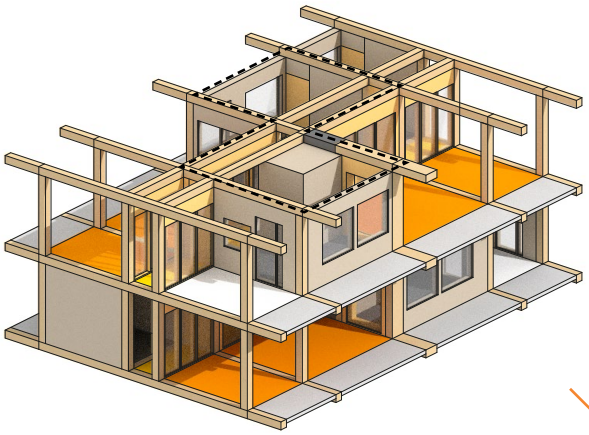
Adjusted floor slabs

Modular floor slabs provide stability and are adjusted with protective coating and insulation depending on their initial function:

exterior circulation slabs (gray)
- raw concrete

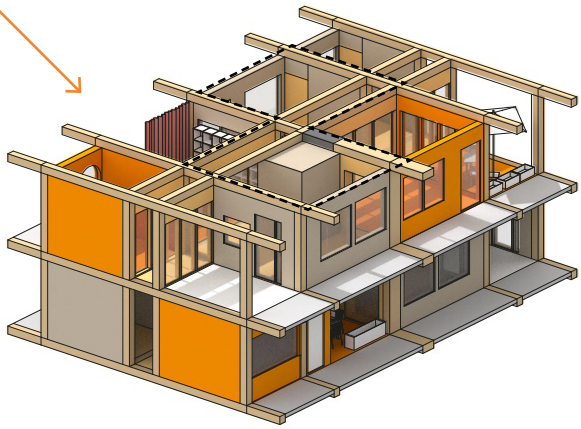
interior apartment floor (black)
- insulated underneath

exterior to interior extension space (orange)
- coated



Wall-modules define living space

Pre-fabricated light-wall modules create the core apartments and are installed along with kitchen and bathroom before residents move in.



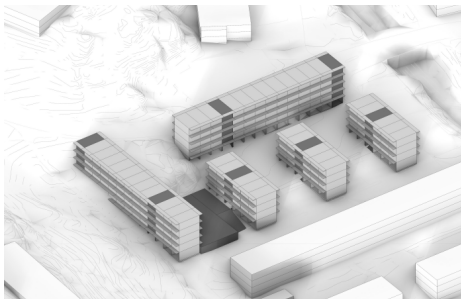
Extensions fill up the building

As the residents take their spaces into use, they begin to furnish the big balconies, eventually incorporating them into the internal apartment space by adding external walls or disassemble and re-use the wall modules adjacent to the extendable spaces.

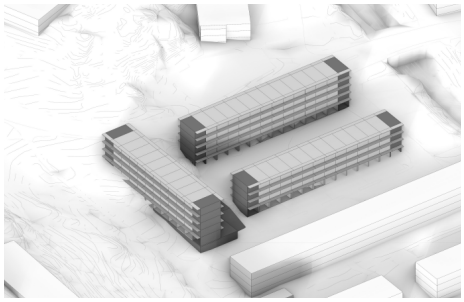
Typology adapted to site

Adaption tests of typology to the chosen site

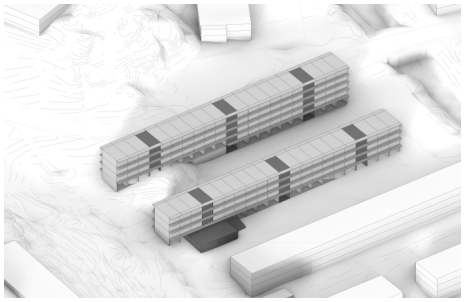
1:
+ simple application of concept to topography
- no adaptation, cuts vegetation, no yard?



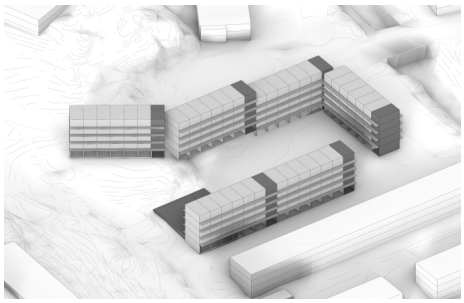
2:
+ simple shapes, different sizes, daylight and greenery,
- parking ruined, noise protection?,



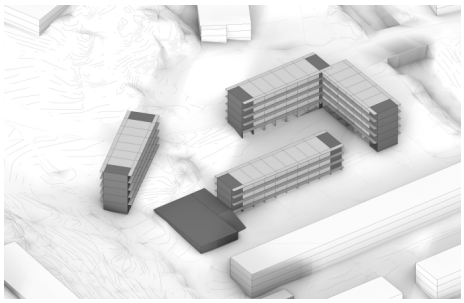
3:
+ similar to surrounding, elongated typologies, simple concept
- too simple and modernistic?, not adapted to context



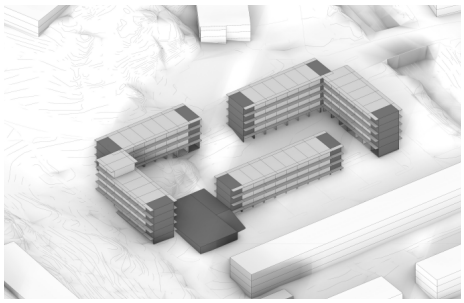
4:
+ simple concept, appropriate to context,
- only placed in context, not adapted..., cuts through greenery



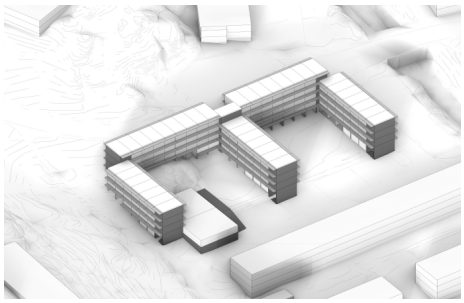
5:
+ protection from noise, frames road,
- cuts some vegetation, weird shape, daylight to old buildings



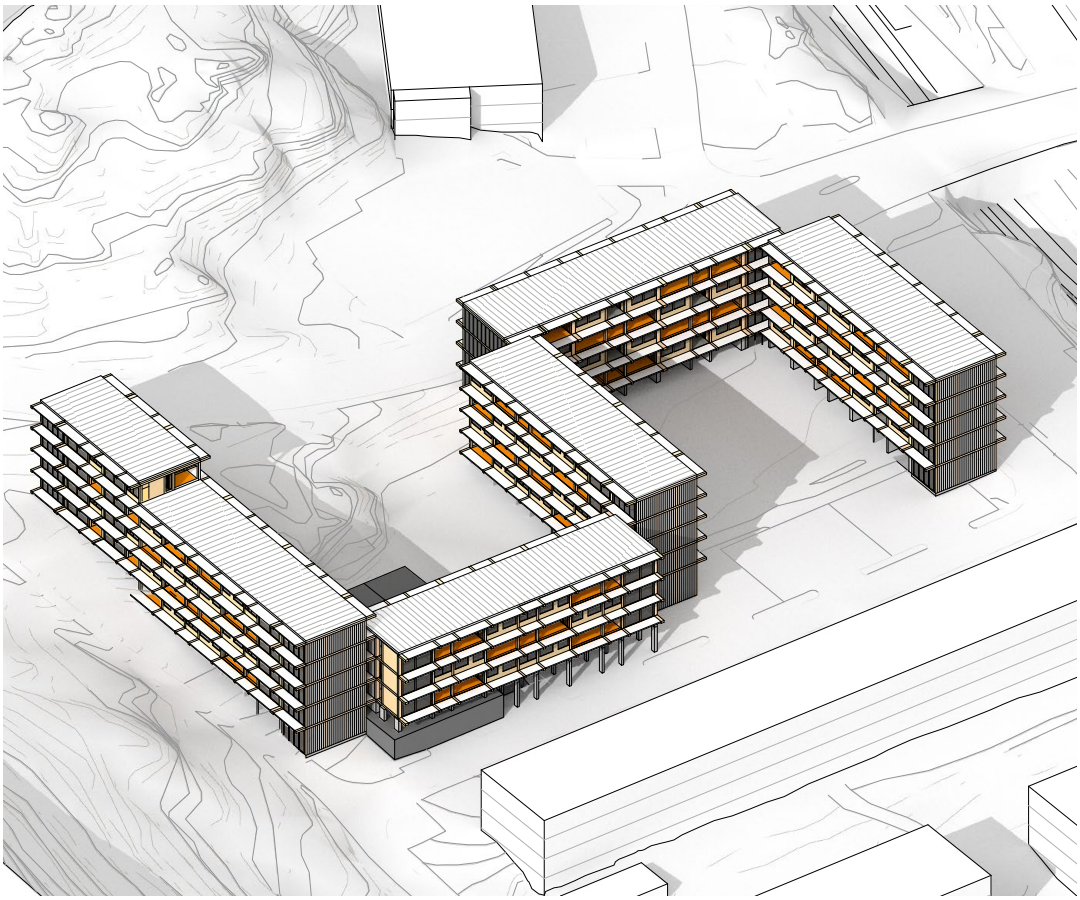
6:
+ different shapes from typology, adapted to terrain
- not unison concept, unclear to take in



7:
+ frames it to a yard
- tight spaces, daylight? not adapted to terrain...



8:
+ daylight (old&new), parking untouched, noise protection from road, green space to view too
- cut down trees & vegetation

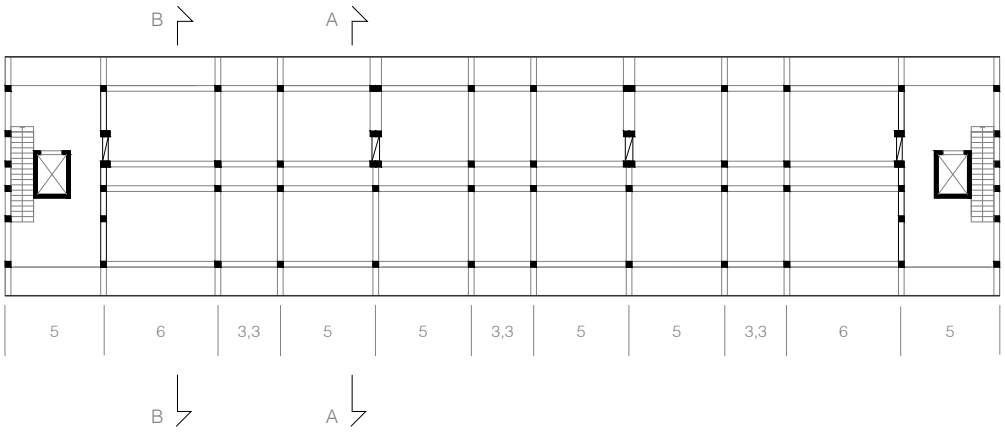


Optimal configuration for its context

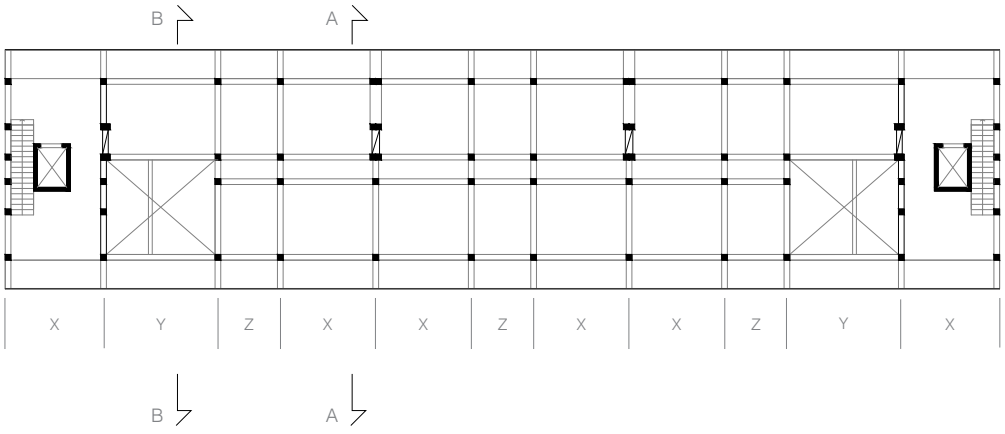
The typology interlinks with several units at the stairwells to create the larger housing complex viewed here. It have adapted to the local topography and greenery, letting the fully grown trees on the slope remain, forming two exterior spaces with different levels of order (the wild slope and the structured lawn). Its height and orientation varies to improve daylight conditions, at one part stretching over the parking lot in order to not have too tight courtyards.

Spatial configurations

structural layout - load-bearing elements

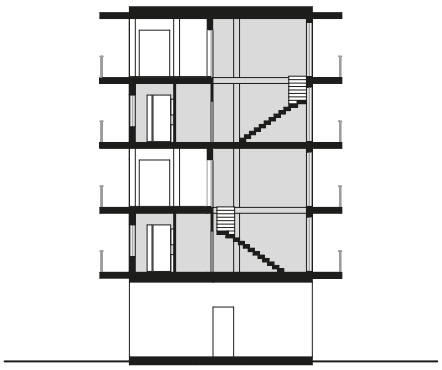


structural plan A 1:400



structural plan B 1:400

Section A: type 1 - single 1:400



Section B: type 2 - duplex 1:400

Principal divisions

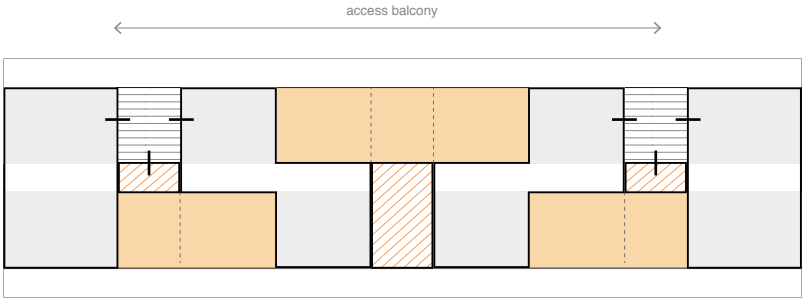
The typology is divided up with three different dimensions according to the core apartment function:

X = 5m segments for the Type 1 single apartments that expands horizontally.
Y= 6m segments for the Type 2 duplex apartments that expands vertically.
Z = 3,3m segments for an elastic space between apartments which change ownership.

In a larger housing complex the stairwells can be positioned further apart.

Spatial configurations

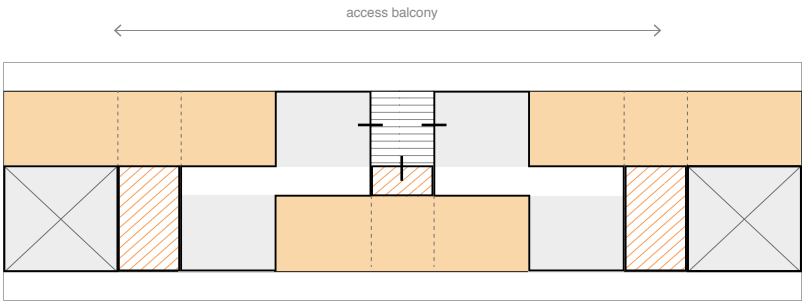
Initial configuration



apartment configuration normal plan A 1:400

Legend:

Upon construction 2-4 apartments on each floor is available, with each core unit (gray fields) having access to expansion area towards the facades (orange fields).
Elastic space between apartments, can belong to either neighbour (diagonal hatch).



apartment configuration normal plan B 1:400

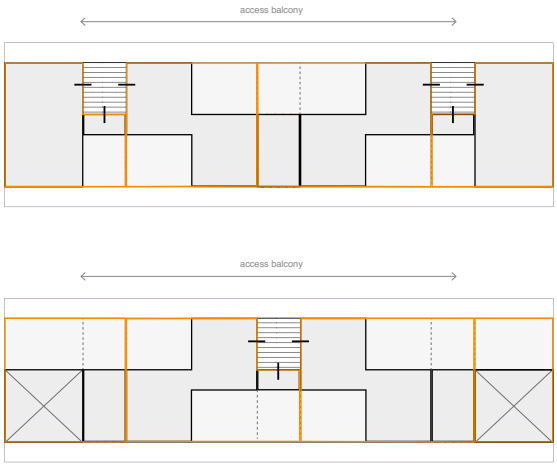
Main attributes:
Initial core apartment configuration: 2-4 on each floor

Entrance from side via open elastic space, for a more private entrance & to not stop the traffic on the balconies.
Private balcony on the back to allow work on all extensions to be done without the need for supporting structures or cranes.

Extension area towards access balconies, one space per unit(orange)
Elastic space between, can belong to either neighbour (hatch)

Expanded apartment configuration

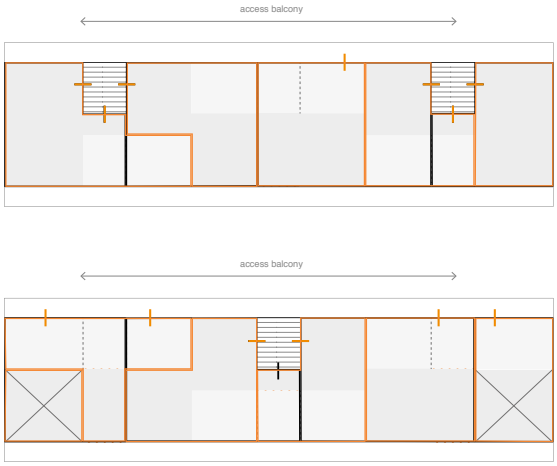
After some time all the apartments have expand to its total size, removing all open spaces apart from the entrance alcoves.
From this point and on the building enters its next phase.



Partitioned apartment configuration

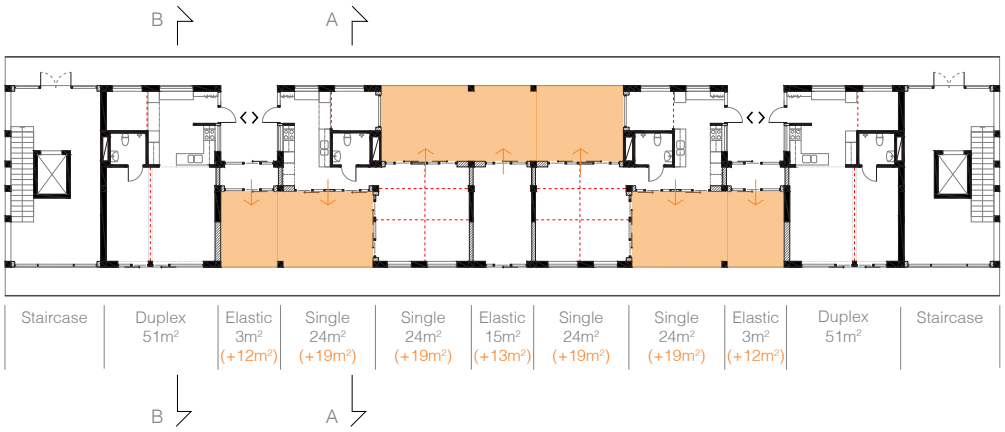
Partitioning up the bigger spaces after parts of the household have moved out is vital in order to let the residents remain on location for a longer time.

From the initial 2-4 apartments per floor level, between 5-6 apartment configurations can now be achieved through negotiating new property contracts among the homeowners.

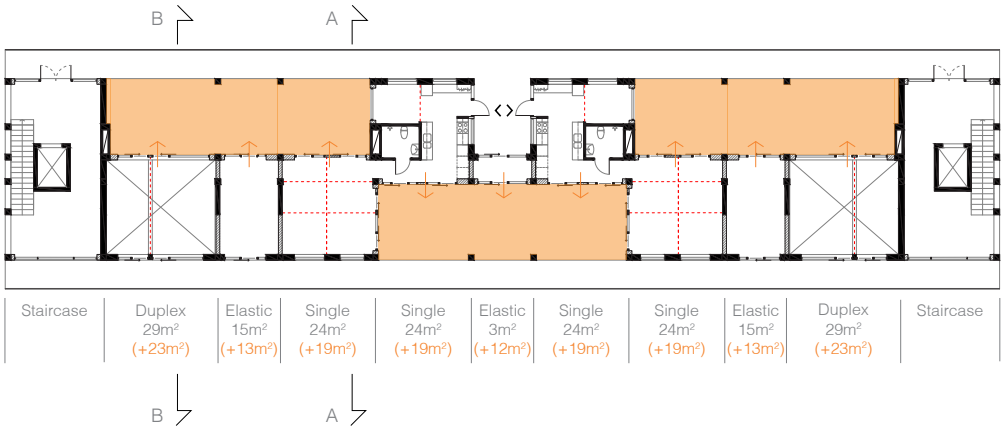


Apartments

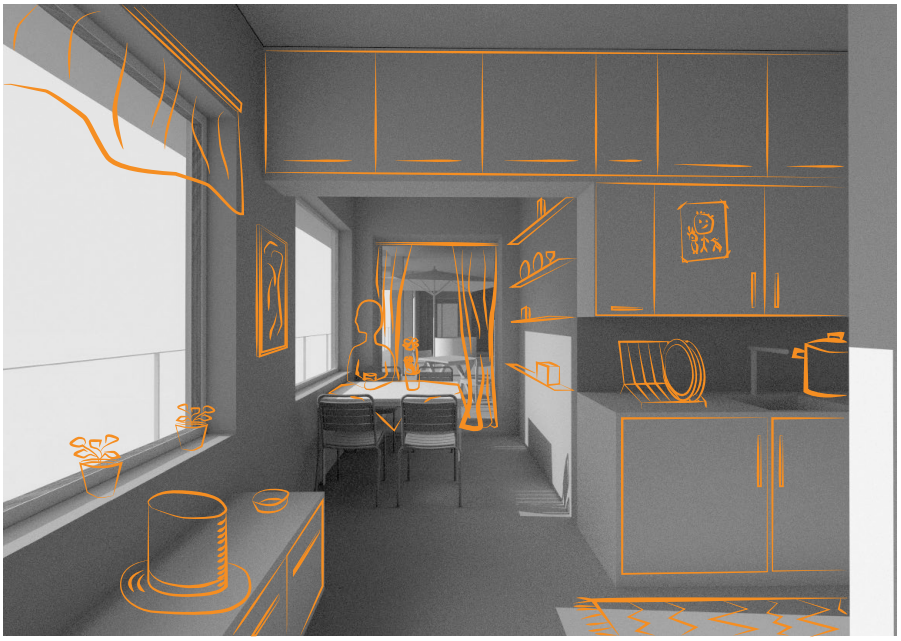
Initial layout - core apartments



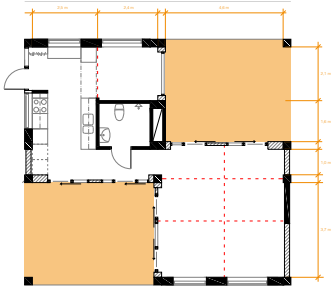
normal plan A 1:400



normal plan B 1:400

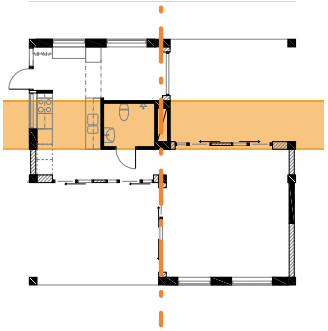


Interior perspective - kitchen



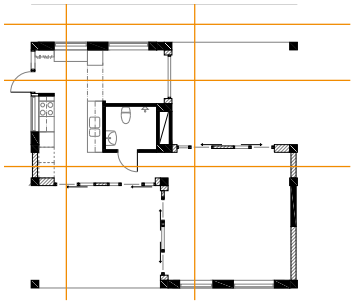
Type 1 measurement plan

Initial core apartment with a compact package of more rigid elements such as bathroom and kitchen, and a bigger RAW surfaced open room, capable of multiple divisions and furnishing variations within its 5x5m floor space, similar in size to the possible extension



Type 1 plumbing line

All type 1-apartments are reflected from its central core line between the floors.
The plumbing package is almost centrally placed and moves along the same line throughout the building.

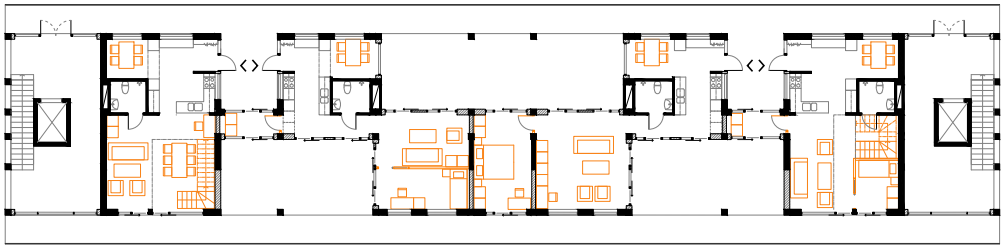


Type 1 sight lines

Movement is directed towards natural light sources and along the facade, starting from the entrance from the side alcove of the access balcony.
Upon extensions these lines could change and give rise to circular movements around the core package.

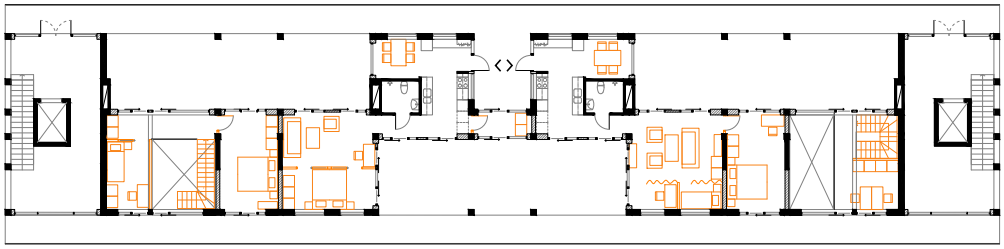
Apartments

Furnished core apartments



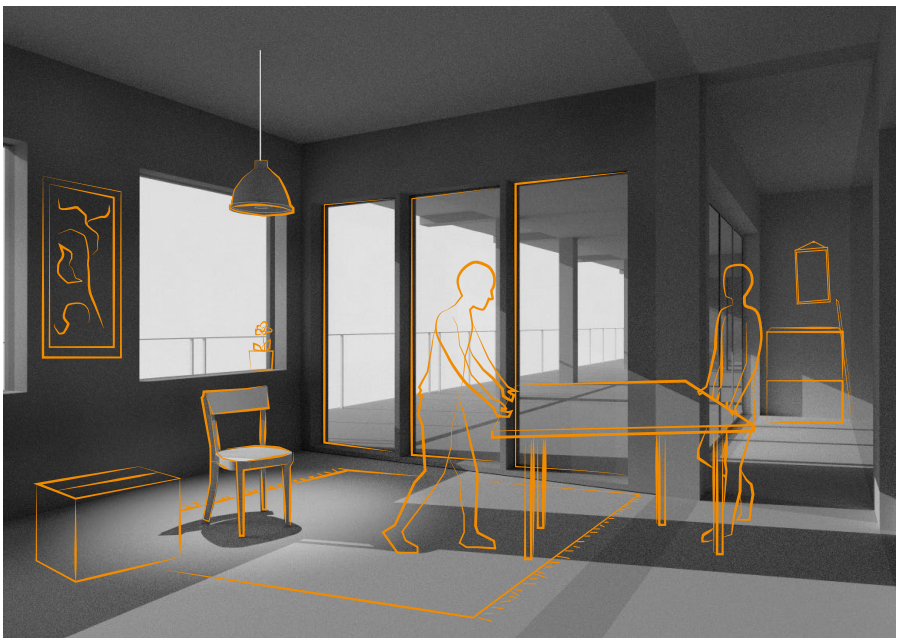
Apt A:	Apt B:	Apt C:	Apt D:
Duplex	Single (+ elastic)	Single + elastic	Duplex (+ elastic)
2-? rok	1-? rok	2-? rok	1-? rok
95 m² (+36m²)	51 m² (+50m²)	63 m² (+51m²)	83 m² (+35m²)

normal plan A 1:400



Apt A:	Apt E:	Apt F:	Apt D:
Duplex + elastic	Single (+ elastic)	Single + elastic	Duplex
2-? rok	1-? rok	2-? rok	1-? rok
95 m² (+36m²)	51 m² (+50m²)	63 m² (+51m²)	83 m² (+35m²)

normal plan B 1:400



Interior perspective - main room

Furnishing options and apartment sizes

Before any extensions are made, the residents have a slightly limited potential in terms of the internal adaptability. The main room can be divided in two for separation of private bedroom and more public living room. Most single households however will probably keep it as a big room and install a smaller sleeping cubicle, possibly raised up on a mezzanine level to not disturb the open space. For the duplex apartments, while the initial apartment comes without a internal staircase, it is highly likely that it will be constructed early on in order to utilize the extra potential floor space on the upper floor.

The type 1 apartments have the potential to expand to almost double the initial size, over time going from 50-63m^2 to over 100m^2. Its initial size is larger than what was originally intended, but they had to grow to accommodate the requirements of the Swedish building code. The elastic space also increases the floor space considerably and makes it even more expensive towards the first-time householders who are intended to move into this building. A balance was made here in regards to the potential usages and flexibility over time, something which requires extra floor space.

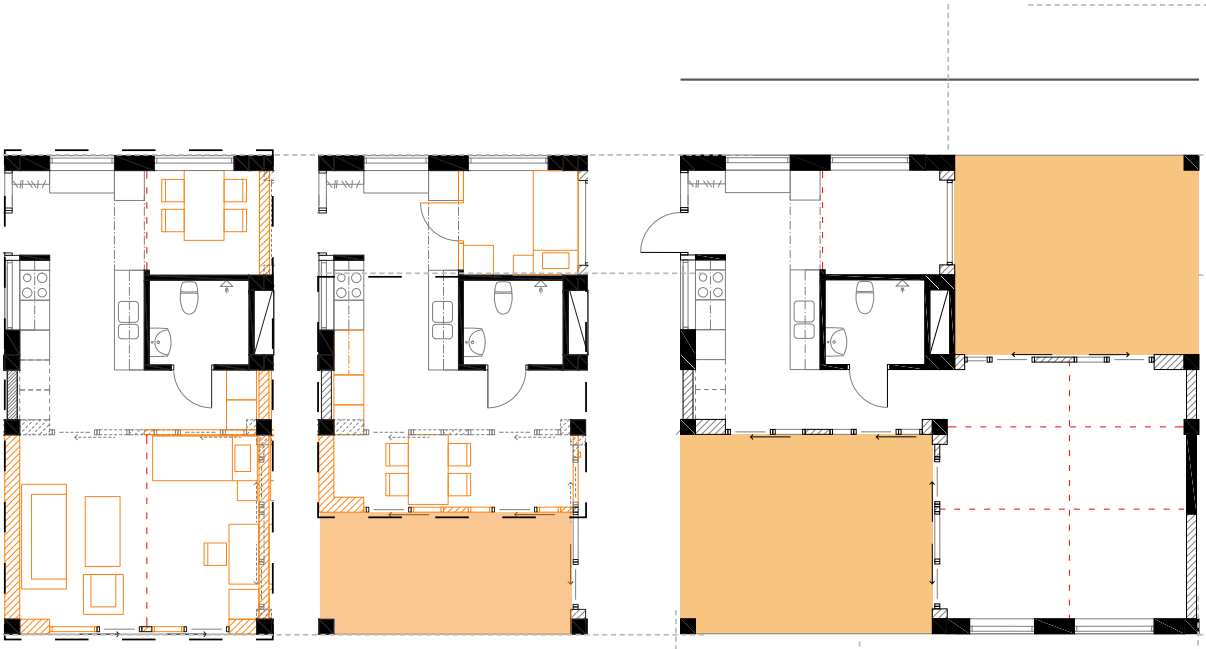
The framework to life

people moving in,
life fills the void,
outside for playing and growing
now inside for meeting and seeping,
the residents customize
with re-found materials,
the building personifies
the spirit of its dwellers,
a messy composition
but distinct in its character,
the built space,
evolving over time

Growth possibilities

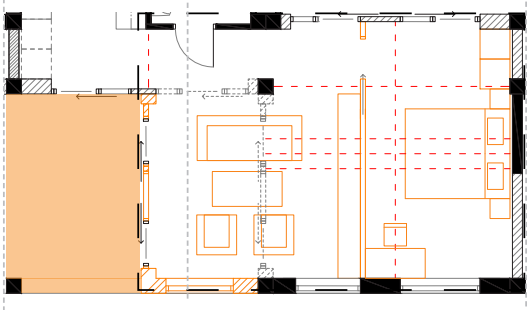
changes to type 1: single unit

A lot of work was put into making sure that the extensions would be possible to do in different ways and in incremental steps, either using the engawa-wall modules or building the walls from scratch, as shown here by the orange colored walls. Over time, the residents can adapt the apartment to their spatial needs and grow into the extendable spaces, which when left undeveloped could be used similarly to what was shown in the image on the previous page.

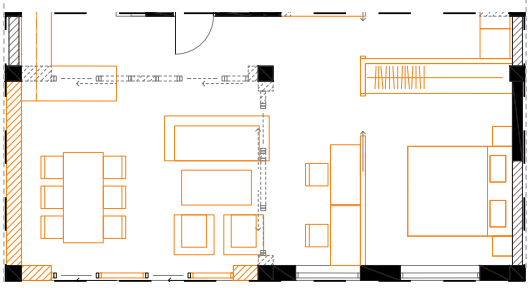


Complete extension, divided into narrow core apartment

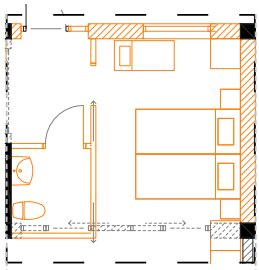
Half extension for dining space, re-used engawa module, new guest room by the entrance



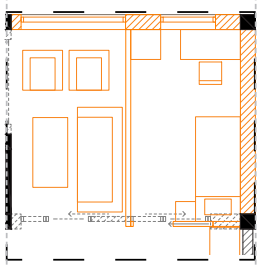
Half extension, re-used engawa module, cross direction, increased living room



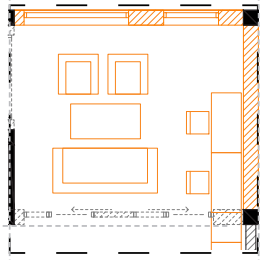
Complete extension, new material, expanded kitchen, dining space and living room



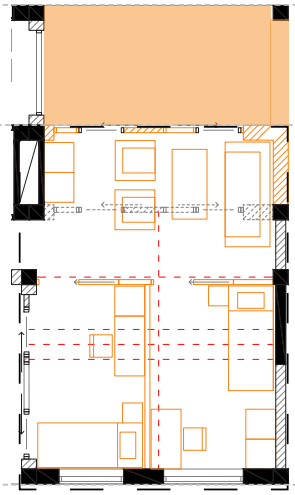
Full extension, extra bathroom and semi-autonomous bedroom



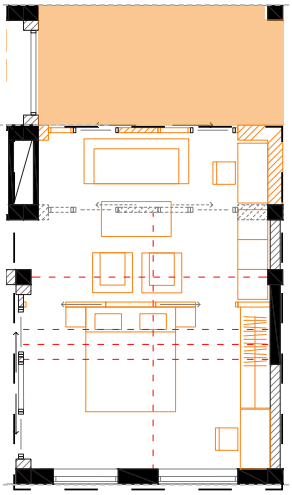
Full extension, two smaller rooms



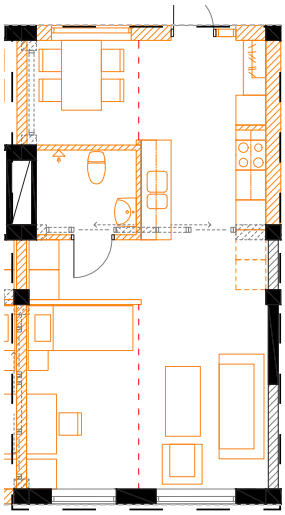
Full extension, big rooms



Half extension, re-used engawa module, small living room and two bedrooms

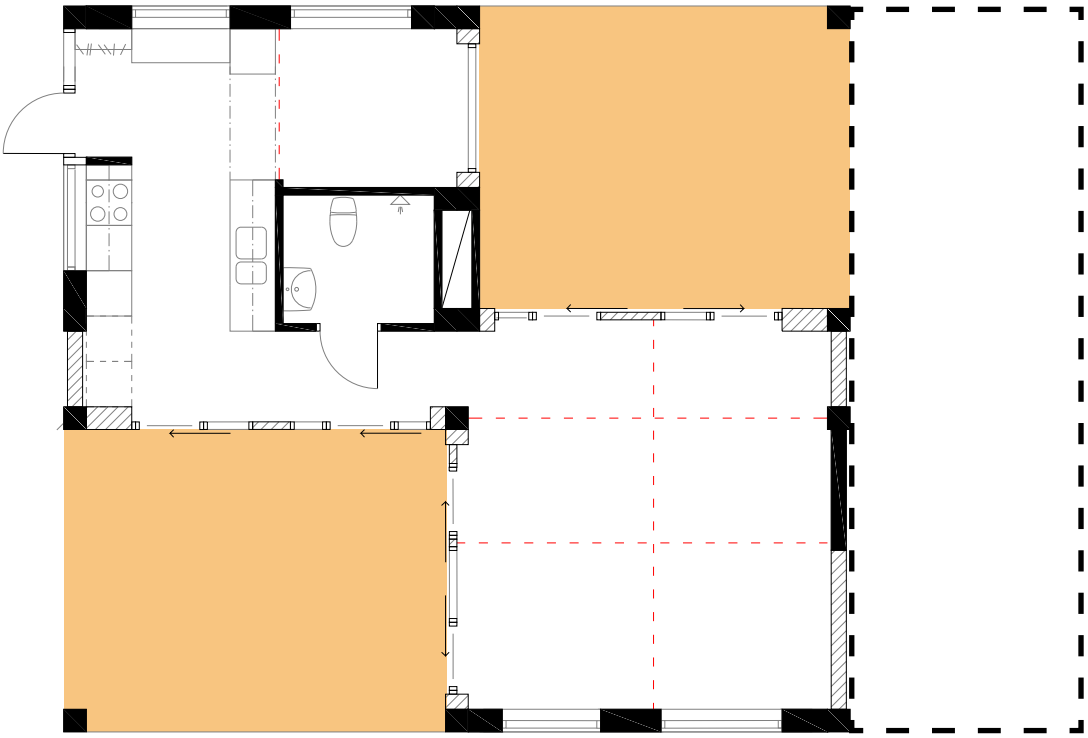


Half extension, re-used engawa module, two big rooms of proper size



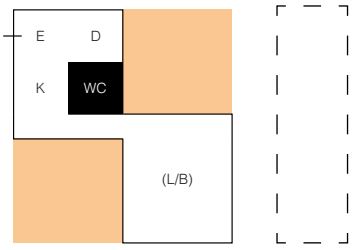
Complete extension, divided into narrow core apartment

Extended apartments



Type 1: single apartment
Growth & Divisions

Following are some extensions and adaptation scenarios showcased in its entirety in floor plans.

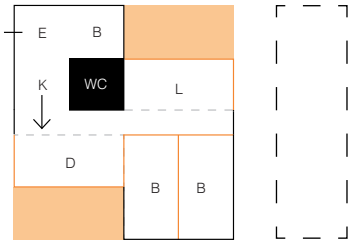


core apartment

E = Entrance
D = Dining space
K = Kitchen
WC = Bathroom
L = Living room
B = Bedroom
W = Workplace

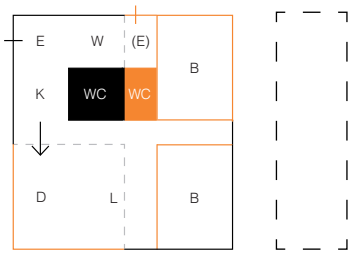
= core apartment
= bathroom
= extendable space
= elastic space
= extension facade
= added bathroom

legend



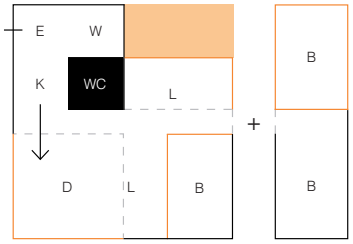
half extension front & back

Partial extensions in both façades for more generous floor space, possible to do early on upon moving in.



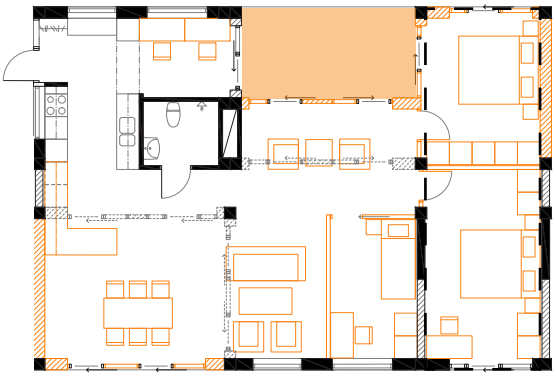
complete extension

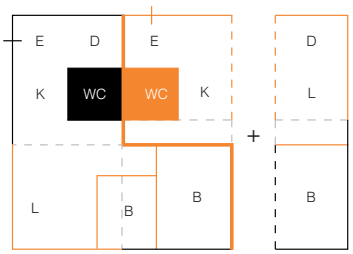
Fully grown apartment with additional bathroom and a secondary entrance



partial extension + elastic space

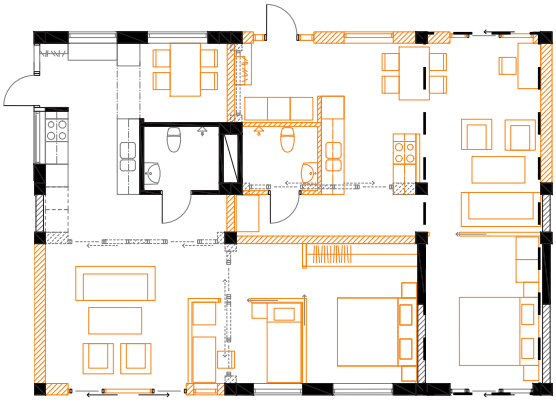
Family of 5, needing a bigger kitchen and more bedroom arrangements



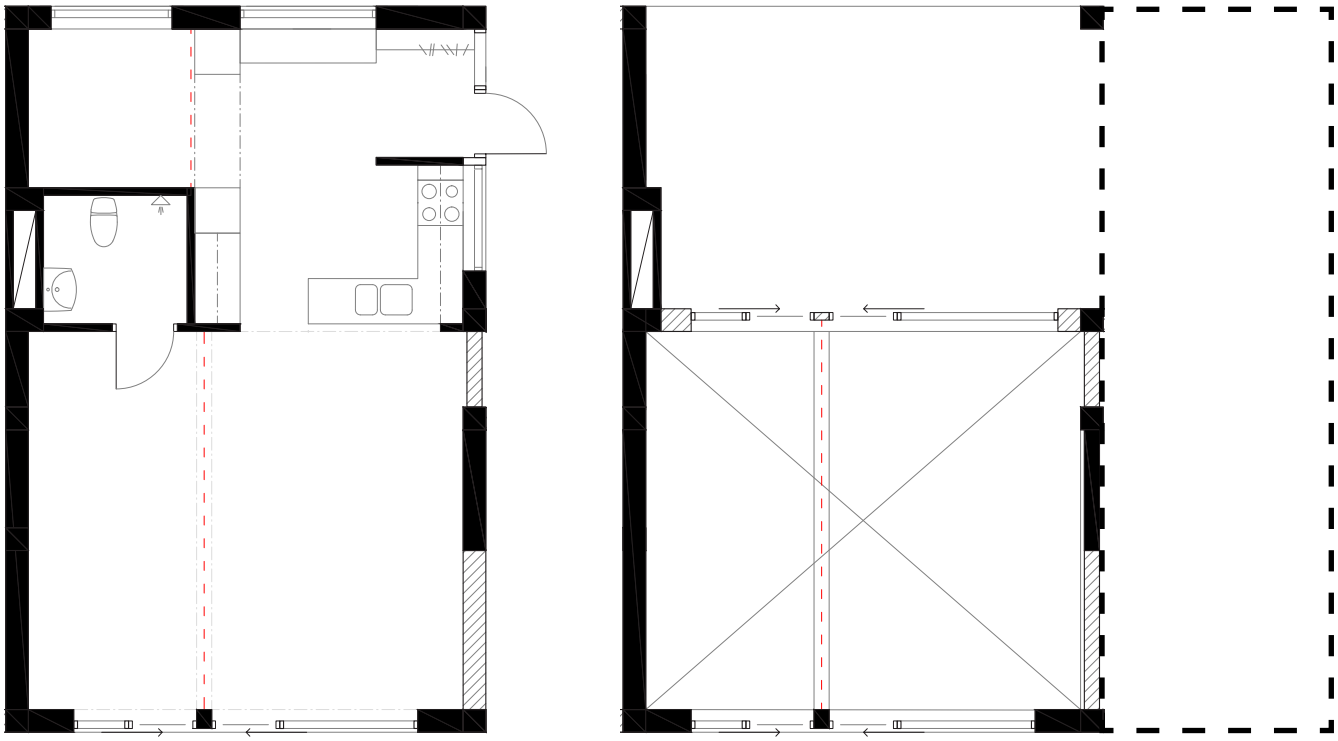


complete extension + elastic space -> partitioned

After kids have moved out, or the private economy have faltered, the homeowners can sell of and partition their dwellings and create new apartment configurations

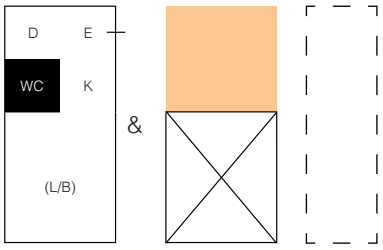


Extended apartments



Type 2: duplex apartment
Growth & Adaptations

The duplex apartments have more limited extension possibilities, but the big vertical space offers a lot of potential for internal customization.

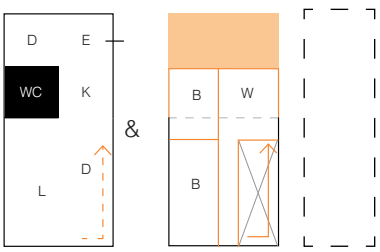


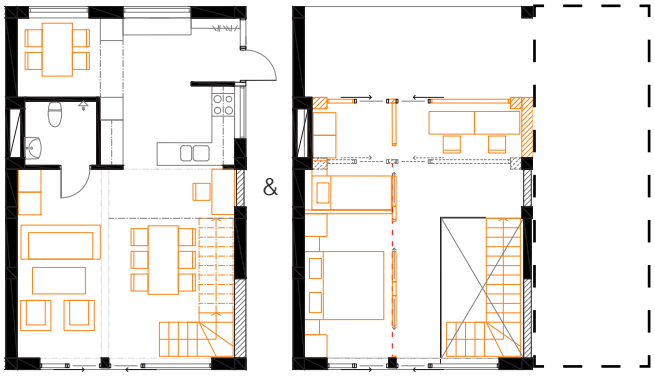
core apartment

E = Entrance
D = Dining space
K = Kitchen
WC = Bathroom
L = Living room
B = Bedroom
W = Workplace

= core apartment
= bathroom
= extendable space
= elastic space
= extension facade
= added bathroom

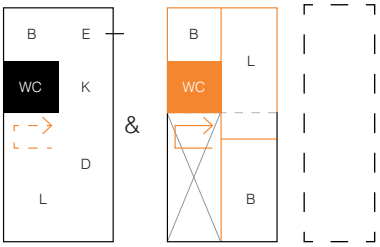
legend

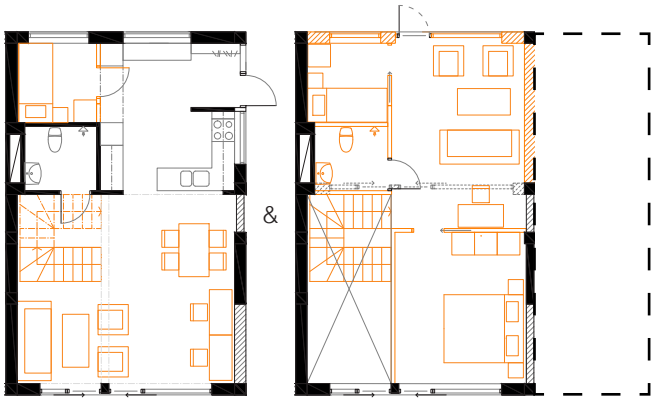




partial extensionl

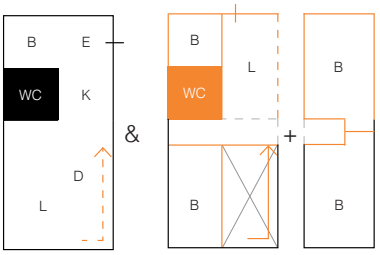
A partial extension is possible to have a bit more space on the top floor without covering the whole space with a mez-zanine floor.

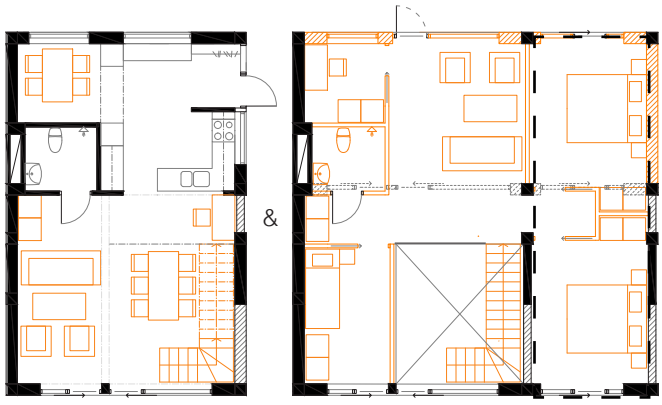




complete extension

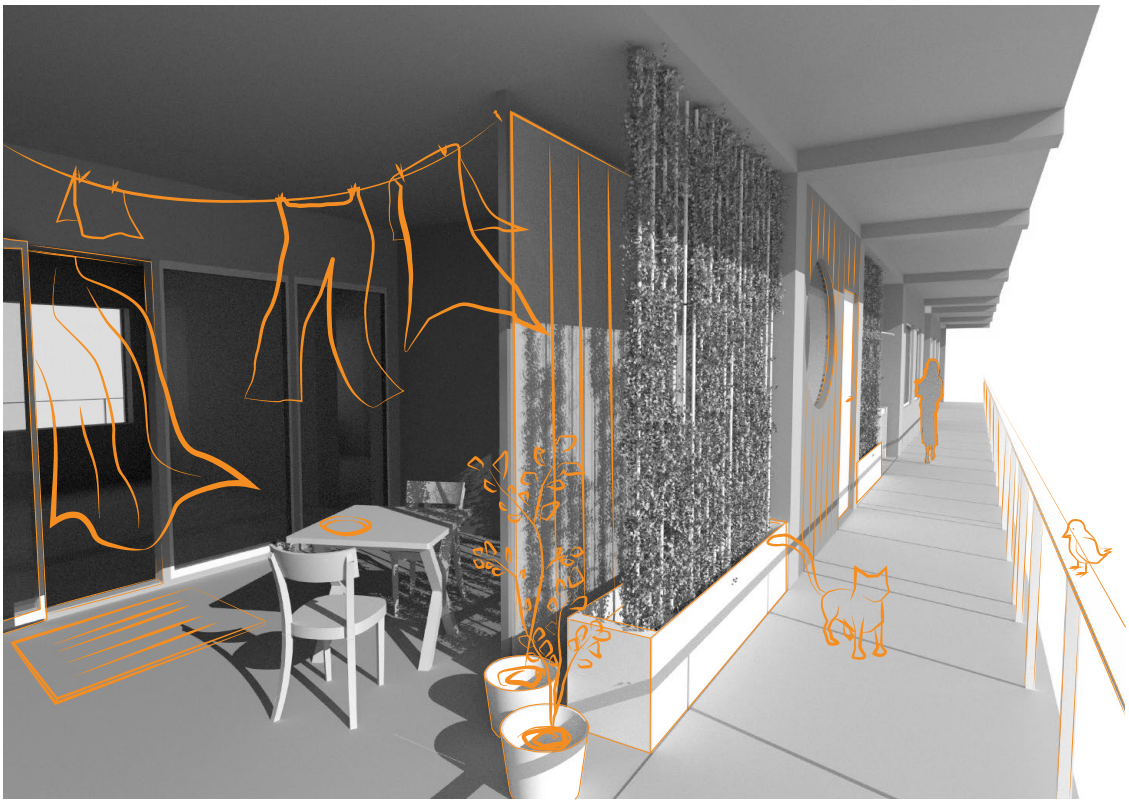
After its full extension the internal apartment layout becomes similar to a row house, with public spaces on the entrance level and more private above.





complete extension + elastic space

The duplex apartment gains a lot of qualities from incorporating the elastic spaces, able to accommodate a large family and several guests.



Exterior perspective - access balcony during its evolution

The extended space could be loosely furnished instead of extended into, becoming a larger outdoor space during the warmer months of the year, which could be screened or fenced of according to personal preferences regarding private and public spaces.

7. Discussion

Conclusion
Reflections

Conclusion

This thesis have investigated incremental housing and self-building movements by doing case studies on relevant projects, which supported the following design proposal with possible solutions and techniques to make the concept more feasible. It has analysed a vast catalogue of information and extracted some key aspects that are necessary to balance for an incremental housing project in Sweden, and related those to the fundamental design principles which the proposal itself is based on.

This proposal aimed to assert itself as a new housing typology, or at least an updated version of the classic lamella, where the partially constructed building over time evolves and grows according to the needs and requirements of its residents. Essentially the proposal is a system and possible method of designing the initial framework which the users then takes charge over, a balancing act of architectural qualities and residential empowerment with the end goal of the architect relinquishing control over the design after its finalization. The simplicity of the initially built apartments is contrasted in the residents own customization, giving each apartment and building a character entirely unique from its peers.

To illustrate its potential as a general housing typology, possible to be implement in a number of different contexts, it was developed separately from any site but later inserted to a site in Kortedala that suited the established narrative and aim of creating affordable and long-term housing opportunities. The inherent potential to make adaptations and create diverse apartment sizes makes it possible to stay and re-configure the home instead of moving away due to changes in the life conditions. By relying on self-building methods and communities, the IKEA-effect (where people feel a deeper connections to something they had a part in making) and long-term financial incentives such as property value to guarantee the quality of any changes, the residents should be able to form a long-lasting bond with the home and their neighbours.

The final proposal is only one way of reaching the aim of the thesis however, and not everything was possible to solve and figure out whiten the boundaries of a master thesis project. Complicated issues such as the technical requirements or the organization and financial possibility to develop this project only approached it on a surface level and were unable to come to a clear definitive suggestion on their resolutions. Thereby the thesis can in some ways be viewed as unsuccessful and not reaching its initial aim, as one of the research questions related to investigating how to make the proposal feasible in a Swedish context. It is however a starting point for discussing affordable housing architecture, and that the building codes and norms in the praxis is not enough to cut costs for new housing development. The thesis visualize both this problem and the potential of new approaches that dares to ask something from the users themselves, something the Swedish building code was not designed to do.

Reflections

Cutting costs, apartment price and ownership

The final costs of the apartments was difficult to calculate. It was moved here because due to time constraints and the complexity in this project it was only possible to do a quick estimate. Due to it being a special and "new" typology, no contemporary reference project of similar scale and context could be used as a basis, so instead the apartment price is based on some figures of cost-savings discovered and mentioned in the theoretical chapters, namely those relating to how relying on self-building by the users and raw interior surfaces could cut between 10-30% of the initial construction costs. The modularity and pre-fabrication potential within this project should be able to cut costs even further, but no definitive source on that resulted in the estimation that at least a 20% reduction in costs and price for the dwelling is reasonable.

Comparing with the mean average of newly developed housing projects in the vicinity of the site in Kortedala by use of Hemnet (hub for selling homes), the price reduction of 20% would net a price per square meter of about SEK 40 000, and an estimated price of the initial Type 1 apartment of 51m^2 to roughly SEK 2 040 000. Which is not that affordable for first-time households with all things considered, and does not even take into account the unbuilt external spaces, the cost of which the developer have to pay for according to the current market system. Most likely it would be built in the public housing domain, since municipalities could financially take an immediate hit but make contracts that becomes profitable over a longer time frame than most companies can afford to, as seen with the Egnahemsrörelse a century ago.

It is also possible that the pre-fabrication and modular construction methods can cut costs significantly more, but even with a 30% price reduction we still land at roughly SEK 1 800 000 for the smallest apartment. Some subsidies would therefore be needed to make it accessible to the target clients, or perhaps initially it can be sold as a rental apartment with a big outdoor space, and upon doing any extensions the residents can pay and receive complete ownership of the entire space or a part of it, giving them full control to develop or sell or sublease the space of to their neighbours. By signing longer forms of lease which guarantee the right to make changes and extension to the living spaces it might be possible, but no such system is in place today so it would be a difficult road to go down on.

While this project is not made with the intention of a Joint Building Venture, since the target users are not a significant part of those projects and it is exclusive by nature, given that the proposal has a lot of potential for personal customization to each apartment, it could theoretically be made as a JBV as well. The benefits with applying the design principles developed in this thesis is that instead of waiting for a house to be completely finished before moving in, this can be done much quicker by using the proposed typology as a "Catalogue house 2.0" to establish the framework for the future customizations of the building venture, only adapting the number of floors and initial size to suit the collective budget..

Method and process

Structure:
More focus on the structure earlier would have been appropriate, and go into details regarding insulation, thermal protections and how the additions would be attached to the initial core structure by the residents.

Self-build and amount of hours:
There was an ambition in the design process to calculate and estimate the amount of time it would take in regards to hours spent to make an extension of my proposed size, which would have impacted the design.

Interviews from case studies:
It could have aided to ask people from Däckshuset how they saw their homes, but the design went another direction early on, and the target group in that project and for my own proposal was so different, that the result would probably not have yielded relevant answers. Instead reaching out to people in self-building projects and discussing its feasibility would have been more beneficial, but a lack of response and time to implement all ideas and theory into the design meant that focus had to be put elsewhere.

Up-scaling

A multi-storey building causes some difficulties regarding ownership and affordability compared to a villa or row house, as the creation of the supporting structure itself and the "empty" volumes upon construction increase all of the costs and is a financial risk for the developer. Most likely it would result in higher prices and sever any affordability, regardless of tenancy-model. However, with the potential of a larger demand and pre-fabrication methods to industrially mass producing the structure with the core apartments, these costs could fall within a margin of affordable houses for first-time households. Since a lot of space is left for each homeowner to customize the appearance of their exterior according to specific site conditions and personal wishes, each building would essentially be very different from its siblings, removing it from any comparisons to the modernistic and identical housing mass housing projects of the 60s. If the Swedish government would once more start investing in developing a new housing program for the 21st century like it did then, this proposal could act as inspiration for such urban planning projects.

Design choices

Structure & feasibility:
Some things was not able to develop completely to the degree of realisation as a built project today, and would require further studies and time to reach that level of feasibility. Particularly regarding its construction and the many problems with thermal bridges that arise from the way the modular system is designed. It would have been appropriate to investigate further the complexity that comes with changing and moving the thermal boundaries of a building. As it stands now, energy losses due to cold bridges through the structure will last to some degree after all extensions have been made, and some level of thermal discomfort will therefore have to be accepted by the residents of this typology. Regardless, since this proposal places the users in a place of power after the buildings initial construction, any modification on an individual level to the apartments in terms of extra insulation is perfectly in order.

Site:
It was designed largely without taking into account the site, therefore its general shape and spatial qualities was made to be able to place it in many different contexts without too much adaptation to local situations. However, the general area, that of a suburb with a mass housing-history, was always the goal and most likely effected some design decisions. Some of the chosen scenarios and hypothesizes regarding how the apartments could grow or adapt, and how the extensions would most likely be used, was influenced a by what could most likely occur in the local context.

Initially good vs. greater potential:
A big part of the project revolved around finding the proper balance between good room spaces upon construction, which could be adapted and changed a number of different ways, and having an affordable home with a greater potential for change. In the end, the design veered on the side of affordability by attempting to build less initially, which resulted in some narrow and tight floor plans when dividing the open spaces. The argument is that over time, as the building grows larger, the extra space needed to create more appropriate sized rooms will come, and with it the apartments will become even greater, thus providing an incentive for the residents to make the investments to their homes.

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Most reference figures have been modified to only show black and white.

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Fig. 26: O'Brien, A., & Carrasco, S. (2020). Diagrams of evolution over time [Illustration]. *Contested incrementalism: Elemental's Quinta Monroy settlement fifteen years on*. Higher Education Press. https://doi.org/10.1016/j.foar.2020.11.002.Reprinted with permission.

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8. Appendix

Quinta Monroy
Däckshuset

Quinta Monroy

Architect:
Alejandro Aravena,
Elemental

Location:
Quinta Monroy,
Chile

Built:
2003

One of the most prominent examples of incremental housing is the "half-houses" made in 2003 by the aforementioned architect Alejandro Aravena at Quinta Monroy in Iquique, Chile. The project received critical acclaim globally and was adopted in a number of other social housing schemes in Chile in the years that followed, expanding on the initial concept and adapting it to new contexts. (Carrasco & O'Brien, 2021) The project sought to replace the informal settlements in Quinta Monroy with middle-class housing that offered better living conditions to the 100 families currently residing illegally in the area. The size and design of one initial unit, around 30 m^2, was heavily influenced by the current Chilean housing subsidy of in total US $750,000 for the 100 units, that had to cover the cost of land, infrastructure and architecture. According to Aravena (Archdaily, 2008), the land price was considerably higher than in normal social housing projects, but as shown in a report by Weiner et al. (2016), the location being more central and closer to work opportunities is vital for the success of a social housing project.

The units were configured and constructed with the intent to double in size to approximately 72 m^2 per family home, thus initially only including the necessary amenities and functions that could not be provided at a later stage by the family themselves, such as the load bearing structure, plumbing, stairs and kitchen. With the units stacked on top of each other like urban row houses, each plot provided housing for two family homes and the supporting structural framework that allowed expansion without interfering with any of its neighbours. (Carrasco & O'Brien, 2021)

These borders for the expansion where however often crossed by the residents after a few years, as observed by Carrasco & O'Brien (2021) when they returned 14 years after project completion. Informally constructed additions like extra rooms and balconies were considered to have negatively affected the living conditions for the residents regarding amount of space, daylight and airflow, becoming in some cases similar to their previously informal settlements and creating a risk of fire on several occasions. Many of these additions was a result of an expanding family situation or to create space to be rented out to outsiders, showcasing that at least the evolving and adaptable aspect of the concept worked in reality and that the homes could become a source of income to the residents in the future. According to their survey among the residents, negotiation with neighbours for the expansions where often necessary and could lead to deteriorating relations if done poorly. The very minimal direction from the architects in how to expand and customize their homes, basically recommending using lightweight walls and suggesting which material would be suitable where, felt for many to be a bit lacking and was identified by the surveyors as something that could have maintained quality living conditions longer (Carrasco & O'Brien, 2021).

Fig 4. Quinta Monroy
(© Elemental)

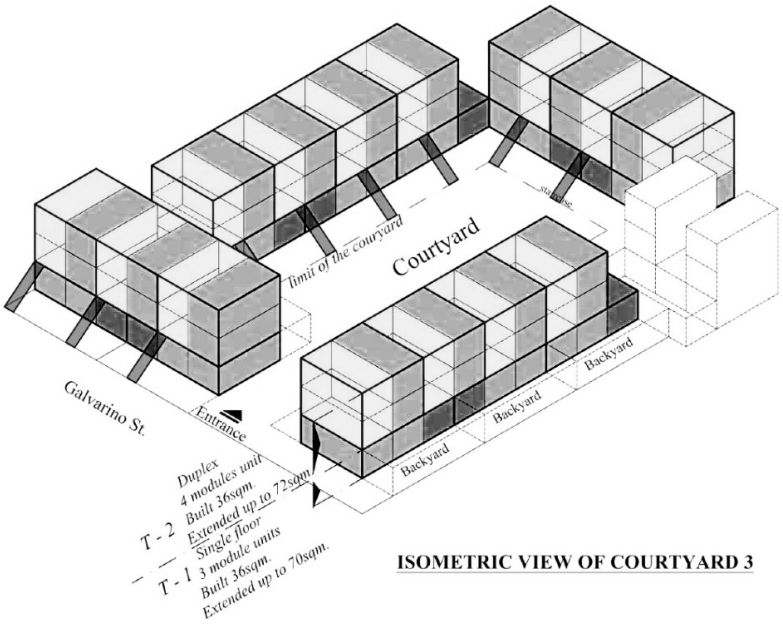

Fig 25. Isometric view of courtyard 3. Printed with permission.
(Carrasco & O'Brien. 2021) Reprinted with permission.

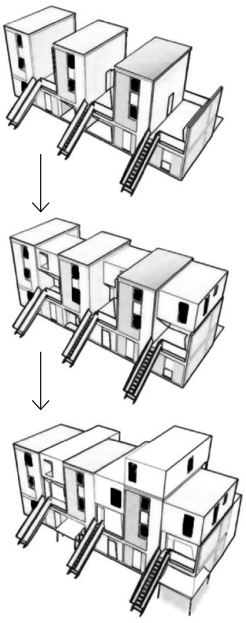

Fig 26. Diagrams of evolution over time.
(O'Brien & Carasco. 2020).
Printed with permision

Däckshuset

Architect:
Erik Friberger

Location:
Gothenburg,
Sweden

Built:
1960

Däckshuset (lit. “The Deck-House”) in Kallebäck, Gothenburg designed by Erik Friberger in 1960 shows how the idea of incremental housing can be applied in a Swedish context. Despite initial excitement and international curiosity, it did not inspire a change in building typologies in Sweden. If that was due to a failure of concept or the contemporary resentment towards participatory design is however still debated.

Built with the idea of “vertical villas”, free-standing houses with their own roofs were stacked on top of each other on a concrete shelf. Its aim was to offer to the residents the freedom and customizable empowerment that comes from owning your own private house in combination with a more urban setting in difficult terrain, which was indeed the main appeal to most of the residents. Other than the shelf-like structure, staircases and plumbing fixtures, little else was provided to the tenants initially. Each floor was divided into four segments of 10m deep and about 144-210 m^2, with each staircase reaching two of said plots, and sold to the tenants as a form of housing plot in which they could freely design their new villa within. A system of wall elements that could be anchored to the concrete floor slab was created to guide in the design, that successfully fulfilled their intentions of making the outer roof, cladding and floor plans fully customizable to the individual requirements of the tenants (White Arkitekter, 2018).

However, not all things went according to plan. Contrary to the architect’s idea, almost all the tenants choose to maximize their plots and build on it entirely, resulting in a much more closed of property than initially conceptualized. Perhaps this was due to the central and quite luxurious location, which attracted a wealthier clientele than intended. The planned balcony gardens were also not realized due to the difficulties in construction and increased costs that would have resulted from planting 80 cm of soil on the overhanging outer balcony slabs.

Fig 5. Däckshuset exterior
(GP)

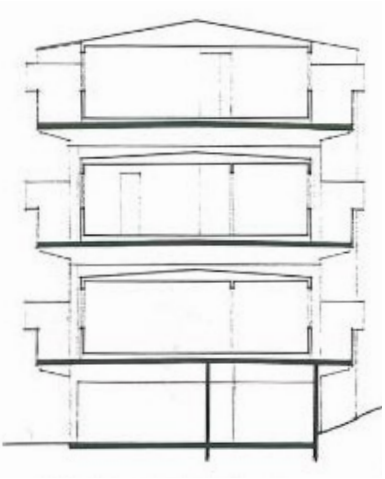

Fig 27. Däckshuset original drawings
(Friberger, E)

Fig 6 . Däckshuset gable
(White Arkitekter. 2011)

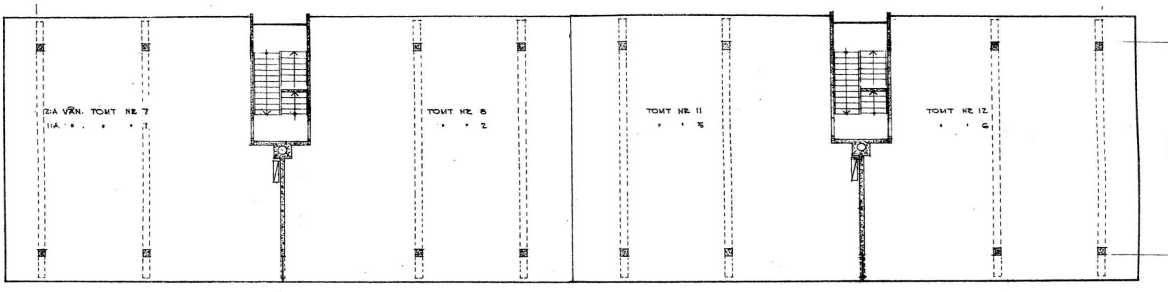

Fig 27. Däckshuset original drawings
(Friberger, E)

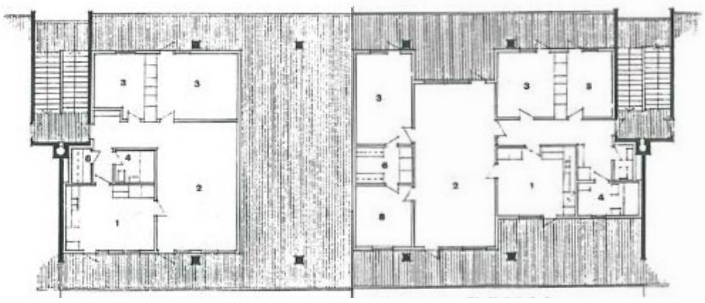

Fig 27. Däckshuset original drawings
(Friberger, E)

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