



Provide and Pre-choose

Arrangement

Visibility and Attractiveness

Ownership

Community and Commitment

Visualized Info and Feedback

A Nudging Home

a home full of strategies facilitating a sustainable lifestyle

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Spring 2023

Examiner: Anna Braide
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Architecture and Planning Beyond Sustainability, MPDSD
Master's Thesis
Spring 2023
Direction: Housing

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Abstract

We stand in front of an urgent global challenge and the climate crisis is a fact. One part of the solution is a transition to a more sustainable lifestyle. Our lifestyles are a result of activities and daily choices in our home, making the home a perfect arena for making a change.

The purpose of the thesis is to explore and answer the two research questions:

1. How can nudging strategies be used in residential architecture to support and promote sustainable lifestyles?
2. What would such a nudging home look like?

Nudging is an umbrella term for a number of strategies which alters the choice situation to encourage the user to take a certain action, without infringing on their free will. Nudging is used to influence people to do more long-term and sustainable actions, for themselves, our planet and society. One nudging example is to put the vegetarian alternative at the top of the lunch menu, which increases the sale of the dish drastically.

Swedes are willing to change their lifestyles to lessen their climate impact. However, there is a gap between intention

and actual behavior. Nudging can bridge this gap and facilitate a change to a more sustainable lifestyle.

Through research, case studies, site visits and interviews, nudging strategies have been collected and transformed into an architectural toolbox. The toolbox consists of six strategies divided into different tools and examples of tangible interventions. The toolbox provides examples of interventions for different stakeholders, but the architect's role has been emphasized.

The toolbox is applied and tested in a design project in an emerging part of Västerås. The proposed nudging multi-family housing block puts the bike at the forefront and is organized around the shared spaces and functions. The building is presented in architectural drawings showcasing the nudging interventions.

The thesis sheds light on the importance of designing for sustainable lifestyles and contributes to the discussion of what future multi-family housing will look like. Nudging is not the single answer to the challenges we are facing, but can be one important puzzle piece.

Keywords: Nudging, Sustainable lifestyles, Housing, Architecture, Toolbox

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Figure 1. Facade of a Nudging Home.

Introduction

The interest for Nudging as a concept and the will to immerse ourselves in a housing project laid the path for the thesis. In the transition to a more sustainable building sector, a lot of focus is paid on the development of new building methods, materials, and structural solutions. But there are more aspects to develop to achieve the Sustainable Development Goals. The Paris Agreement says:

“...sustainable lifestyles and sustainable patterns of consumption and production [...], play an important role in addressing climate change,”

(UN, 2015, p.2)

However, how architecture and sustainable lifestyle aspects interact have not been studied extensively during our education, but something we found to be an exciting topic worth exploring further. Choosing the topic for our master thesis resulted in an investigation on how to use nudging strategies in a residential context, to facilitate a sustainable lifestyle. The more we learned about nudging and the translation into architecture, the more certain we became that the combination is an important part in the transition.

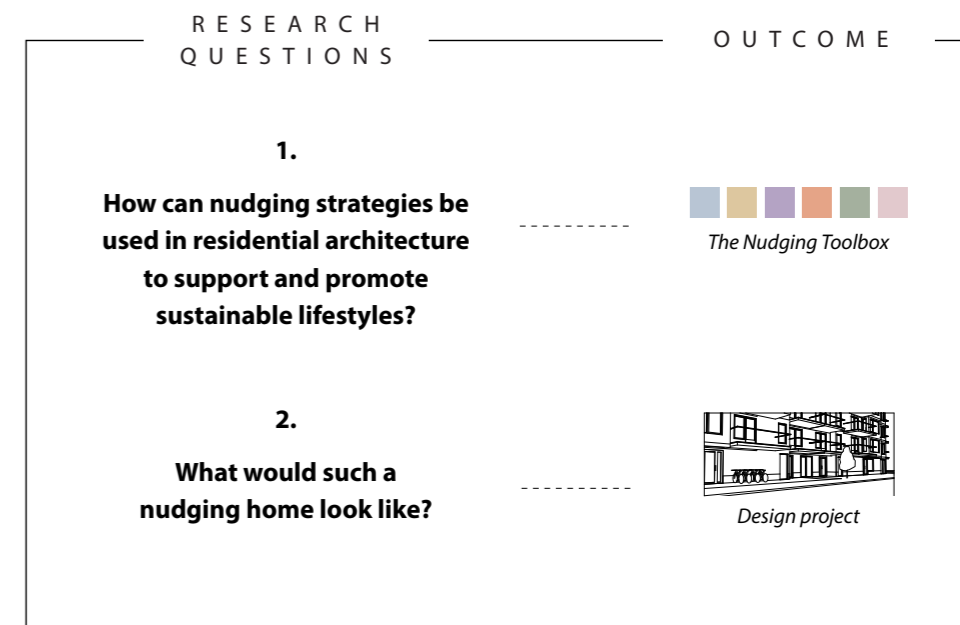
Purpose and aim

Purpose

This thesis explores the field of nudging strategies incorporated in residential architecture, with the goal to make it easier for people to make sustainable choices. We want to make the threshold for a sustainable lifestyle as low as possible and target everyone, also those who do not actively live a sustainable lifestyle today.

Aim

The thesis aims to develop knowledge and strategies to use in the design of our homes to lower the emissions from individuals' everyday choices, while at the same time achieve a social sustainability within the neighborhood. We want to add to the discourse on sustainability in general and sustainable housing in particular: The choices by the designer drastically impact peoples' ability to live a sustainable lifestyle. Architects have a great responsibility in this regard.



Outcome

1. A Nudging Toolbox with nudging strategies and tools that can be used in our homes by different actors, including architects.
2. A design project where the Nudging Toolbox is tested in a specific context, with focus on the aspects that architects can influence.

Method

This thesis is based on literature studies and theoretical research of the fields of nudging, multi-family housing architecture and lifestyle. By summarizing the research of nudging a base of nudging strategies is formed, which is then translated into a Nudging Toolbox for the field of multi-family housing architecture. Supporting activities for this translation are workshops, interviews and studies of reference projects. The toolbox is then analyzed in regard to the involved stakeholders, defining what part of the toolbox is the architect's arena.

The final part of the thesis is an implementation of the Nudging Toolbox. The nudging strategies are tested in an application project in Västerås and the output from the testing feeds back into the toolbox. The process is therefore iterative, bouncing between refinement of the toolbox and application on a specific site. Sketches, illustrations, drawings and diagrams are tools used in the design phase. The final toolbox and design project is the result of this iterative process.

Delimitations

The thesis is written in a Swedish setting and the toolbox is applicable in a contemporary, urban context. Specifically, the interventions exemplified in the Nudging Toolbox is developed for an urban, middle class multi-family-housing area. If used in other contexts, one has to redefine obstacles and motivators for sustainable behavior and develop nudging interventions from there. The strategies presented in the toolbox stay the same.

Due to limited possibility to calculate costs, building cost of the proposal is only regarded in general reasoning, imagining a housing developer who is interested in trying a new concept focusing on sustainability.

There is already research, developed methods and certification systems for ecologically sustainable buildings. This thesis focuses on the building's effect on the lifestyle of its residents, with only a general reasoning around building materials, methods, technical systems and structural engineering solutions.

The design project aims to test the strategies and tools of the Nudging Toolbox in a specific context: a new urban, well-off multi-family-housing neighborhood, where the general plan is the base for our proposal. The toolbox is not tested in any other setting, nor in renovation of an existing building, even though the strategies and tools (and some of the interventions) can be used in those conditions as well.

Glossary

Nudging A grouping of strategies which alter the choice architecture/choice situation to encourage the user to take a certain action without infringing on their free will (two examples of classification of nudging strategies are given on pages 18-19).

Choice architecture The design of the physical and digital environment presented to people when deciding about an action, for example the number of choices presented, if there is a default-option and how and where the options are presented.

Behavior An action that can be captured on film..

Lifestyle The collection of a person's behaviors, constituting a person's way of living.

Strategies In this thesis, general guiding principles for stakeholders designing and maintaining a residential building to achieve a nudging home.

Tools In this thesis, specific instruments to achieve a nudging home (a sub-category to strategies).

Interventions In this thesis, specific examples of design actions one can take to achieve a nudging home.

Sustainable functions Functions which allow a sustainable lifestyle, for example shared belongings, vehicle pools and shared spaces.

Necessary, possible and social activities Necessary activities are everyday activities we need to do, (i.e. eat, sleep, do laundry...). Possible activities are those we can choose to do or not, for example spending time in the yard or in a shared space. Social activities arise when we spend time and engage ourselves. Best conditions for social activities are when the spaces are attractive and people feel welcome and safe (Gehl, 1980).

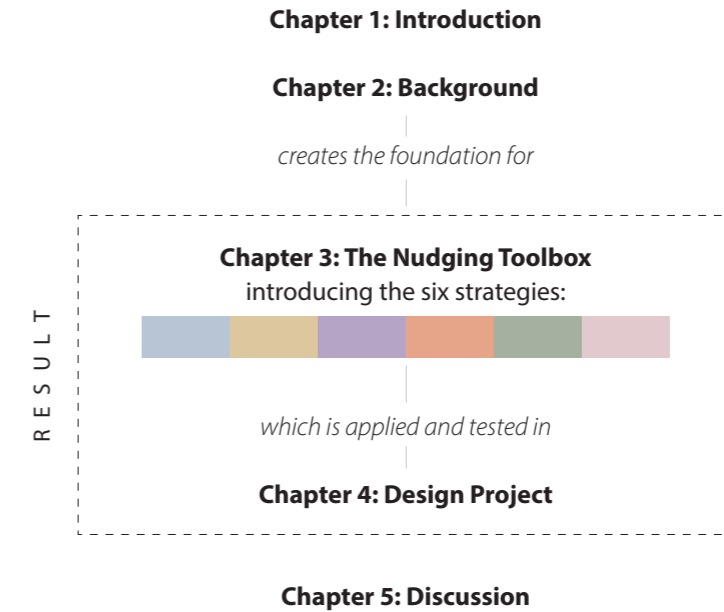


Figure 2. Chapter structure for the booklet.

Reading instructions

The thesis is divided into five chapters: Introduction (current chapter), Background, The Nudging Toolbox, Design Project and Discussion (Figure 2). Each chapter starts with a colored spread and is then marked on the edges of the pages.

Throughout the booklet, we will present graphics and body text. When we are concluding something from the graphics or body text which we will use for our outcome (toolbox and/or design project), it will be written in this colored, italic font.

The toolbox is divided into six strategies, each with its own color. These colors are used in the Design Project to refer back to the strategies from the toolbox, by underlining the text with the color of the strategy.

The thesis is presented in two ways, the full booklet and a folded flyer which is easy to distribute and summarizes the toolbox and how to use it. By this, we hope to reach as many readers as possible and the most important knowledge will be graspable in a quick and fun way.



Figure 3 and 4. Two examples of successful nudges towards greener eating habits:

When designing the registration form for an event, the vegetarian meal option was put as the default option. This resulted in 90% of the attendees choosing the vegetarian option (compared to 12% the previous year when the meat-option was the default one). (Beteendelabbet, 2018)



Carrots were placed by the minced meat and beans by the taco products to target the two most popular meat dishes: pasta bolognese and tacos. The customers were encouraged (by the placement, with notes and guiding "green" steps on the floor) to use the vegetarian options in their bolognese and taco. The sales of minced meat were reduced by 917 kg and the sales of beans and carrots increased by 956 kg. (Beteendelabbet, 2016).

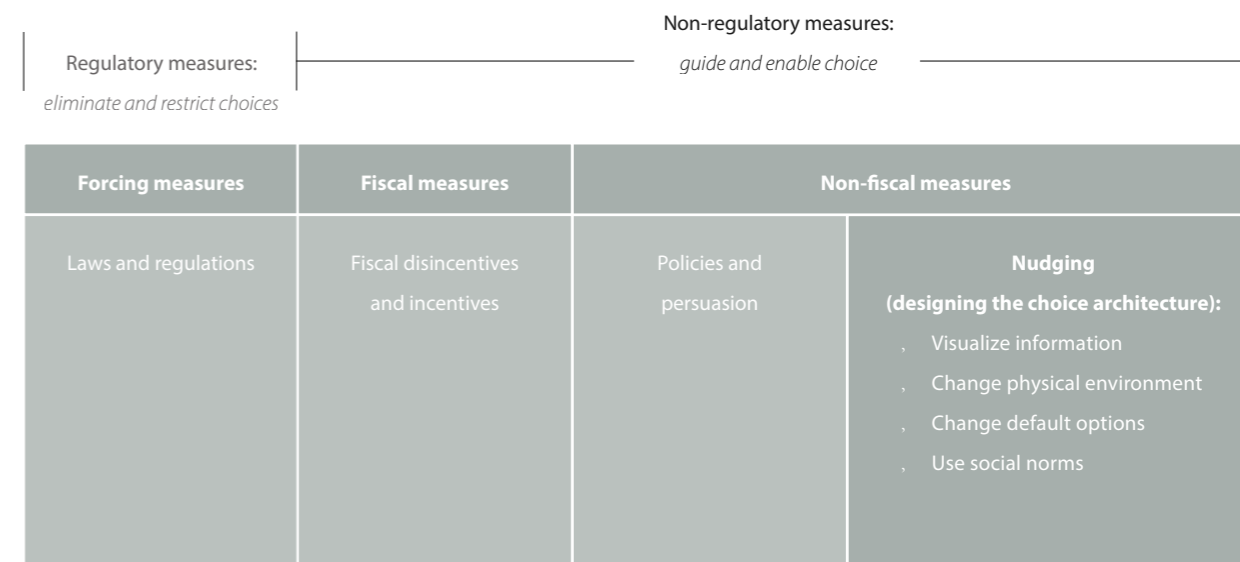


Figure 5. Types of measures to affect the individual's behavior. Adapted and simplified from House of Lords, 2011

What is nudging?

It all started with a sticker in a pissoir at Amsterdam airport in the early 2000s. By sticking a fly close to the outlet, the urine spillage was reduced by about 80 percent as visitors paid more attention and accuracy to aim at the fly (Thaler & Sunstein, 2008). This small intervention and its great result made Richard H. Thaler and Cass R. Sunstein curious, which resulted in the book: Nudge — Improving Decisions about Health, Wealth, and Happiness. In the book, the concept of nudging is described as:

“A nudge, as we will use the term, is any aspect of choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly changing their economic incentives.”

(Thaler, R & Sunstein, C. 2008)

Today, nudging is a wide, and somewhat undefined, grouping of strategies which in some way alter the choice architecture and/or choice situation to encourage the user to take a certain action (two examples of classifications of nudging strategies are given on pages 18-19).

Nudging can be used for commercial purposes, but in our and many others’ work, the goal of nudging is to promote sustainable and long term behavior for the individual and the society, without infringing on their free will.

Since the behavioral science concept of nudging was popularized by Thaler and Sunstein in 2008, interest has increased and a number of studies have been published (Lemoine et al., 2019). Today, nudges are used in many different sectors (Norén, 2018). Examples of nudging by governments have been found, for example in the UK, Germany and Japan, as well as internationally by UN, the EU and OECD. With this thesis we hope to contribute to the topic from an architectural point of view.

What counts as a nudge?

To understand what nudging is, one can define what it is not. There are several ways to achieve a change of behavior, shown in the table above (Figure 5). To the left the forcing measures are placed, the further towards the right, the looser the measure. Nudging is defined as a subgroup to “non-regulatory and non-fiscal measures” at the far right of this spectrum (House of Lords, 2011).

Thaler and Sunstein give the example: “Putting the fruit at eye level counts as a nudge. Banning junk food does not.” (Thaler & Sunstein, 2008). By designing the physical and digital decision-environment (the choice architecture) the designer can utilize the cognitive biases of our brain to promote a certain behavior. This is what the next chapter will explain.



Figure 6. An AI-generated illustration of the automatic and reflective cognitive system working together to make decisions (Dall-e, 2023).

SYSTEM 1 THE AUTOMATIC SYSTEM

Fast, unconscious and automatic

Used for everyday decisions

SYSTEM 2 THE REFLECTIVE SYSTEM

Slow, conscious and effortful

Used for complex decisions

Why does nudging work?

To understand why nudging works and how to succeed with a nudge to behavior change, we need to take a closer look at how our brain works and how we make our decisions.

The two cognitive systems

We have two types of decision systems, one for quick and simple ones, called the automatic system, and the second one for more considered and slow decisions, called the reflective system, shown in figure 6 to the left (Thaler & Sunstein, 2008). The reflective system is used when solving a math problem or doing something you are not used to, such as learning to ride a bike. The automatic system is used when grabbing a pasta package in the supermarket, or doing something you are used to, such as brushing your teeth. Research shows that 95% of our behavior is controlled by the automatic system (Lakott & Johnson 1999 from Martin 2008).

Cognitive biases

Thaler and Sunstein (2008) claim that in our busy and complex world, we often have to make quick decisions, not having the time to consider our choices. Consequently, we don't always make the most rational decision, or the best choice for either ourselves or our fellows. This is the result of so-called *cognitive biases*. These cognitive biases can be summarized (from Lemoine et al., 2019 and Thaler & Sunstein, 2008):

- , We tend to make decisions that benefit ourselves right now, and not in the long-run
- , We are inherently lazy and often choose the option that requires the least effort and is framed and presented in the most appealing way
- , We are highly influenced by social norms and tend to follow the big group of people
- , We tend to suffer from “loss averse”: we find it hard to give up what we have, which might make us avoid a change even if it would be to our advantage
- , We sometimes adopt rules of thumbs to simplify the choice situation

To nudge the automatic system

Nudging focuses on influencing our *automatic system*, and takes advantage of our *cognitive biases* to nudge us in a desired direction (Lemoine & Lindström, 2016). Since 95% of our daily behavior is controlled by the automatic system, nudging has great potential. We as individuals are so-called “nudge-able” because of how we make our daily choices, act and get influenced by our surroundings (Thaler & Sunstein, 2008). This is where this thesis takes off

Two ways of categorizing nudging strategies

Nudging is an umbrella term for a number of tools, instruments and strategies that aim to influence people's behavior in a desirable direction. Different publications and sources name and define the strategies in different ways, but similarities are found between them all. Below, two examples of categorizations as well as short explanations of the strategies are presented. These strategies form the basis of the toolbox presented in the section *A Nudging Toolbox*.

Mont, Lehner and Heiskanen (2014) divide nudging into four instruments, A-D:

A. Selection of default options

People tend to choose the default option, which means minimum effort in the choice situation. One example is found in organ donation statistics. In countries where one is registered in a donation program by default (and one actively need to exit if one does not want to participate), the number of members are much higher compared to countries where you actively need to register. (Johnson & Goldstein, 2003). The designer should therefore choose the default option with care.

B. Simplification and framing of information

We are heavily influenced by how information is presented. Some strategies included in this instrument is to simplify the information, make it clear and direct and adjust the presentation for the target group. One can also frame the message by selecting the most important information, leave the other information out and put emphasis on the message.

To give immediate and effective feedback is another way to target and streamline the information flow towards the user.

Beteendelabbet divides nudging into ten strategies, 1-10 (Lemoine et al., 2019):

1. Change the default option

Humans are lazy and want to make things as easy as possible for themselves. To choose the default option means minimum effort for the person in a choice situation. Therefore, alternating the default option has been shown to be an effective way to guide peoples' behavior.

2. Frame the information

The message and the values communicated have a major impact on how we act. The information should be tailored for different audiences.

3. Lead the way — Draw attention to the behavior

Reinforcing and clarifying the desired direction simplifies the choice architecture. For example, green footsteps leading the way to a garbage bin to reduce littering.

4. Give positive feedback

Receiving a reward after a certain action increases the chances that the behavior will be repeated.

5. Make the effect visible

People who have donated blood and gets the message: "Thank you, your blood has now benefited a patient", are more likely to continue to give blood (Carpman 2019 from Lemoine et al. 2019). Inform and remind the user about the consequences in a clear and honest way!

C. Changes in the physical environment

Our choices are highly influenced by our physical environment. One clear example is the layout of the grocery store, where milk (that is one of our most frequently bought products) is placed at the far end of the store. The customers have to pass all other products on their way and will probably buy something extra that was not written on the grocery list (Nordgren 2007 from Mont, Lehner & Heiskanen 2014). Another example is to place the best-selling items at eye level, or candy close to the checkouts, which both lead to an increase in sales of these products (Goldberg och Gunasti 2007 from Mont, Lehner & Heiskanen 2014). In other words, we can design and adjust our physical environment to promote a certain behavior.

D. Use of social norms

We are affected by what other people do: by social norms that are constructed in our society as a whole and by the smaller social contexts we spend our time in. To be the most effective as a nudging instrument, the social norms should be clear and notable (Cialdini and Goldstein 2004 from Mont, Lehner & Heiskanen 2014), and the more we get reminded of them, the more they will affect us. Statistics show that social norms are the most important input for an individual in choice situations, and will therefore affect our own behavior and choices heavily (Cialdini et al. 1990 from Mont, Lehner & Heiskanen 2014).

6. Change the location

Studies show that where and in what order the choices are presented have a big impact on how we will behave. If the salad is placed first on the buffet table, we will end up with more vegetables and less meat on our plate than if the salad is placed last (Dayan & Bar-Hillel, 2011 from Lemoine et al. 2019). The design of our physical environment is therefore important when trying to encourage a certain behavior.

7. Create barriers

Another way is to raise the threshold to undesirable behaviors. However, it is important to distinguish between prohibiting and making the choice more difficult; both choices should still be offered, but the desired one should be more accessible and easy.

8. Provide social proof

When we know what other people do, we often end up in the same pattern. This strategy is about informing about what the people around us and/or the majority is doing to push people in a certain direction.

9. Create ownership

Feeling ownership is a way to increase commitment and create motivation for behavioral change. We tend to overvalue things that we own or have been involved in, which leads to more care and caution.

10. Make it time-bound

A completed deadline gives a feeling of satisfaction and happiness and can motivate us to do something sooner than later. Adding a reward after the finished deadline will most likely make us repeat the behavior.

It is not an exact science to group the nudging-related themes into packeted strategies. In our project, we have arranged our Nudging Toolbox so it serves the purpose best. Nudging strategies work best when they are combined and used simultaneously.

Criticism of nudging as of today

The criticisms of nudging can generally be divided into three categories:

- Ethical concern: Nudging is manipulative and violates one's free will, therefore it's a threat to democracy
- Effectiveness: Nudging as a method is too inefficient to achieve societal change
- Reliability: The method produces unreliable, context-based results which are difficult to measure

Ethical concern

Hausman and Welch are debating the threat of nudging to people's free will and how it can be unethical: "Systematically exploiting non-rational factors that influence human decision-making, whether on the part of the government or other agents, threatens liberty" (Hausman and Welch, pg. 136). They also argue that in the end, nudging can be a threat to democracy: "No matter how well intentioned government efforts to shape choices may be, one should be concerned about the risk that exploiting decision-making foibles will ultimately diminish people's autonomous decision-making capacities." (Hausman and Welch, page 135).

This concern is met by the argument that the design of our physical and digital environment always affect our choices in one direction or another. We cannot avoid the nudging effect of choice architecture altogether (Sunstein, 2014). The choice architecture should therefore be designed to nudge people into what is best for human, nature and sustainable development (Sunstein, 2014).

Furthermore, nudging is a way of executing "Libertarian paternalism", which gives individuals incentives to take a certain decision. The other option is hard paternalism: forcing laws and regulations. Libertarian paternalism still keeps the individual's freedom of choice (Sunstein, 2014). Nudging can also advance one's autonomy, since the time to take small everyday decisions is decreased and more time is freed up for one's interests. Nudging can also help us with complex and/or boring tasks with no clear immediate consequence (Sunstein, 2014), for example decisions about pension funds which affects the social welfare, and public health (Sunstein, 2014).

Hausman and Welch stress the importance of informing the individual about the nudge, even if it makes the nudge less effective (Hausman and Welch, p 135).

Effectiveness

Goodwin criticizes the effectiveness of nudging: "nudging alone is not an effective strategy for changing behavior on the kind of scale needed to solve society's major ills." (Goodwin 2012, page 86). An agreeable middle ground for both parties.

However, nudging is, as we have seen, a good way to influence small changes for a lot of people, which in the end will add up to a needed complement to large scale political and economical initiatives. Nudging makes people try something new, a behavior outside their pattern, which might turn out easier and even more enjoyable than they thought. People are welcoming to nudges which appeal to the automatic, subconscious system if they align with one's goals or help with self-control issues (Sunstein, 2014). Nudging can also aim to induce reflective thinking, which in the end can result in a value change and therefore long-term behavior change which can inspire others.

It is true that the climate crisis is not all about the individual's lifestyle, but we need to address every single part of our society to be able to meet the emission goals. Mont, Lehner, and Heiskanen (2014) summarizes findings of effectiveness of nudging strategies within sustainable behavior in regards to energy use, food habits, and personal transportation. The overall conclusion is that nudging is effective, but the highest effect is achieved in controlled environments, for example a canteen.

Reliability

This leads us to the last critique: it is difficult to measure the actual effectiveness of nudging. Nudging attempts are very context sensitive, and therefore the results are difficult to generalize (Mont, Lehner & Heiskanen, 2014).

However, nothing is black and white when tested in the real world, and we need all tools we can get to combat climate change and creating a sustainable society.



Figure 7. SWOT-analysis of nudging methods, concluded from Mont, Lehner & Heiskanen (2014)

There are difficulties and risks with using nudging. But no environment is neutral and by understanding choice architecture and designing it well, we can promote actions towards a sustainable society, without infringing on peoples' free will. It is not the only measure we need, but we believe that the strengths and opportunities outweighs the negatives, which are possible to avoid and manage. Also, we need all tools we can get. Nudging in an architectural context is therefore worth exploring further.



Figure 8. Processing by the authors of “The safe and just space for humanity” from Raworth, 2012.

An urgent global challenge

We stand in front of an urgent global challenge: Climate change and depletion of resources are threatening our societies and future on this earth. It is clear that we have to act, and act now.

The planetary roof

The model of the Earth’s nine planetary boundaries was first developed by Stockholm Resilience Center in 2009 (figure 8). It determines nine crucial ecological systems which need to be in place for us to continue to live on this planet for generations. The model also defines quantitative boundaries — the roof — where the impact of us humans might put these vital systems out of balance causing irreversible and catastrophic environmental changes (Stockholm Resilience Center, n.d).

The social floor

Raworth (2012) used the model of the planetary boundaries and merged it with the foundation of social sustainability to illustrate the *safe and just operating space for humanity*. If overstepping the boundaries, we leave the *safe operating space*, and if trespassing the social foundation, we leave the *just operating space*, deprecating human rights. We need to balance the aspects of ecological and social sustainability to be able to thrive as humans. Today, we have already exceeded the limit for the safe operating space of six planetary boundaries, climate change being one of them (Stockholm Resilience Center, n.d).

Combating climate change

The Paris agreement states that global warming must be limited to 1.5°C — or at least 2°C — since pre-industrial values (UN, 2015). To be able to achieve this, we need to drastically lower our emission of greenhouse gases. We need to work on all ends simultaneously and on all levels: international, state, corporate and individual (IPCC, 2022). This includes architects and planners and the cities, buildings and places we design. In other words, we need to choose sustainable materials and design for a long lifespan, but also to build to facilitate for a lifestyle that emits less greenhouse gas emissions, which is exactly what this thesis is about.

Lifestyles and climate change

In the Paris Agreement, the parties vow to recognize that:

“...sustainable lifestyles and sustainable patterns of consumption and production [...], play an important role in addressing climate change,”

UN, 2015, p.2

IPCC (Intergovernmental Panel on Climate Change) also highlights the importance of socio-cultural and behavioral change to be able to meet the emission goals. The report mentions change inducing policies (such as nudging) as an important tool to achieve this change. Behavioral change for ecological sustainability can cause synergies with other sustainable development goals (IPCC, 2022).

The architect and sustainable lifestyles

When explaining a sustainable society, IPCC takes an example related to architecture and planning. The example also illustrates synergies between different sustainable development goals which arise from planning interventions: “measures promoting walkable urban areas combined with electrification and renewable energy can create health co-benefits from cleaner air and benefits from enhanced mobility” (IPCC, 2022, page 59).

Design for sustainable lifestyles is of big importance for our future on this earth. In this thesis, focus will be on climate change and aspects of social sustainability.

So, what is a “sustainable lifestyle”? The United Nations Environment Programme, UNEP, defines it like this:

“Sustainable living means understanding how our lifestyle choices impact the world around us and finding ways for everyone to live better and lighter.”

UNEP, n.d.

Sustainability is often divided into three subcategories: Ecological, Social and Economical. In this chapter, we define and give examples of sustainable practices and habits based on these three perspectives. However, the three are closely connected and sustainability can only be achieved by fulfilling all three, in the middle of figure 9 to the right. How to use nudging strategies and tools to influence people to live a sustainable lifestyle is explained in detail in the Nudging Toolbox.

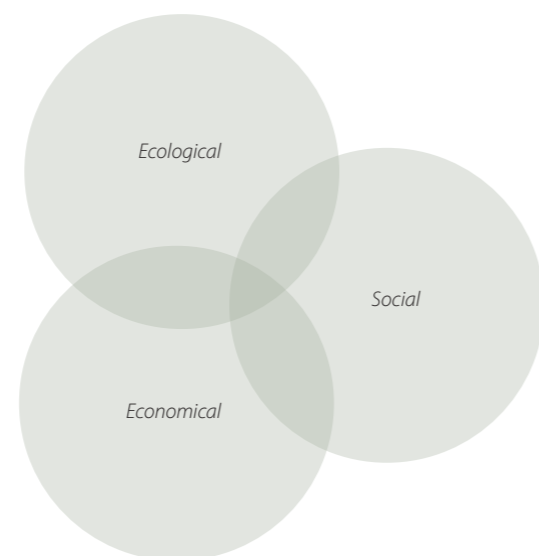


Figure 9. Ecological, economical and social sustainability.

Ecological sustainability

In 2020, the average climate footprint of an individual in Sweden was 7.7 metric tons of carbon dioxide equivalents per year (Naturvårdsverket, n.d.c). To be able to reach the Paris agreement, this number needs to be reduced to 1 metric ton per person and year by 2050 (Naturvårdsverket, n.d.b). This is illustrated in Figure 10.

60% of the 7.7 metric tons each individual emits comes from “direct consumption”: our dwelling, transportation habits, food habits and consumption patterns (clothes, electronics, furniture etc). These are all part of our lifestyle and are a result of activities and daily choices in our home, making the home a perfect arena for making a change.

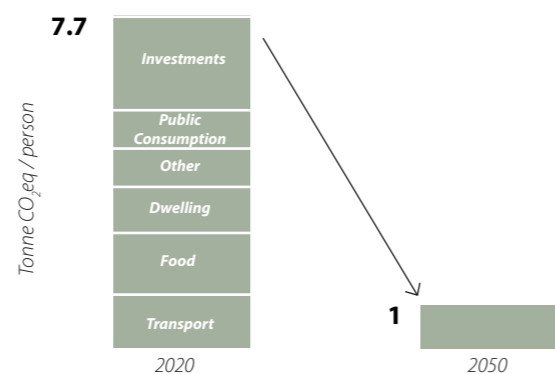


Figure 10. Tonne Carbon dioxide equivalent per person in Sweden 2020. By the authors based on (Naturvårdsverket, n.d.b).

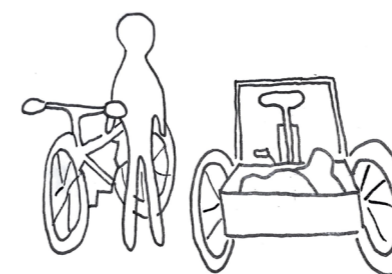


Figure 11. Ecologically sustainable transport options: a bike and a cargo-bike.



Figure 12. A well-stocked pantry with sustainable foodstuffs.

Transportation

To lower the emissions from our personal transportation, we need to change our transport habits. Most fundamentally, increase walking, biking and riding public transportation as modes of transport (figure 11). Secondly, use car pools and shared vehicles instead of using private cars. Walking and biking also have health benefits and public transportation increases encounters with other people, which is good for social sustainability. This green transport transition has been an important part of the toolbox and design project.

Diet and food

A healthy diet, for the planet and for ourselves, consist of less red meat, poultry, eggs, dairy and starchy vegetables and more nuts, whole grains, legumes, fruit and vegetables than we eat today (Eat-Lancet Commission, 2019). By mapping the foodstuffs we should increase our intake of, and how Livsmedelsverket recommends storing these, it was clear that a lot of these products were to be kept in a pantry or a dark space with 12-15°C (Figure 12) (Livsmedelsverket, 2022). When designing the kitchen, these foodstuffs should be prioritized. It should also be easy and inviting to cook one’s own food, avoiding processed and semi-processed foodstuffs.

One of Generation Waste’s messages to decrease food waste is to make the freezer to your best friend. (Generation Waste 2022). The freezer size and its position is therefore an important part of the design of the kitchen.

Consumption

Our consumption habits are a big part of our emissions and resource use. The EU Waste Framework Directive defines the waste hierarchy as a model to limit waste (Figure 13). The first step is to minimize the amount of products. The second step is to re-use and then recycle materials. If this is not possible we should firstly recover energy out of the materials and lastly deposit it (European Commission, n.d.).

A sustainable lifestyle reduces the inflow of products and re-uses as much as possible. What is not reusable is recycled. By facilitating sharing and a circular economy, it is possible to minimize the number of duplicates of products and maximizing the re-use of the products that are produced.

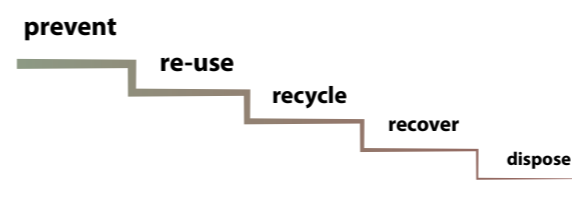


Figure 13. EU Waste Framework, the waste hierarchy. First and foremost, waste should be prevented by producing less potential waste. Secondly, items should be reused and if not possible recycled.

Social sustainability

Social sustainability is a condition for achieving a sustainable society where we can thrive as humans. In this thesis, focus has been to transform the definition of social sustainability into our context of a multi-family residential project.

“A socially sustainable society is an equal and equitable society where people live a good life with good health, without unjustified differences. A society with a high level of tolerance where people’s equal value is central, which requires people to trust and rely on each other and participate in the development of society.”

Folkhälsomyndigheten, 2022

To reach a sustainable society, all neighborhoods should be planned with easy and close access to health care, education and services.

Shared areas and functions

To increase encounters between residents, shared areas and functions should be provided. This gives opportunities for neighbors to get to know each other, which in turns improves the community. We strongly believe, the better the community, the more functional shared functions and areas, and vice versa — they benefit each other. In a multifamily housing unit, the shared spaces are of high importance, which is discussed in “Det lilla grannskapet” (Olsson et.al, 1997). The common stairwell is in winter time often the only meeting point between the residents. This makes it an important zone and its design might influence the community. The authors discuss that by keeping the number of people in the stairwell low, a feeling of security and a better social neighborhood occurs. The possibility to decorate the stairwell and the common spaces is another important aspect lifted in the book. These points have been developed and used in the toolbox and in the design project.

Inclusion and social boundaries

Ellinor Ostrom, Nobel prize winner in Economics in 2009, states eight rules for managing the commons, which are important in forming of a strong community. The principles include defining clear group boundaries and include group members in the development of rules and principles (Walljasper, 2011). These principles have been taken into account in the development of the toolbox.

Transparency for accountability

As concluded before, our actions are affected on how others behave. Therefore, increasing transparency between different lifestyles and people in the community can encourage and inspire people to test a different, and hopefully, more sustainable lifestyle.

Economical sustainability

Circular economy

The EU has set up a goal to transfer from today’s disposable society to a circular society (Figure 14) that is carbon neutral, environmentally sustainable, non-toxic and fully circular by 2050, and works actively to accelerate this transition (Nyheter Europaparlamentet, 2023). In this thesis, this has been targeted primarily by the implementation of circular economy related functions on different scales. For example, it is to create space and organize for shared rooms, tools and equipment among the residents and promote these functions physically. This reduces the consumption and the need for private storage, and contributes to a more sustainable lifestyle.

Variation of apartment sizes

Another way to reach economical sustainability is to provide a variation of apartment sizes (figure 15) and costs to attract different people and family constellations.

Balancing private and common

Shared areas within the residential building can contribute a lot towards social and ecological sustainability, however they also make the apartments more expensive for the tenants since they share the cost for building and maintaining these areas. Therefore, a balance needs to be found between the private and shared areas. This thesis challenges the norm of a “good” private/shared ratio since we believe that the future living scenario requires more shared spaces. We are confident that the rooms and facilities showcased in the design project follow the Nudging strategies set up in the toolbox, and we hope to stretch norms and be an inspiration for future residential buildings.

The aspects lifted in this chapter are the goals our toolbox strategies work towards — a sustainable lifestyle. The three pillars of sustainability are intertwined and need all to be accounted for. Synergies between these are common and it is difficult to separate them. In the toolbox and design project, all three will communally be seen as “sustainability”.

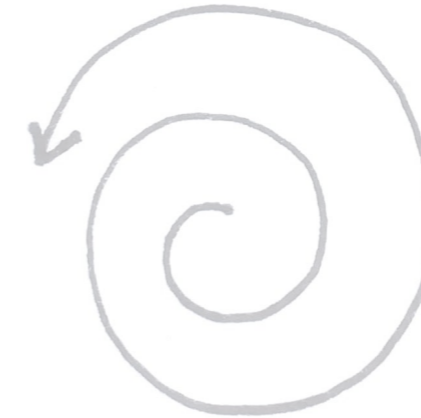


Figure 14. Illustration of circular economy.



Figure 15. Illustration of a variation of apartment sizes.

The intention-behavior gap

Statistics show that the yearly consumption emissions of swedes are slowly decreasing, but we need to accelerate the pace to reach the environmental goals (Naturvårdsverket, n.d.c). When asked out on the streets, 9 out of 10 swedes are willing to change their lifestyles to lessen their climate impact (Mogren, 2022). However, we know that change is happening too slow and when it comes down to the actual action, it is difficult to follow one's intention. There is a gap between attitude, intention and actual behavior, and we need to bridge this gap.

Why is there a intention-behavior gap?

One would think that the path to sustainable behavior is a simple three step process: Knowledge about sustainable behavior leads to attitude change and finally sustainable actions. However, there are many complicating factors in this process. Cross-disciplinary literature ex-

plains this gap as a result of social norms, the complexity of the decision-making process and institutional and infrastructural-related barriers (Mont and Power 2013). The different types of barriers have been categorized by Kollmuss and Agyeman (2022) shown in figure 16. The first type includes factors related to the individual, such as lack of interest and laziness. The second one is barriers arising from the individual in relation to the social context, such as lack of responsibility or accountability as a result of no ownership or no trust. The last type regards institutional, practical factors, such as lack of time, money, infrastructure, information or facilities.

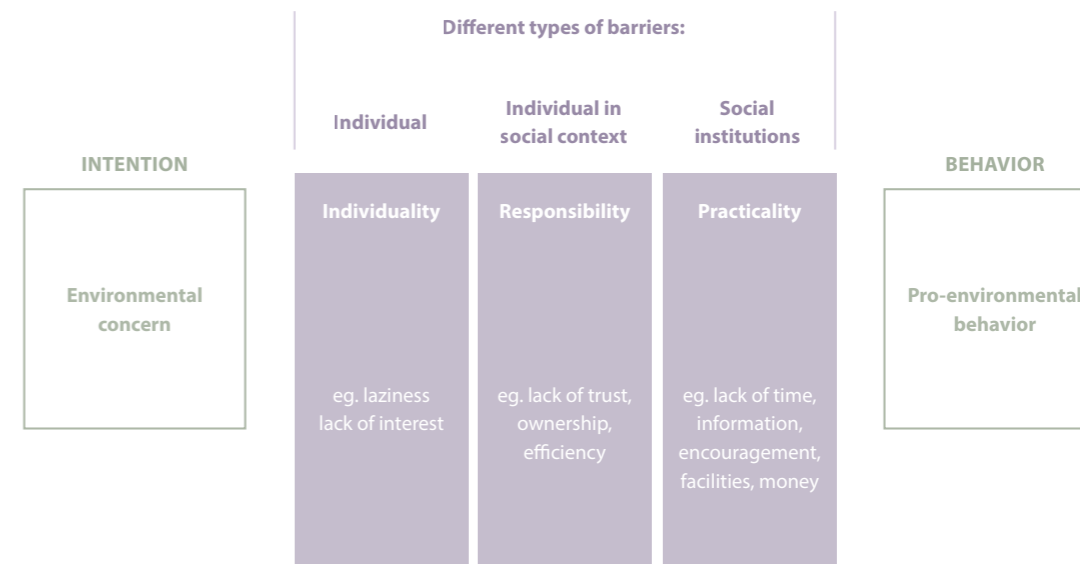


Figure 16. Barriers between environmental concern and pro-environmental behavior. Adapted from Blake 1999.

Nudging to bridge the gap

The strategies of nudging can address the barriers lifted by Kollmuss and Agyeman (Figure 17). A change of the physical environment can spark interest, increase the feeling of responsibility and most definitively decrease practical barriers.

By using social norms, laziness and lack of ownership can be targeted. Visualization of information will increase awareness but also reduce practical barriers and increase one's feeling of responsibility and contribution.

When the designer chooses the sustainable option as the default, laziness will actually end up in a sustainable behavior and the practical barriers are almost non-existent. UNEP also stresses the importance of making a sustainable lifestyle the default one, that is to say the most accessible, effective, cheap and well-being inducing one (UNEP, n.d.).

Conclusion

To conclude, we are facing an urgent global challenge and have to develop within the safe and just operating space for humanity. We need (among many other things) to change our lifestyles: We need to transport, eat and consume more sustainable. There is a general will to change, but there are barriers making it difficult for us to change. Nudging can bridge this gap and at the same time facilitate for an easy lifestyle change for people who don't actively aim for a sustainable lifestyle now. With design, we can nudge people to sustainable everyday actions. Now, we will present how this can be used in a residential context.

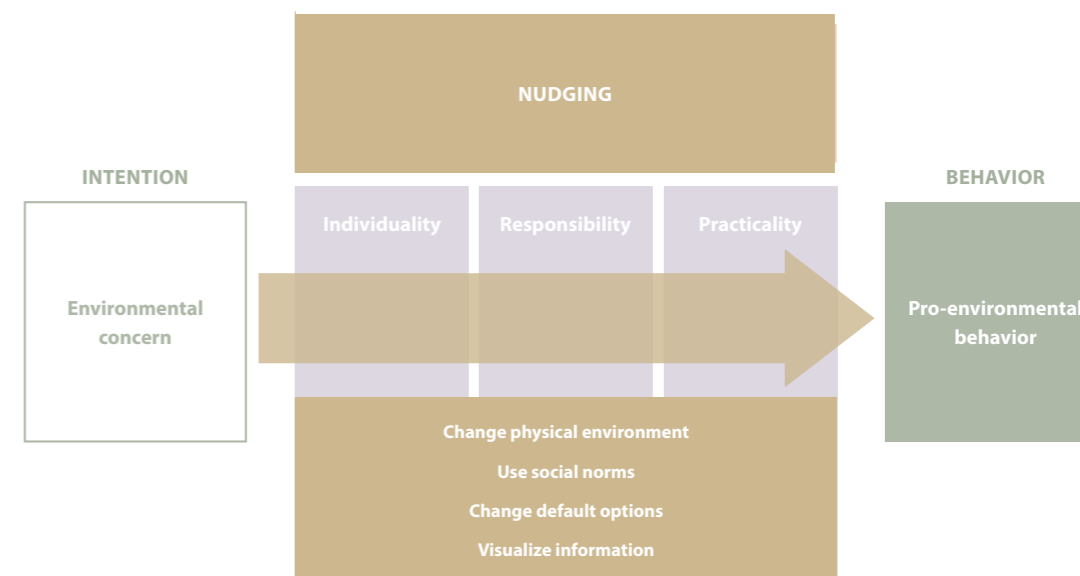


Figure 17. Nudging bridging the gap and breaking the barriers between intention and behavior. By the authors, based on Blake 1999 (above).

The design and keeping of our homes affect the way we live our everyday lives. The toolbox describes strategies and tools to use the home as an arena to promote sustainability and nudge the residents towards sustainable lifestyles. We hope that a sustainable lifestyle will be both easy and natural for the residents, something that occurs without reflecting upon it and quite frankly, the easiest one for the individual.

Strategies, tools and interventions

The toolbox consists of six strategies divided into different tools and examples of tangible interventions (Figure 18). The toolbox is applicable in new production, renovation projects and additions to the existing building stock. It can be used in everything from city to apartment scale. The interventions have different levels of impact and effort and can be applied one by one or many at the same time. The strategies and tools are more of guiding themes, while the interventions are tangible examples of how these can be applied.

The toolbox's target users

The toolbox targets and can be used by different stakeholders: Architects and Planners, Developers and Housing Companies, Residents and Community, Companies and NGOs as well as the Municipality and State.

What we as architects should focus on is mapped in the diagram on page 48 and 49. A division between design and user phase has been drawn, where more focus of the design part has been given, as the architect has more influence here.

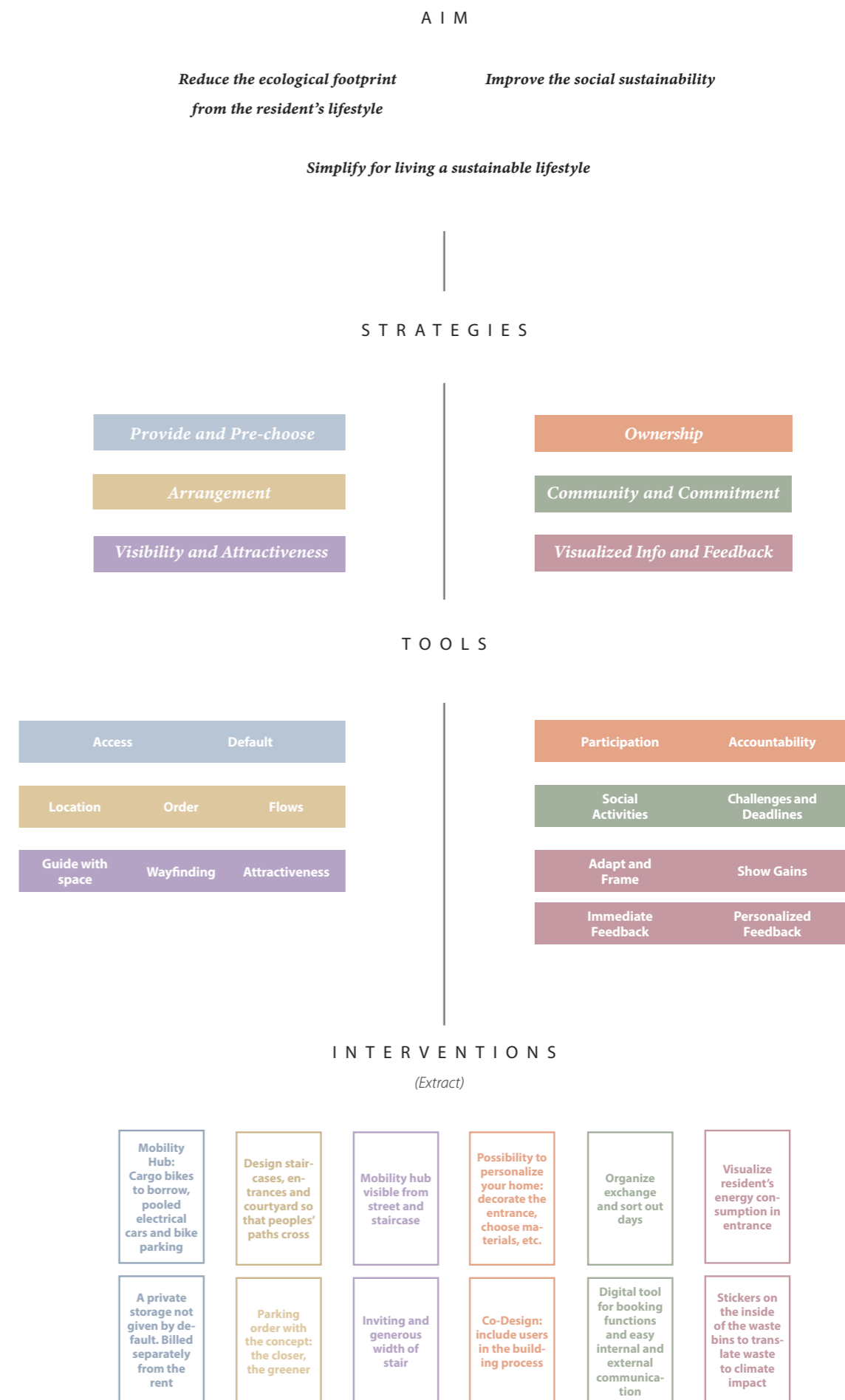
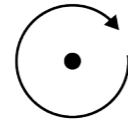


Figure 18. Diagram of the Nudging Toolbox

1. Provide and Pre-choose

As a first and basic step, we need to make sure that it is possible to use sustainable functions — they need to exist. Secondly, the default option should be chosen with care. People are generally content with the pre-chosen option.



Tools:

Provide Access

Having an unsustainable lifestyle can merely be the result of not having access to components that make a sustainable lifestyle possible. By giving access to sustainable choices, more people can change their lifestyle. It should be possible for people to try things outside the norm.

The infrastructure for communication between residents is crucial in order for the community to blossom. It has to be easy and approachable to contact one's neighbors and we need to enable this through physical meeting points, digital and physical communication tools. A lot of the issues with shared functions are related to how people use it and leave it after they've used it and can be avoided with good communication. When people meet, they learn from each other and innovate, a vital component of a socially sustainable community.

Who is responsible?

- Architects and Planners X
- Developers and Housing Companies X
- Residents and Community X
- Companies and NGOs X
- Municipality and State X

Default Options

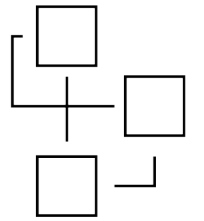
When facing monotone, boring or complex tasks, humans often choose the option which requires the least effort, namely the default option or the one on top of the list. By choosing the default option with care, the designer can have great impact on the individual's behavior. In reality, it means that less people will have a parking spot or storage if they are not provided one by default.

Who is responsible?

- Architects and Planners X
- Developers and Housing Companies X
- Residents and Community X
- Companies and NGOs X
- Municipality and State X

2. Arrangement

The spatial concept of arrangement can influence peoples' behavior. We often go for least effort, for example we prefer the shortest walking distance. By placing socially and ecologically sustainable functions centrally we can increase the usage of these.



Tools:

Location

Shorten the path to the sustainable functions and actions. Place them centrally, where people pass by for other reasons. Think about what functions are placed close together and which are more separated.

Who is responsible?

- Architects and Planners X
- Developers and Housing Companies X
- Residents and Community X
- Companies and NGOs X
- Municipality and State X

Order

Let people pass sustainable functions on their way to more unsustainable ones. This reminds the person of the other — more sustainable — option, which might change their behavior over time.

Who is responsible?

- Architects and Planners X
- Developers and Housing Companies X
- Residents and Community X
- Companies and NGOs X
- Municipality and State X

Flows

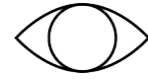
Design the flows of people between different functions for spontaneous encounters to arise. With good communication between the residents, common functions blossom.

Who is responsible?

- Architects and Planners X
- Developers and Housing Companies X
- Residents and Community X
- Companies and NGOs X
- Municipality and State X

3. Visibility and Attractiveness

To use sustainable functions, one needs to know that they exist. As architects, we have a great opportunity to guide people there and make them stay, using architectural qualities and wayfinding.



Tools:

Guide with Space

Use light, views, outlooks, focal points, openness, secludedness and other architectural qualities to guide people to sustainable functions. People can find new sustainable habits this way. Openness is important for perceived safety.

Who is responsible?

- Architects and Planners X
- Developers and Housing Companies X
- Residents and Community Companies and NGOs
- Municipality and State X

Wayfinding

It is easier to use sustainable functions if they are marked well with signs but also from afar with markings leading to the function. Use color to accentuate and get attention. This tool is very useful for renovations, in new production “guide with space” should be preferred over “wayfinding”.

Who is responsible?

- Architects and Planners X
- Developers and Housing Companies X
- Residents and Community Companies and NGOs
- Municipality and State X

Attractiveness

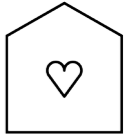
Make sustainable functions attractive by working with spaciousness, color, light, etc. Make people feel at home in shared spaces and design for maintenance and cleaning. Make sure that the functions are easy to use and well functional, for example an automatic door opener to the bike room.

Who is responsible?

- Architects and Planners X
- Developers and Housing Companies X
- Residents and Community Companies and NGOs
- Municipality and State X

4. Ownership

Ownership is especially important for social sustainability, social cohesion and a functioning community. Ownership also increases the will to take care of the space, which is beneficial for ecological sustainability and increases the likeliness for the shared functions to work successfully in the long run.



Tools:

Participation

Design for opportunities for residents to grow their own food, produce energy and decorate their space. This motivates people to take care of the place and can lead to new social connections between neighbors. Co-design and involve residents during the design and building process increases the feeling of ownership and that the building suits the users’ needs.

Who is responsible?

- Architects and Planners X
- Developers and Housing Companies X
- Residents and Community Companies and NGOs X
- Municipality and State X

Accountability

People take better care of their space when feeling personally significant and important. For example, a lower number of users in a specific space increases the feeling of importance of and accountability for one’s actions in the space. Social control and transparency allows for accountability and inspiration from others.

Who is responsible?

- Architects and Planners X
- Developers and Housing Companies X
- Residents and Community Companies and NGOs
- Municipality and State X

5. Community and Commitment

What others might think is a contributing parameter to our actions, and we often do as other's do. Therefore, the community can be one way to engage people. We are social creatures and like to socialize and compete. These types of activities strengthens the community and creates commitment. Commitment and support from others is needed both for a long term change and a jump-start.



Tools:

Social Activities

Create infrastructure for social activities to take place and interest groups to form. Interest groups can cultivate in the green house, meet in a reading circle or an individual can teach neighbors a specific skill such as knitting or using a computer. The social events should be on every scale, from two persons to the whole block.

Who is responsible?

Architects and Planners
 Developers and Housing Companies X
 Residents and Community X
 Companies and NGOs
 Municipality and State X

Challenges

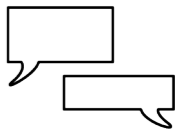
Humans are motivated by deadlines and competitions. For example, challenges can take place between the buildings on the plot, between different floors or even individual challenges, for example to make a pledge to bike to work every day this week. Deadlines motivates action.

Who is responsible?

Architects and Planners
 Developers and Housing Companies X
 Residents and Community
 Companies and NGOs X
 Municipality and State X

6. Visualized Info and Feedback

To be able to make informed decisions, we need information which grabs our attention and is easy to comprehend. Information is mainly communicated via physical or digital notes and appliances, but it is important to architecturally design with these strategies in mind.



Tools:

Adapt and Frame

Analyze the target group, adapt and frame the information to make it easier to digest. Provide the information at the exactly right time, namely when one executes the action.

Who is responsible?

Architects and Planners
 Developers and Housing Companies X
 Residents and Community
 Companies and NGOs X
 Municipality and State X

Show Gains

Emphasize on what the individual can gain directly from changing their lifestyle. Highlight the effects on the world and our common future. This knowledge is a strong motivator for changing a habit.

Who is responsible?

Architects and Planners
 Developers and Housing Companies X
 Residents and Community
 Companies and NGOs X
 Municipality and State X

Immediate Feedback

Give actions immediate feedback. Reward sustainable actions through connote them with positive consequences. This makes us more probable to repeat a sustainable action.

Who is responsible?

Architects and Planners
 Developers and Housing Companies X
 Residents and Community
 Companies and NGOs X
 Municipality and State X

Personalize

With personalized feedback, one can set up short and long term goals and be in control of their own actions: personalized feedback strengthens the connection between behavior and consequence.

Who is responsible?

Architects and Planners
 Developers and Housing Companies X
 Residents and Community
 Companies and NGOs X
 Municipality and State X

Examples of interventions

On this spread, an extract of tangible interventions is presented. The interventions are mapped according to their strategy and tool, scale of implementation and phase in the process. Interventions not directly relevant to architects have a thinner border. More interventions are showcased in the design project.

Architects have a lot of influence here!

Not as relevant for us as architects, but we need to design so it is possible for another stakeholder to implement during user phase!

	DESIGN PHASE										USE PHASE								
	Provide and Pre-choose		Arrangement			Visibility and attractiveness					Ownership		Community and Commitment		Visualized info and feedback				
	Provide access	Default Options	Location	Order	Flows	Guide with space	Wayfinding	Attractiveness			Participation	Accountability	Social Activities	Challenges and deadlines	Adapt and Frame	Show Gains	Immediate Feedback	Personalized Feedback	
City	Efficient public transport with frequent stops	Green energy as default when choosing energy provider	Shared living/Co-living/next to traditional apartments <i>Make sharing the normal</i>	Always present walking, biking and public transport as first option				Design sustainable functions with focus on maintenance and easy cleaning											
Neighborhood	Ride sharing spots/organization <i>Decrease amount of privately owned cars</i>	No designated residential parking spot. Charged separately from the rent	Parking for private cars coordinated in parking garages. <i>"hide" the unsustainable choice</i>	Parking order with the concept: the closer, the greener	Make people see and meet people that have a different lifestyle	Outdoor and indoor gym at a visible location	Colored paths to bike lanes in neighborhood	Remove traces of stolen bikes from bike parkings											
Block	Stuff library - Borrow tools, equipment, bulky toys etc		Recycling room at a central and easy accessible location. <i>Facilitate recycling</i>	Place recycling bins closer to entrance of recycling room, residual waste further in	Design staircases, entrances and yard so that peoples' paths cross	Transparent and light sustainable functions <i>Make people feel safe and increase use</i>	Colored path on ground to mobility hub and bike garage	Smell absorbing color or photo walls and floor drawing <i>Encourage sorting and limit littering</i>											
Building	Mobility Hub: Electrical cars, bikes and cargo bikes to borrow <i>Facilitate for green transport</i>	A private storage not given by default, billed separately from the rent <i>Increase the shared storage</i>	Stairs closer than elevator to entrance <i>Meeting neighbors and promote physical activity</i>	Place shared storage closer to circulation than private storage	Make space for micro-meetings in circulation spaces	Mobility hub visible from street and staircase	Use color to separate and lead people to often used bikes from seldom used bikes in bike room	Spacious bike room, easily accessible from street and staircase											
Floor	Quarter space - shared "un-defined" area for residents to furnish after need <i>Increase social encounters</i>	"No advertisement sign" on mailbox as default	Possibility to bring the bike up to the apartment for safe storage and unloading of bulky items	Provide recycling spots in staircase, residual waste in waste room further away	Provide a "front porch" <i>Slow down flow into apartments</i>	Inviting and generous width of stair <i>Meeting neighbors and promote physical activity</i>	Clear signs promoting sustainable functions	Social and shared laundry <i>Increase encounters, fewer and more filled up machines</i>											
Apartment	Private balcony - Achieve spaciousness and possibility to cultivate and store food	Dishwasher in every unit. <i>Save water</i>	Make pantry cabinet central and spacious in kitchen <i>Promote sustainable food alternatives</i>				Different sizes of recycle bins in kitchen. Big bins for recyclables, smaller for residual waste.	Use ceiling height, light, balcony to create spacious while compact apartments											

To be able to arrange successful social activities and challenges, the residents need to know each other. For architecture, this means that we have to facilitate for planned and unplanned meetings and design attractive shared spaces.

Information needs a medium, which can either be people — we need to design for people to meet, physical or digital — we need to design and analyze for good spots for information exchange.

Reference projects

Of course, projects promoting sustainable lifestyles already exist today and many of our proposed interventions and functions have already been tested. Below, we present the main examples we have used as inspiration and background

for our work. Our goal is to show how these projects push people towards a sustainable lifestyle, from a nudging perspective. Our takeaways from each project are written in the italic font.



Figure 19. Collage of Iggy and Oh Boy. (J. Cardenal, M. Palván, O. Jais, P. Carlsson, n.d.)

OH'BOY and IGGY by Siegel Architects, Malmö

Both Iggy and OH'BOY are pilot projects with the goal to reduce car use and offer a variety of mobility solutions. The projects offer possibility to park the bike outside the apartment, bike pools, shared equipment and vehicles and organized container days. Here we find both compact one-bedroom apartments with luxurious balconies, penthouses with terraces and loft apartments with a generous ceiling height (Siegel Architecture. n.d.a and n.d.b).

Possibility to bring the bike up to the apartment, shared equipment and vehicles, digital notice board, volume and loft.



Figure 20. Collage of BRF Viva (Riksbyggen, n.d.)

BRF Viva by Malmström och Edström, Gothenburg

BRF Viva is located on Guldheden in Gothenburg. Viva provides the opportunity to live a car-free lifestyle due to its geographical location, the mobility services offered and the well-functioning public transport system in close proximity. The residents also have the possibility to engage in local cultivation, a system for sharing equipment and a swap room. According to a survey, more than half of the residents are using the facilities and they are very appreciated (Braide & Nylander, 2021).

Generous and light bike room, common room, entrance balcony, interest groups.



Figure 21. Collage of BRF Ramselyckan (HSB, n.d.)

BRF Ramselyckan by Okidoki, Ölgersjö

Ramselyckan consists of 81 apartments in a variety of sizes with a generous ceiling height of 2.7m. The private balconies have one glazed and one unglazed part. In the open stairwell it is possible to stay for a coffee with the neighbors and store bulky and dirty equipment. The big common room has a fully equipped kitchen and plenty of seats, suitable for private gatherings. It can also be used as a guest room and is equipped with exercise equipment. The waste room has been given extra care with a sink and intentional design (HSB, n.d.b.).

Ceiling height, volume, design in waste room, generous glazed and unglazed balconies, storage in common hall, homely community room.

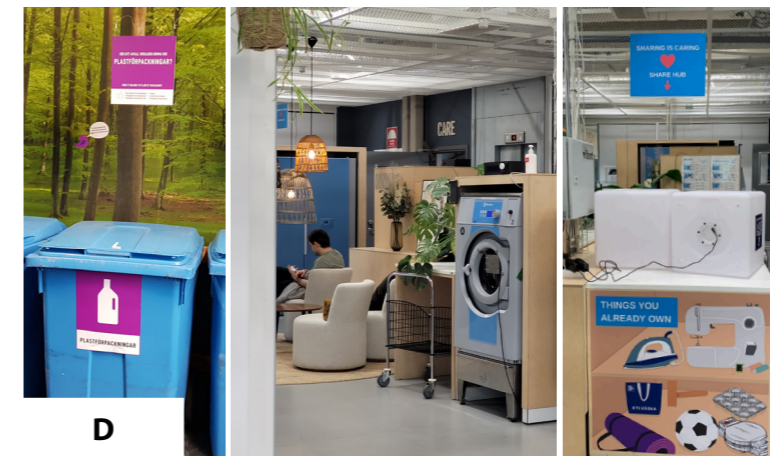


Figure 22. Waste room in HSB Living Lab. (NUDGD, 2022)

Figure 23. Collage of HSB Living Lab (Photos by the authors)

HSB Living Lab by Tengbom Arkitekter, Gothenburg

HSB Living Lab is located on Chalmers campus and conducts experiments on future housing, for example new building materials, how to design the waste room to improve recycling and a testing of a social laundry room (HSB, n.d.).

Try new things! Designing the waste room gave results. The social laundry and sharing shelf.

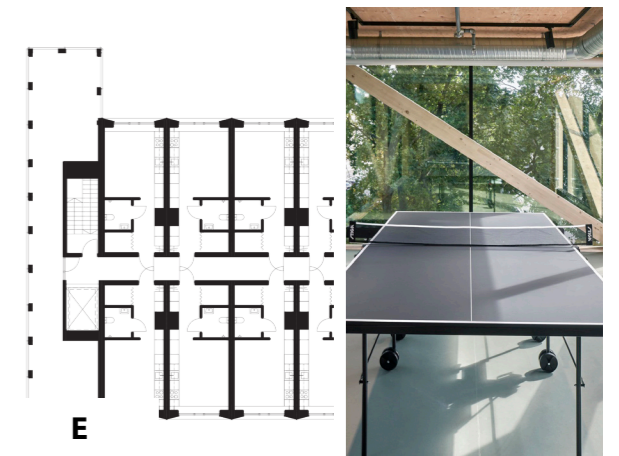


Figure 24. Collage of Gibraltarvallen. (Å. Eson Lindman, n.d.)

Gibraltarvallen Guesthouse by Olson Lyckefors, Gothenburg

The project contains 100 dwellings aimed for international students on Chalmers with a high amount of shared spaces (Olson Lyckefors Arkitektur, n.d.).

The common rooms are located where people do not spontaneous walk by, does that lead to reduced use?



Figure 25. Collage of MOBO. (Mo-Bo, n.d)

MOBO concept by TIP Architects

MoBo is a platform and a service which support new construction and remodeling projects to develop sustainable travel solutions for the building. The focus on the private car is reduced and shared vehicles and climate-smart mobility solutions are allowed to step forward. MoBo guides and provides examples of how to handle the architectural changes this leads to. The main idea is to remove garages and private parking spots to free up both space and capital, focus on the design of the bike garages and invest in shared mobility solutions. The freed space from the garages can be used for common and social functions to improve the social sustainability in the house (Theory Into Practice, 2019).

Access direct from street to bike room, the social mobility hub, workshop area, shared vehicles, generous bike room, transparency.



Figure 26. Collage of ETC-husen. (By the authors)

ETC-husen by Hans Eek & Kaminsky, Västerås

ETC Bygg has developed a housing concept with the ambition of low carbon footprint and low apartment rents. The project include two electric cars in a shared car pool, bikes to borrow, tools to borrow, and the possibility of cultivation, on the private balcony as well as communally (Gunne, N. 2021).

The priority of bikes, electrical car charging spots, outdoor environment, digital notice board in entrance.



Figure 27. Collage of Green house. (MKB Fastighets AB, n.d)

Greenhouse by Jaenecke Arkitekter, Malmö

Green house is a one-of-a-kind project in Augustensborg, which is developed as a sustainability focused area. It consists of two buildings of rental units, one 14-storey building with 20 sqm urban farming balconies, one part glazed and one open. They also have a separate utility room for handling plants in direct connection to a separate elevator and the balcony, keeping the dirt away from the living quarters (MKB, n.d.). The apartments are equipped with smart electricity solutions, for example a display showcasing the use and special power outlets only connected to the solar panels on the roof (NCC, 2023). The rooftop has two common greenhouses and outdoor space which has increased the social community (Persson Boonkaew et.al., 2018).

A residential project for a specific lifestyle where this lifestyle is the core of everything. Two separate entrances to the apartment - a clean and a dirty one. Big balcony with glazed and unglazed section. Cargo bikes to borrow.



Figure 28. Collage of Bäckby Centrum. (Archus Arkitekter, n.d)

Bäckby Centrum by Archus, commissioned by Mimer, Västerås

Bäckby Centrum is a rental housing project in Västerås and part of a transformation of the area. The project was carried out in close cooperation between the architects, the client and the residents. The ground floors have a various of common activities, all according to the residents' wishes. To increase security and perceived safety in the area, the location of functions, to create spots for interaction, lighting, glazed and transparent spaces were of big importance (A. Sjödin, personal communication, 17th of February, 2023).

Cooperation between stakeholders, context based functions and activities, work with security to reach social sustainability.

The architect's nudging tools

The architect is not the only one who influences the design and use of a home. Therefore, we need to analyze the Nudging Toolbox from a stakeholder perspective. The following five groups of stakeholders have both a high influence and interest in creating a nudging home: Architects and Planners, Developers and Housing Companies, Residents and the Community, NGOs, Companies and Media, as well as the Municipality and the State.

The tools are placed within the diagram (Figure 29) to showcase which stakeholder(s) are in charge for what. Architects and planners need to collaborate with other stakeholders, and make sure that we facilitate for other stakeholders to be able to carry out their responsibilities.

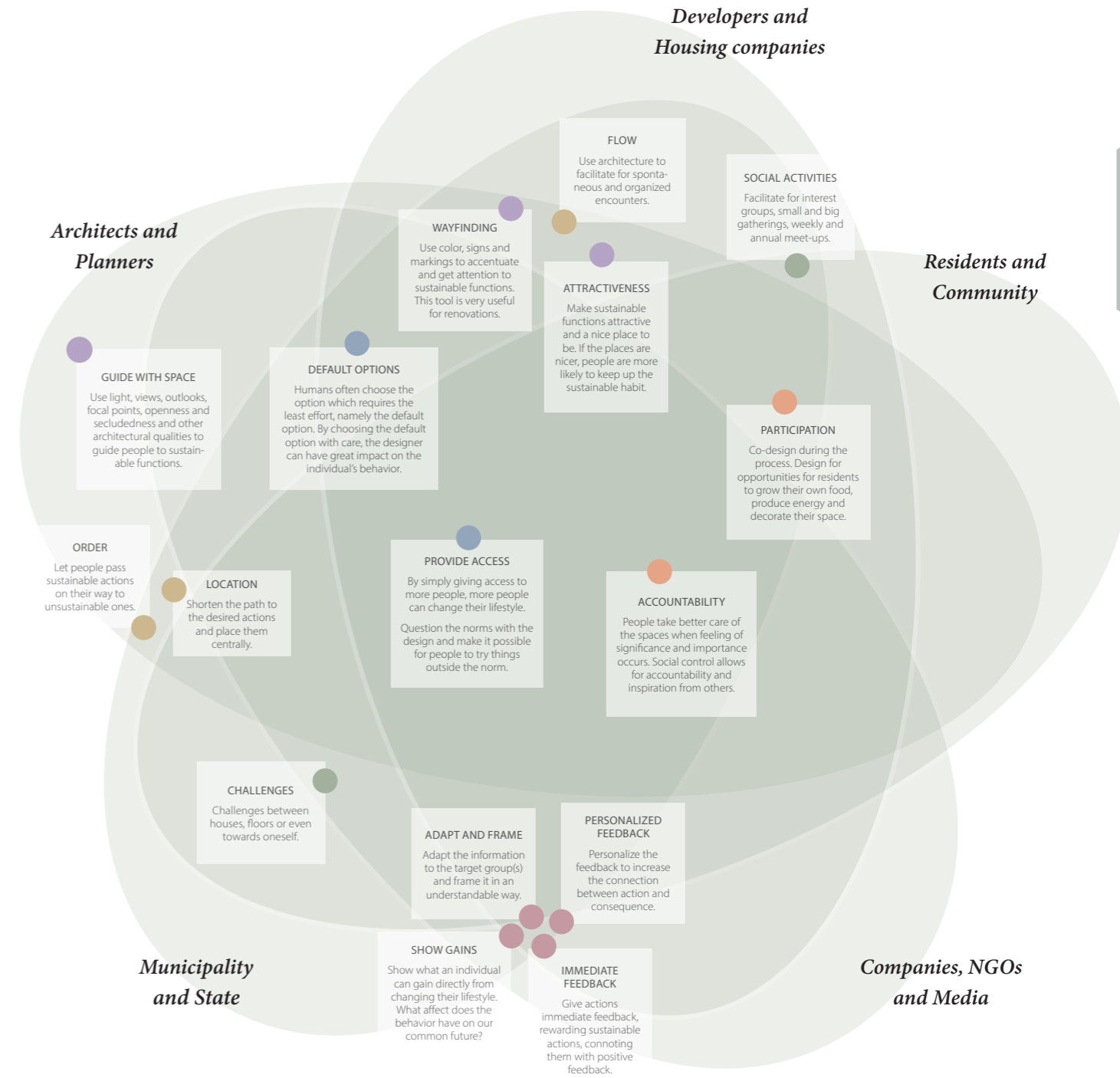


Figure 29. The tools of the Nudging Toolbox according to responsible stakeholders.

Applying the toolbox in a design project

The conclusion from the stakeholder diagram (Figure 30) is that architects and planners have their responsibilities mainly within the first four nudging strategies: Provide and Pre-choose, Arrangement, Visibility and Attractiveness as well as Ownership. These four are also mainly used within the design phase.

From now on, focus will be on the ten tools under these four strategies. They are applicable on all scales, from city to apartment and result in different implications and spatial interventions on different scales, all leading to a nudging home.

The remaining two strategies will be analyzed and regarded as a matter of facilitating and giving the right conditions for the stakeholders to carry them out in the user phase. This is commented on the interventions example-table on page 40.

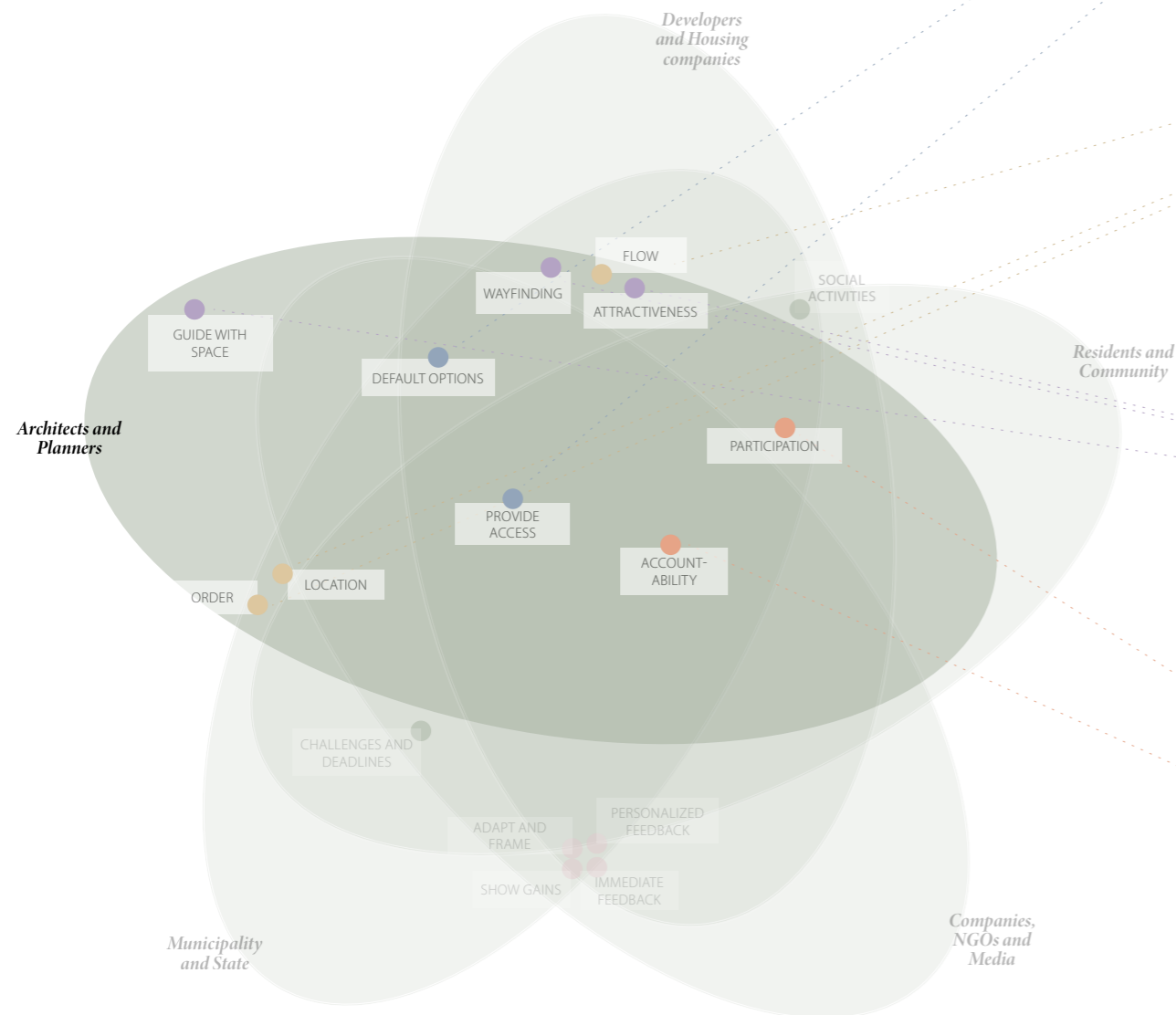


Figure 30. Stakeholder diagram. Responsibilities of the architect and planner.

Examples of relevant, supporting instruments for architects

Provide and Pre-choose	Access	<ul style="list-style-type: none"> Map existing functions and analyze accessibility for different user groups, access to services and recreation, for example using Grahn's eight nature/garden room characteristics (2005)
	Default	<ul style="list-style-type: none"> Space Syntax: Attraction Point Analysis (Attraction Reach, Attraction Distance) to sustainable functions Question the norm — regulations and guidelines regarding mobility, recycling and other sustainable functions.
Arrangement	Location	<ul style="list-style-type: none"> Space Syntax: Angular Integration, Network Betweenness
	Order	<ul style="list-style-type: none"> Node diagrams Study sequences of spaces and functions for common usage patterns
	Flows	<ul style="list-style-type: none"> Space Syntax: Angular Integration, Network Betweenness Spaghetti diagram: Analyze attraction points, movements between these for different user groups
Visibility and Attractiveness	Guide with space	<ul style="list-style-type: none"> Study sequences of spaces and functions for common usage patterns
	Wayfinding	<ul style="list-style-type: none"> Use architectural qualities, study axes and focal points Choose colors and materials to facilitate easy orientation
	Attractiveness	<ul style="list-style-type: none"> Use the analysis model of public—common—club—private when designing, to ensure ownership feeling CBA's method MAB: Study and compare qualities in the residence
Ownership	Participation	<ul style="list-style-type: none"> Co-design and workshop with other stakeholders, importantly the users and maintainers
	Accountability	<ul style="list-style-type: none"> Mapping of how many people are sharing each function. Use result from studies such as: "Managing the Commons" by Ostrom. E and "Det lilla Grannskapet" by Olsson. S, Cruse Sondén. G, Ohlander. M.

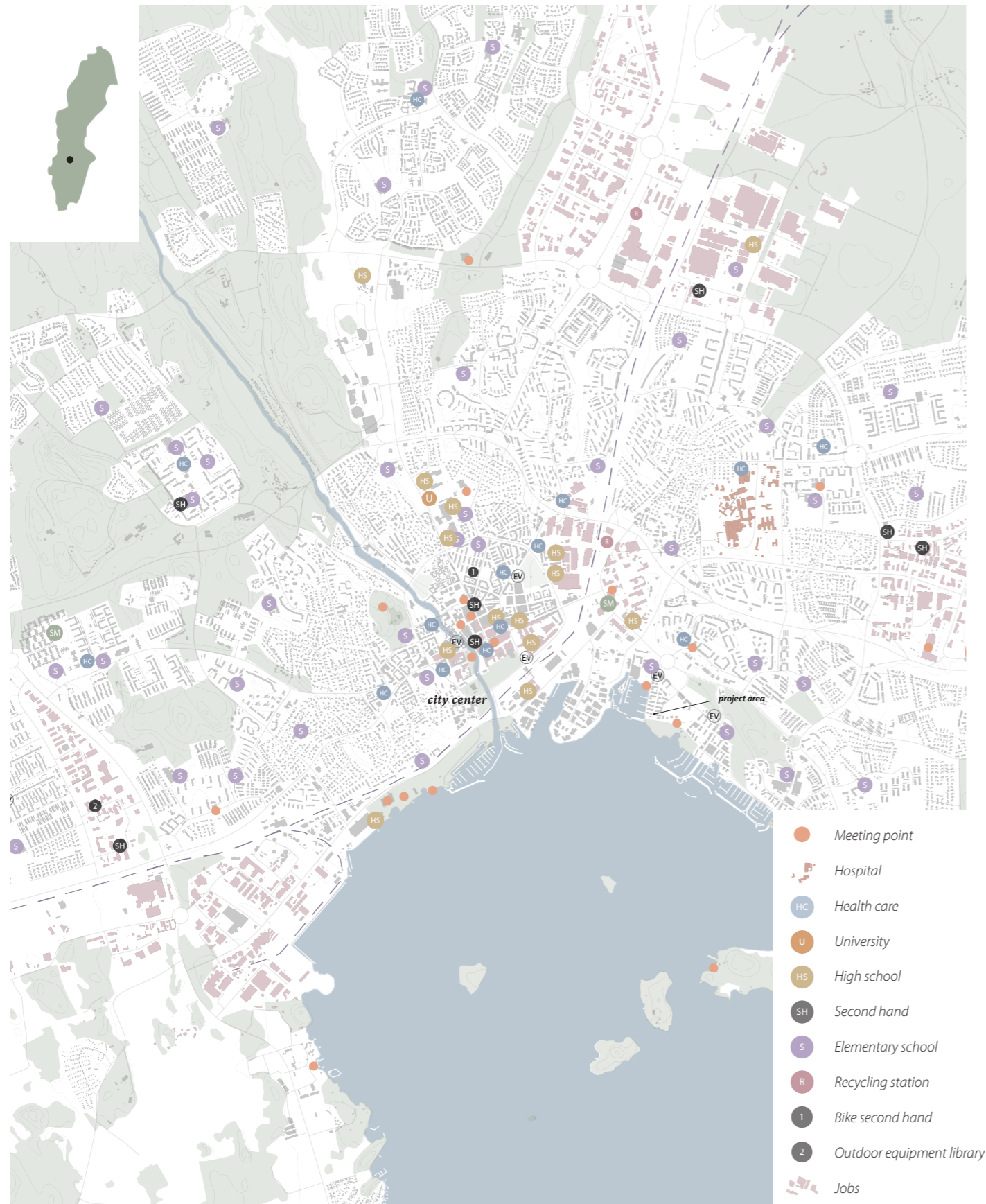


Figure 31. Analysis of Västerås

The project plot is located in an emerging area in Västerås, a middle sized big city of Sweden on the shore of Lake Mälaren. Thanks to its size, the city has a variety of services, meeting points and education facilities. The maps above and to the right shows the city's functions, qualities, needs and opportunities and the relation to the project plot — everything based on aspects of a sustainable lifestyle.

City scale conditions for a sustainable lifestyle



Figure 32. Sustainable transportation for daily commute

Sustainable daily commute

Västerås is a bike friendly city due to its flat topography. High schools, university and the major work place districts are all reached within a 15-30 minute bike ride. There are two bus lines in the vicinity of the project plot, both connecting to the central station in 10 minutes. From here, remaining bus lines can be reached as well as the 60 minute train to Stockholm.

By providing well-designed bike parking, there are good conditions for residents to bike to work and school.



Figure 33. Weekly and bulky errands

Weekly and bulky errands

One big supermarket is located a 10 minute walk from the plot and two other ones further away. The car is often a convenient mode of transport for the weekly grocery shopping and the distances increase the likeliness for people in the project neighborhood to use the car. Recycling centers are located far away. Since many heavy and bulky items are recycled, there is a need for complementary solutions.

Rentable cargo bikes or car pools would decrease the need for a private car. Organized recycling days would promote recycling and reduce car dependency.

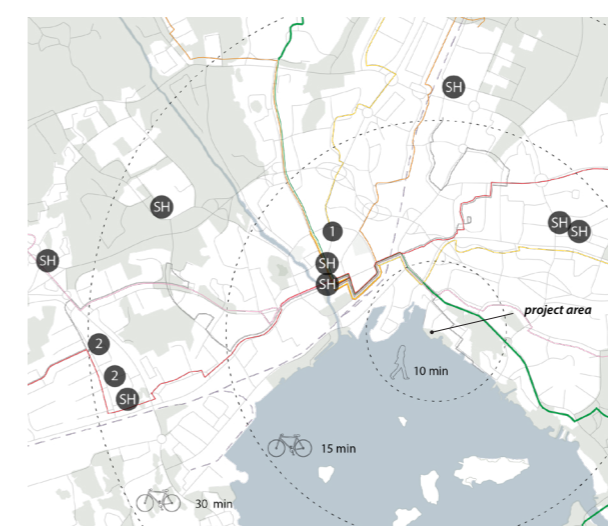


Figure 34. Sustainable consumption

Sustainable consumption

There are two smaller second hands in the city center, more than a 10 minute walk away. In the outskirts of town, a 15-30 min bike ride away, a couple of larger second hands are located.

Second hands and other swapping facilities closer to the plot would be beneficial to promote a sustainable consumption behavior.

Analysis of the neighborhood



Figure 35. Analysis of the neighborhood

The neighborhood Öster Mälarstrand stretches from the old steam power plant Kokpunkten in northwest to the small scale luxurious villas of Framnäs in the southeast. During the last decades, the area has been transformed from old industrial use to a dense multi-family housing area with the closeness to the water, city center and nature as its main selling points. The development of the area focuses on ecological and social sustainability.

The area holds many different functions and meeting points and more will come as the area expands.



The old steam power plant Kokpunkten is now a destination hotel, restaurant, spa and water park



Row-houses, some stacked on top of each other, are breaking down the scale in the area



In north, four 16-storey buildings are towering towards the busy Björnövägen



Along the main street there is a big gym in the bottom floor



Facade materials in the area varies from wood and bricks to metal and glass



Mälarpromenaden, a water front promenade through the whole city passes by the project area



Siréntorget is currently quite calm, but is going to be a meeting spot as the area expands



The location on the shore of Mälaren is one of the big selling points of the area



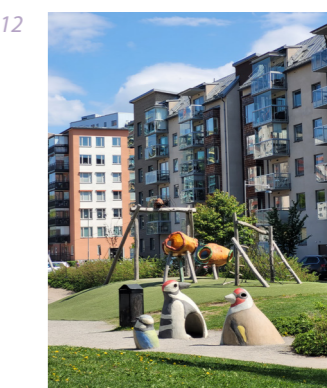
One of the innovative building projects with solar cell roofs and EV-parking spots



Lasse Färnlöfs Plats is a bustling neighborhood square with several stores and local life



Along Notuddsparken, the trees and buildings define a board walk



A popular play ground is found in the neighborhood

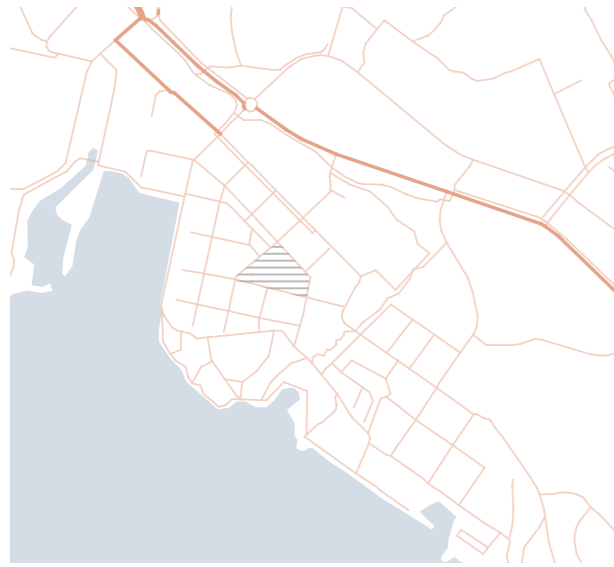


Figure 36. Space syntax analysis: Network Betweenness, non-motorized network, 3km

Familiar neighborhood

Based on the street network, we have conducted space syntax analyses to map to what extent pedestrians and cyclists traveling between neighborhoods move through our area. The analysis shows that the majority of people are traveling along Björnövägen, the road lighting up with red outside of our neighborhood.

The majority of people moving in our neighborhood are residents living in the area.

- Project site
- Highly traveled
- Less traveled

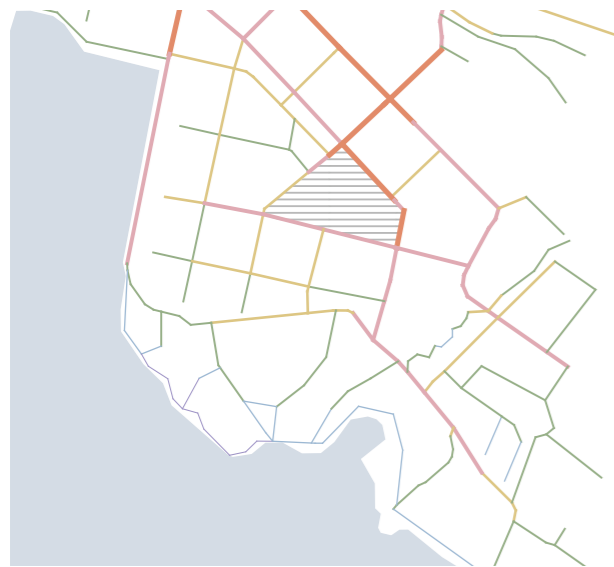


Figure 37. Space syntax analysis: Angular Integration, non-motorized network, 500m

Busy and calm streets

The orange lines show the most central streets in the neighborhood. Not surprisingly, these are the main streets with the bus stops and the green path. The streets around the plot are quite central and trafficked, mainly on the northern and eastern side.

The plot has potential for commercial activity and can attract people from the rest of the neighborhood.

- Project site
- Most central
- Least central



Figure 38. Lake Mälaren

Parks, green structure and lake Mälaren

There are two bigger natural areas next to the neighborhood. To the south, towards Mälaren, is Notuddsparken with focus on recreation and contemplation. To the east, Mälarparken which offers several walking paths, smaller running trails and a popular playground and outdoor gym.

Mälaren is Sweden's third largest lake and is popular during both winter and summer. Walking along the waterfront, swimming, winter bathing, ice skating and enjoying the view over the lake are common activities.

Conditions for green transport habits



Figure 39. Walking distance to closest bus stop. Space syntax analysis.

- Bus stop
- <100m
- 100-200m
- 200-300m
- Project site

Public transport

The bus stop is currently located along the main street. As the area expands, departures will become more and more frequent.

Private car

Next to the bus stop, one of the areas parking garages is located where parking spots of private cars are aimed to be coordinated. According to regulations, 68 parking spots are needed within the block (approx. 120 apt). By implementing mobility measures such as car -and bike sharing, this can be reduced to 48.

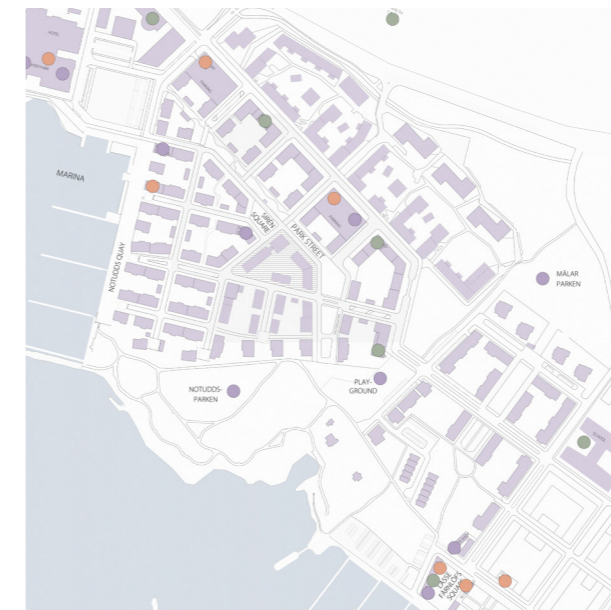


Figure 40. Purple buildings are reached within 500 m walking distance from the plot. Services and functions are marked with dots.

- Schools and services**
 - 2 preschools
 - School F-6
 - School 4-9
 - Elderly home
 - Bank office
 - Health care center
- Leisure Time**
 - 2 gyms
 - 2 hairdressers
 - Gift/flower shop
 - 2 squares
 - Waterfront promenade
 - Marina
 - Big playground
 - 2 large green areas
- Food**
 - Grocery store
 - 3 cafes
 - 2 restaurants
- Project site

Walkability and everyday life

The area is mainly residential, but there are plenty of functions supporting the everyday life. Within 500 m walking distance from the plot, the functions presented above are reached.

The site is located within a 2 min walk from the bus stop which are good conditions for sustainable traveling. In a Nudging Home, green transport habits should be even more prioritized. This can be done by the implementation of additional and carefully planned bike parking spots, a number of shared electrical cargo bikes and provide electrical vehicle charging spots, an organization of ride sharing and car-pools

Socio-economical context

A popular neighborhood

The people who live in Öster Mälärstrand are relatively unanimous in saying that they enjoy their area. According to a satisfaction survey initiated by residents in 2020, the majority are proud of their home and do not plan to move. The residents especially appreciate the water front promenade and Notuddsparken. The closeness to grocery stores, the friendly neighbors and beautiful views over Mälaren are some other things people are pointing out as good aspects. Some people miss common rooms for residents and sport facilities. Around 50% daily commute by car winter

time, and 35% summer time. Other common means of traveling are to walk or bike. Only 12 percent go by bus and results show that about half are satisfied with the public transport (Afsari & Udén 2021).

The wish for more common rooms and the high use of cars are interesting aspects and something we can affect with the Nudging Toolbox.

A wide range of ages

29,8% of the inhabitants in Västerås have kids 0-24 years old.

In Öster Mälärstrand, only 20,7% have kids 0-24 years old.

The variation in age and family constellations within the area leads to a need for a variety of apartment sizes.

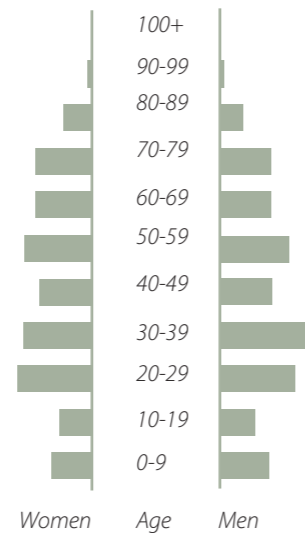


Figure 41. Demography in Öster Mälärstrand. (Västerås Stad, 2022)

A wealthy neighborhood

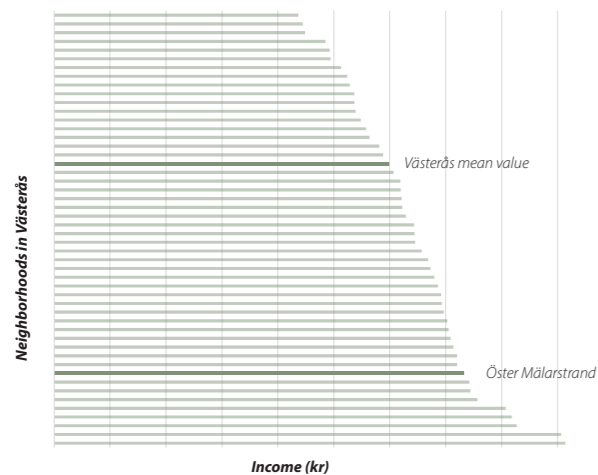


Figure 42. Median total income per area in Västerås, 2017-2021. (Västerås Stad, 2022)

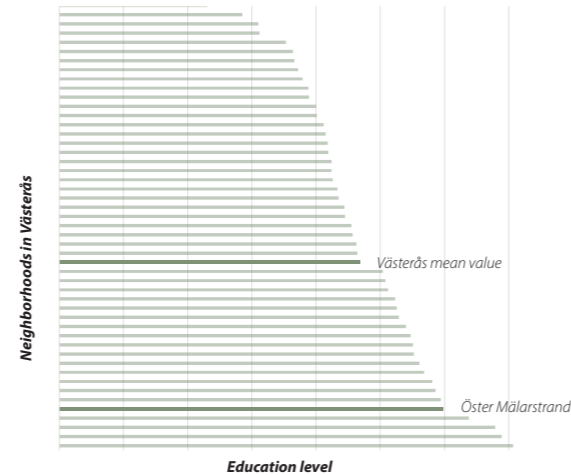


Figure 43. Education level per neighborhood in Västerås, 2019-2021. (Västerås Stad, 2022)

A growing neighborhood

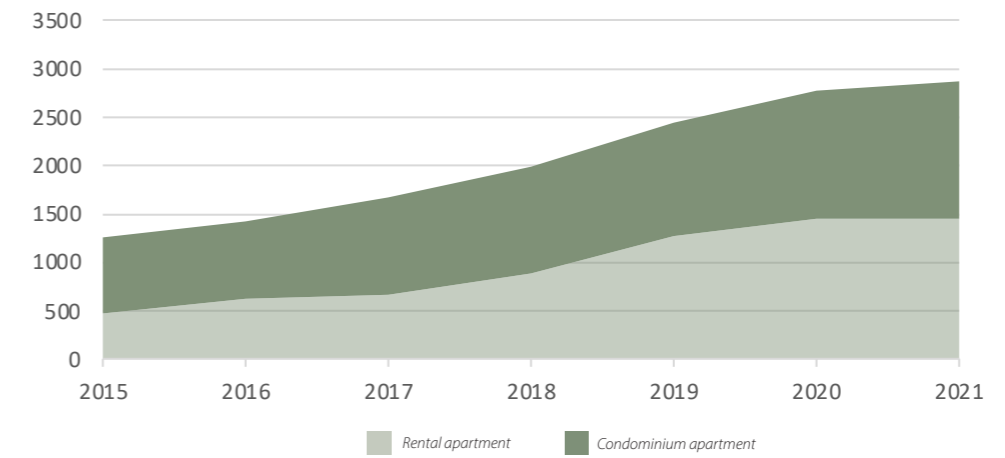


Figure 44. Housing stock: Number of dwellings 2015-2021 Öster Mälärstrand, type of tenure. (Västerås Stad, 2022)

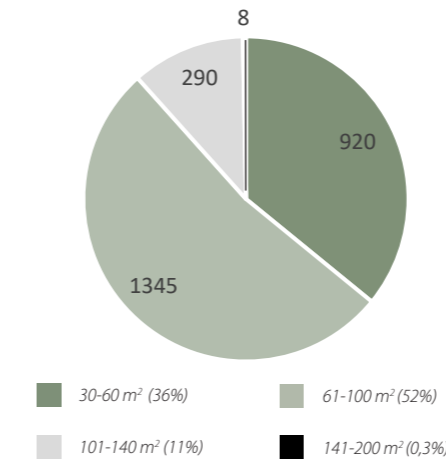


Figure 45. Distribution and absolute number of apartments in Öster Mälärstrand, according to apartment size. (Västerås Stad, 2022)

Öster Mälärstrand is an affluent area with a high education level, which means that people here are likely to have a typical upper or middle class lifestyle which are, as stated before, emitting a high amount of green house gases. Therefore, there are sustainable wins to be made here. A nudging home is well suited in this socio-economic context.

Öster Mälärstrand is growing rapidly and already holds some innovative apartment buildings, making it a good to place a nudging home. There is a variety of tenure types and apartment sizes which gives us the freedom to adapt our building and organization to what suits a nudging home best. Here we believe that condominiums and a mix of apartment sizes meet the Nudging strategies best.

Block conditions

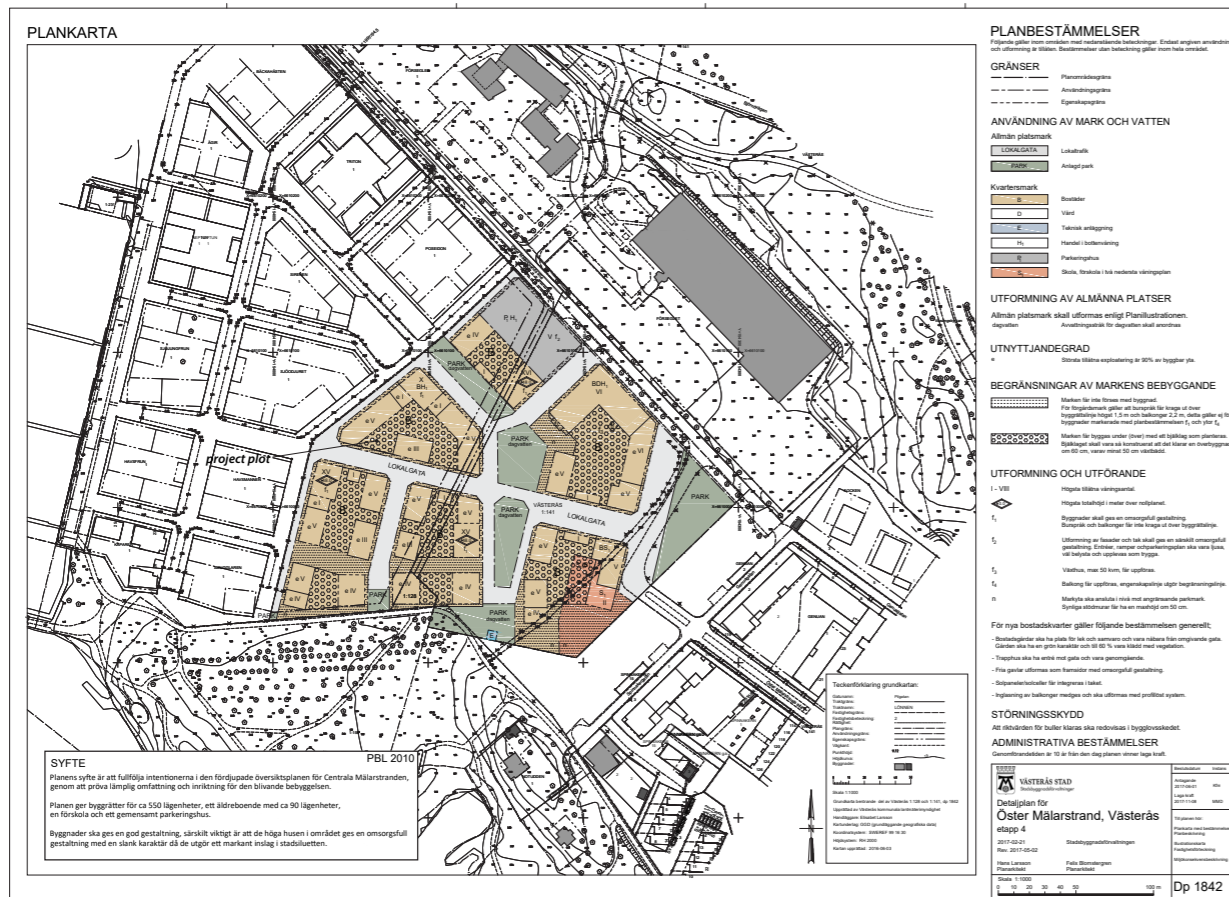


Figure 46. General plan (Västerås Stad, 2017).

General plan

The general plan covering the block was studied early on and has been followed in the design proposal. The neighborhood structure and location provides good pre-conditions for example sun conditions, closeness to public transport, green structure, public areas etc. The parking garage is advantageously located to the project plot, which suggests that an organization of private parking is possible here.

The design proposal follows the general plan, which provided conditions for the project.

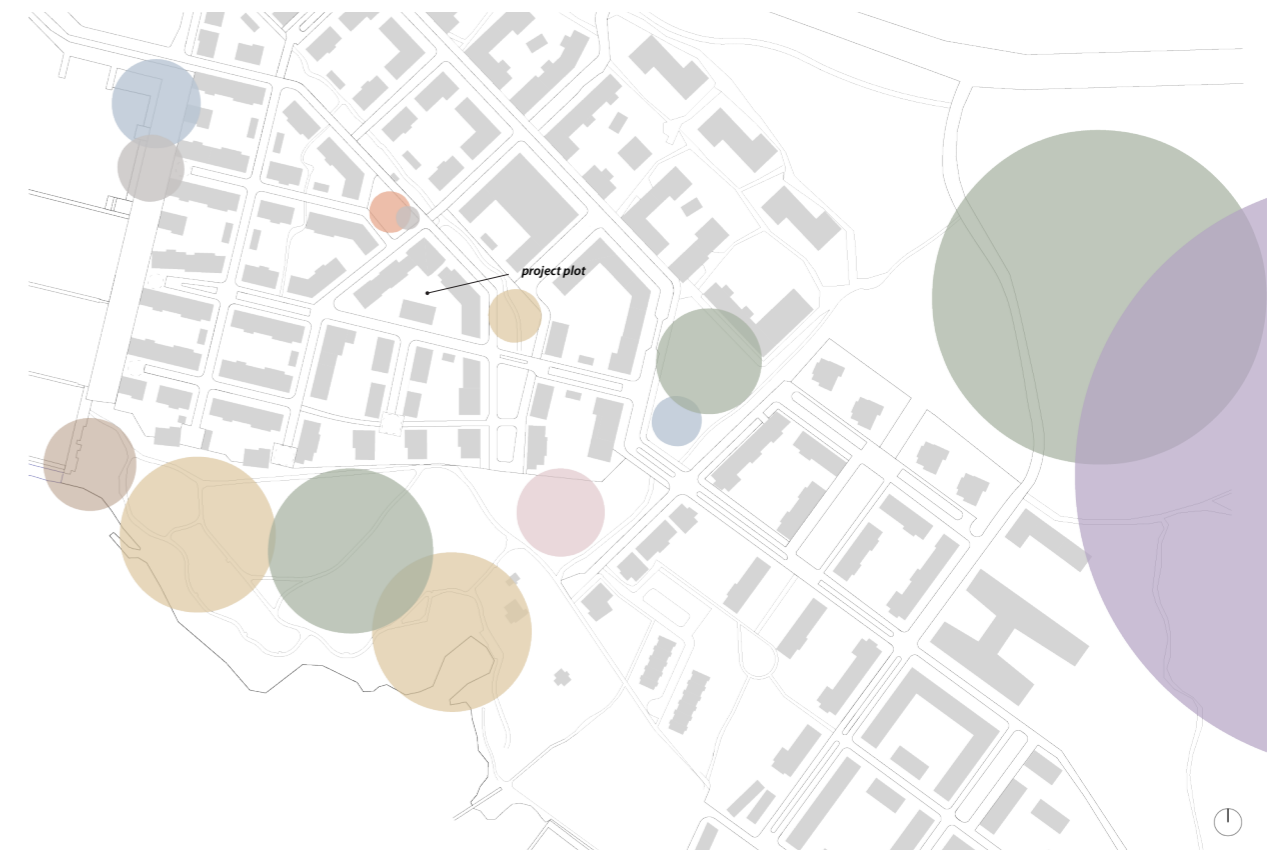


Figure 47. Analysis of the 8 nature/garden room characteristics in the area

- Festive
- Pleasure garden
- Serene
- Wild nature
- Common open
- Space
- Rich in species
- Cultural

The eight nature/garden room characteristics

An analysis of the eight nature/garden room characteristics was executed in the neighborhood (figure 47) to see what to add in the design of the courtyard (figure 50). Below is a short description of the different characteristics according to Patrik Grahn (2005).

Festive Places to hang out and gather such as a square, outdoor restaurant seating or fountain.

Common open Green open space to go out sun bathing, gather with friends, play games or have an overlook.

Pleasure garden A safe and enclosed space, allowing for relaxation, curiosity and play.

Space A coherent area perceived as another world. Vegetation, topography and water are important.

We need a variation of room characteristics to create a high quality outdoor environment. Our plot has a good location due to the wide mix of characteristics in the surrounding area, such as wild nature and festive spots.

Serene An area of peace and quiet, no disturbing elements. Focus on natural elements: water and wind.

Rich in species Diverse vegetation supporting diverse animal life, not overcrowded by human visitors.

Wild nature Minimally maintained, where the ground is covered by vegetation and leaves are left to compost.

Cultural Highlighting the history, historical value and passing of time.



Figure 48. View from street

This is the Nudging Home in Öster Mälarstrand, Västerås.

The Nudging Home makes the sustainable lifestyle the easiest one. The 26 condominiums apartments varies in size and the house is full of strategies, tools and interventions from the Nudging Toolbox which have been adapted to the context. The building contains a variety of shared functions to facilitate for sustainable habits, such as sharing of things, traveling green, recycling correctly, and eating sustainable food, which are keys to achieve a sustainable lifestyle. The

location and design of these encourages desired behaviors and creates the conditions for a strong community to emerge. The proposal do not include building materials, technical systems, methods and economical aspects but focuses on how to use design and architecture to push people to more sustainable everyday actions.

Do you get interested? Come along on the presentation of the Nudging Home.



Mobility organization

The concept of gathering the private cars in two centrally located garages (as the municipality proposes) is ideal conditions for a Nudging Home. By placing the most sustainable transport option, the bike (other than walking), closest to the entrances, the threshold for biking decreases. At the same time, taking the car includes a short walk to the garage - actually the same distance as to the bus stop. This placement and order of the transport options can nudge the residents to walk or bike more often. The residential parking is not included by default with the apartment and is billed separately from the rent, to give an incentive to refrain from a private car.

Sometimes one needs to transport bulky stuff or the weather is horrible, and the car provides a solution. However, in a Nudging Home car pools with electrical vehicles are placed close to the entrances to facilitate for a car free lifestyle. The prominent placement reminds the residents of the option to use the car pool and makes it a viable alternative to the private car. The general rule of thumb is to organize parking spots with the concept “the closer the greener” and “make sure the green options are prominent”.

Car parking	
Requirements for the block according to the local policy:	In a Nudging Home:
3 EV car pool spots	5 EV car pool spots
48 residential parking spots with reduction from mobility management	Up to 48 residential parking spots in a parking garage (which can be reduced in the future)
3 parking spots for the disabled	3 parking spots for the disabled
6 visitor parking spots	6 visitor parking spots

Block scale

Access to, and promotion of, green transport and a circular economy, organized around a common yard.

The block includes approximately 100 apartments. One will not know everyone in the block, but shares the outdoor functions and some indoor circular functions with each other, to encourage exchange between the buildings. For example, a competition in energy use can be held between the buildings, showcased on the digital notice board in each entrance.

A green yard for recreation and social exchange

The buildings of the block are arranged around an enclosed, green yard. The inclusive and attractive yard provides opportunities for play and recreation for all ages, promoting a healthy lifestyle. It is shield from the public towards the busy square in north east, to ensure it being a club good: a large space for a defined group of people (Minoura, 2016). The residents of the block should feel comfortable and invited to stay here undisturbed, supporting the emergence of social activities as Gehl (1980) describes them.

The courtyard is also a social arena. By placing shared functions within the block in the different buildings, the yard becomes a place of movement, we make space for spontaneous encounters. Greeting and chatting is an important way of maintaining a neighborhood (Olsson, et. al. 1997), and we strongly believe the better the community, the more functional shared areas and functions. For planned meet-ups, a variety of places are provided. The yard provides both relaxed areas organized next to a soothing rain bed and a big grass area for hanging out, sun bathing, barbecuing and the kids to play. There is a playground and an outdoor gym to encourage play and movement for both kids and adults.

Circular economy

The block house a big enough group of people to constitute the base for circular economy functions, such as a stuff library where one can borrow tools, rarely used household appliances, toys and similar, and a circular

room where one can donate and pick up new belongings. The block houses small premises in the bottom floor of the tall building in the north, facing the square. These are adequate for local, small companies focusing on reparations or services, contributing to the local economy and simplifying for the residents to live sustainable. For example; a clothes repair shop at this central location makes repairing one's clothes instead of buying new normal and socially acceptable, in the long run maybe even preferable. These functions are accessible directly from street level and visible through large windows.

Green transport

As presented on the previous spread, the private parking spots are located in a parking garage in the neighboring block. Within the block, the private and pooled bikes are parked on the ground floors, to allow for easy access. The shared electrical vehicles have parking spots right outside the entrances to encourage and simplify the use. The bikes and shared cars are prominent when approaching the block, putting the focus on green transport.

Bike parking and bike pools

The bike parking fulfills the demands of gold standard stated in "The Perfect Bike Parking", issued by Västerås Stad.

Requirements according to the local policy:

59 residential spots

15 visitor spots

In a Nudging Home:

65 residential spots, of which
15 spots (23%) are extra large
26 spots (37%) are single ground level
24 spots are two-level

15 visitor spots

2 bike pool cargo bikes

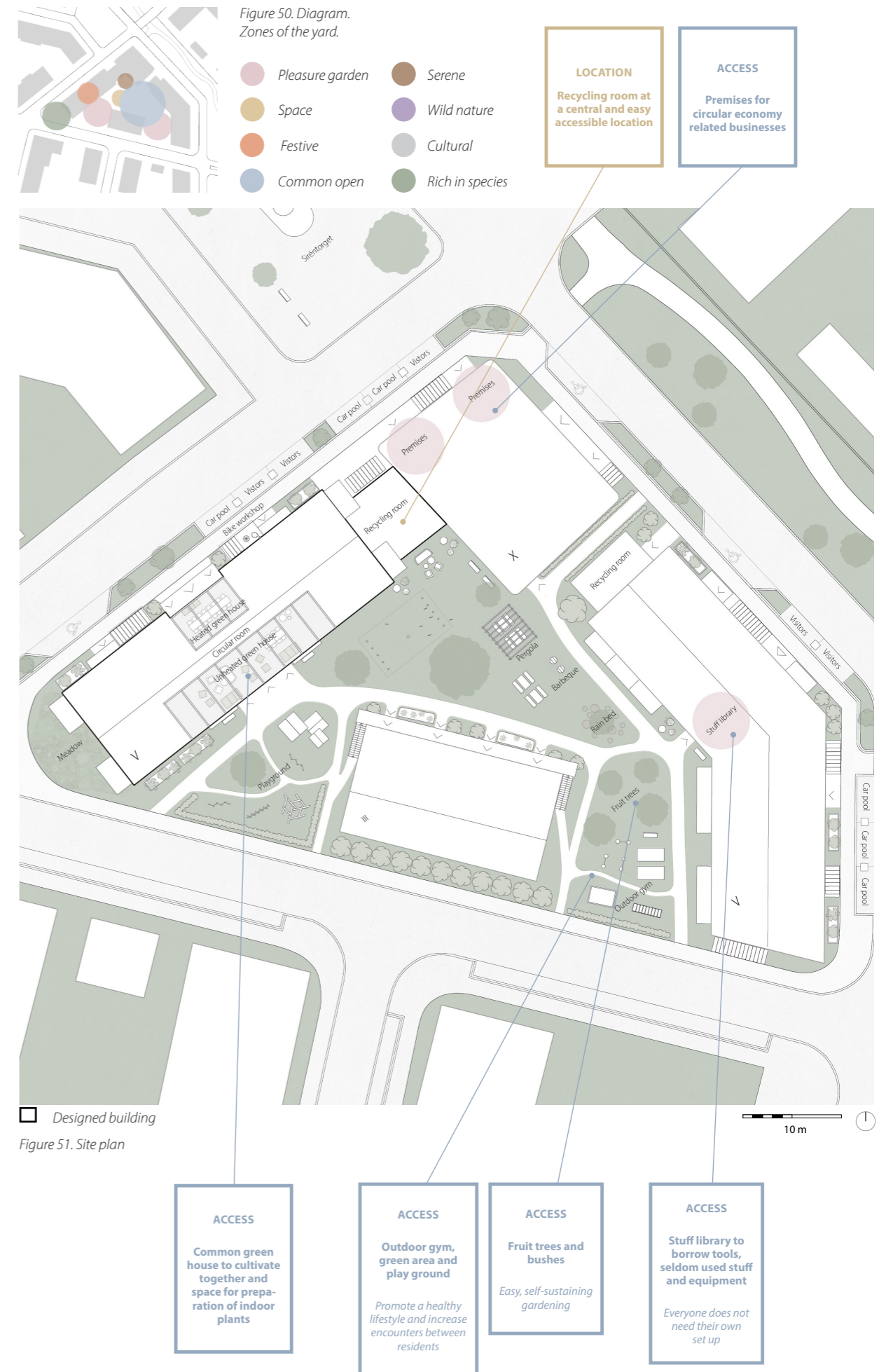


Figure 51. Site plan

Building scale

The entrance floor is the building's everyday heart, the top floor the lush garden and the living floors the social core.

Organization

The Nudging Home consist of a ground floor, four living floors and a top floor with a variety of functions and solutions useful for the residents (Figure 53). The entrance floor is an important node of the building and holds many of the shared and sustainable functions, which are explained on pages 70-71. The building's main entrance gathers the residents to pass by the Circular Room, where the communication is separated into the two staircases, leading up to the living floors: the four "Quarters". The building has two types of living floors, Type A with three-bedroom apartments and Type B with studios and one-bedroom apartments (pages 74-77). On the top floor, there is one one-bedroom apartment and one two-bedroom apartment. All in all, the Nudging Home accommodates a variety of household constellations. The building's shared green house with a heated and an unheated part is located on the rooftop.

Figure 52 describes the social and spatial organization of the block (blue). The Nudging Home is part of the block and is divided into two staircases (purple), which in turn house four Quarters (green), one for each living floor. Each Quarter have two (floor type A) or four (floor type B) apartments (pink).

The Quarters have been important in the design process to create a **strong sense of community and shared responsibility** between the floor neighbors, which eventually will improve the sharing of functions and areas throughout the whole building.

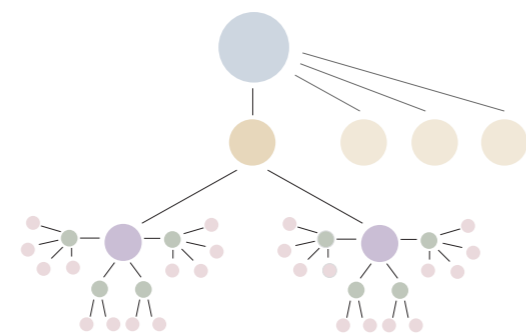


Figure 52. Social and spatial organization

- Block
- Buildings
- Stairwells
- Quarters
- Apartments

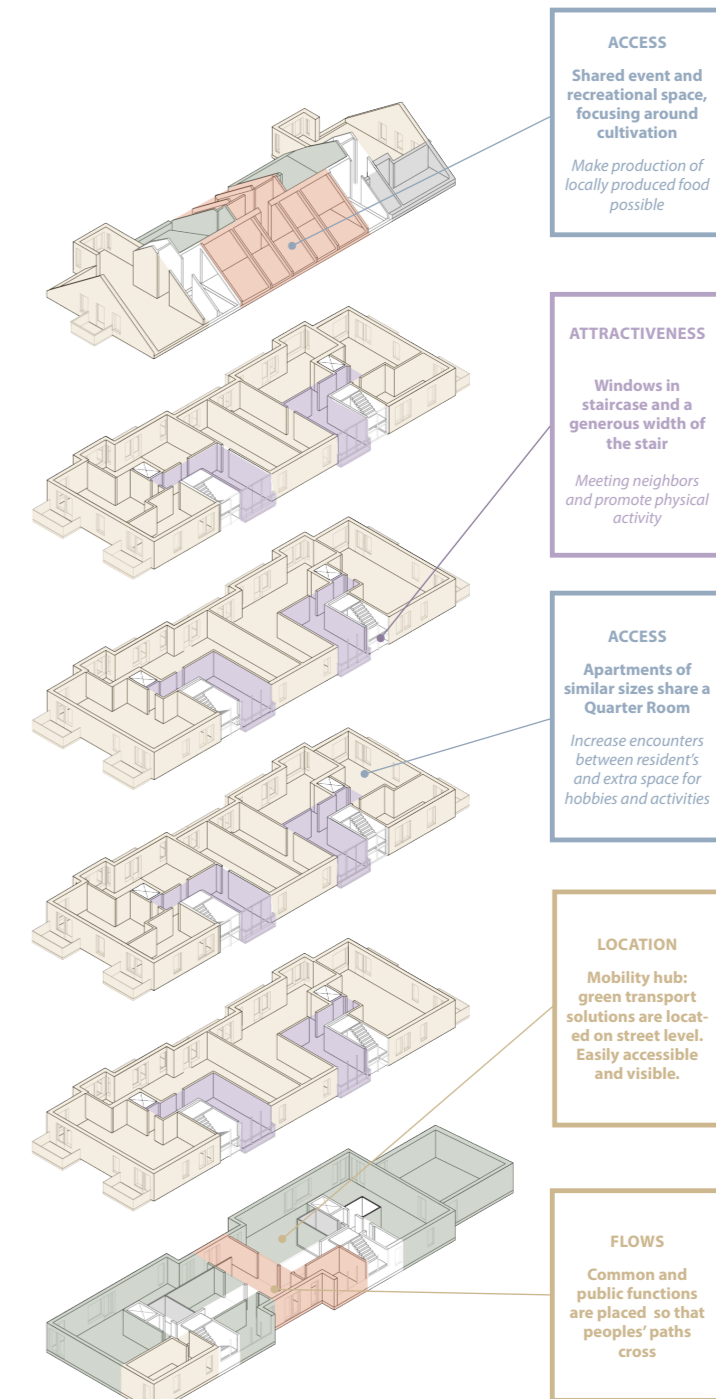


Figure 53. Exploded axonometry

- Shared social
- Shared facilities
- Shared with the Quarter
- Apartments
- Technical rooms
- Circulation

Storage		Laundry		Recycling room	
Requirements according to BBR:	In a Nudging Home:	Requirements according to Electrolux:	In a Nudging Home:	Dimensioning of bins in the recycling room. Recommendations from Avfall Sverige to the left, a Nudging Home to the right.	
Private storage units:	Shared storage:	1 bookable station, including:	2 bookable stations, in total including:	Paper	575 l 720 l
4 instances of 1 m ²	Quarter Room storage 5,2 m ²	2 washing machines	4 washing machines	Carton	1610 l 1980 l
13 instances of 2 m ²	Wet wardrobe 6.6 m ²	1 tumble dryer	2 tumble dryers	Plastic	920 l 1320 l
1 instance of 3 m ²	Shared stuff and extra furniture on the rooftop 4.8 m ²	1 dryer cabinet	2 dryer cabinets	Metal	92 l 140 l
8 instances of 4 m ²	Stuff library across the yard 16 m ²	1 non-bookable washing machine		Glass	184 l 280 l
Total: 65 m ²	Total shared: 32.6 m ²			Compost	575 l 720 l
				Residual waste	2300 l 1980 l
				Bulky waste	6 m ² 6 m ²
	Private storage units:				
	14 instances of 1.5 m ²				
	7 instances of 3 m ²				
	Total private: 42 m ²				
	Grand total: 74.6 m ²				



- ATTRACTIVENESS**
Weatherproofed entrance to bike parking in the Mobility Hub
Lower the threshold for taking the bike
- GUIDE WITH SPACE**
Mobility Hub is visible from the street
Make biking the normal
- ATTRACTIVENESS**
Automatic door opener and automatic lighting in the Mobility Hub
Lower the threshold for taking the bike
- GUIDE WITH SPACE**
The shared greenhouse is visible from the street, lighting up the sky
Attracting attention to the shared spaces
- ARRANGEMENT**
Weatherproofed bike parking spots for visitors next to entrances

Figure 54. Facade from street
1:200
5 m



- ATTRACTIVENESS**
Light, open common areas with qualities not found in the apartment
Improve community within the house
- GUIDE WITH SPACE**
Windows with a view towards the yard in the staircase
Meeting neighbors and promote physical activity
- LOCATION**
Recycling room located on a central and easy accessible location
Facilitate recycling

Figure 56. Facade facing the courtyard
1:200
5 m



Figure 55. View from street

A welcoming facade towards the street

When approaching the building one is greeted by the glazed entrance doors to the main entrance and the Mobility Hub. The heated part of the green house is visible from the street and lights up dark winter evenings nicely. Quick bike parking spots are placed under the balconies for weather proofing. Residents can use the steel net structure of the balcony railing to support cultivation of plants. The plants make the facade green and alive.



Figure 57. Facade facing south
1:200
5 m

Highlighting the shared spaces towards the yard

The facade facing the courtyard is dominated by the large glass section covering the two stairs, the Quarter Rooms and the greenhouse. From the exterior, attention is drawn to the social and shared functions. From the interior, the glass gives a nice view towards the yard and plenty of light. The connection between the building with its functions and the yard is strengthened.

- ACCESS**
Electrical vehicle car pool outside the entrance
Increase use of electrical vehicles and facilitate a car-free lifestyle

Ground floor

Entrance and Circular Room

The main entrance holds mail and delivery boxes. Residents can do grocery shopping online and get the groceries delivered to the house which facilitates a car free lifestyle. The digital notice board shows a live updated public transport time table, tips and ideas for a sustainable lifestyle and results from the latest energy saving competition. From the main entrance one passes by the Circular Room, which works as a mini second hand within the block. It is strategically located where the flow of people naturally occurs. The coffee station is in close connection to the Circular Room and works like a meeting point for the residents.

Mobility Hub

The Mobility Hub is an important part of the Nudging Home and promotes green transport solutions. By giving it direct access to the street, daylight, an workshop area, battery charging spots, and frame locks, the goal is to lower the threshold for taking the bike. The Mobility Hub provides access for the residents to shared, drive-in cargo bikes and electrical cars just outside the entrance. The space is equipped with generously sized bike parking spots, perfect for the private cargo bike or when arriving with bulky items.

Shared laundry

The shared laundry is centrally located with glass partitions towards the Circular Room, ensuring daylight, a good sound environment and a secure shared laundry. The room is equipped with two generous bookable stations, a non-bookable washing machine, a textile workshop and textile recycling.

Co-working space

The entrance floor has a co-working space for when one doesn't want to transport to the office or for those who like to socialize while still working from home. Working at home frees up commuting time which can be used for sustainable habits and lowers the climate impact from transport.

Recycling room

The recycling room is given daylight and direct indoor and outdoor access. The floor mural guides the recycling and reduces littering. The sink, hand sanitizer and generous dimensioning of the bins make it easy to recycle on the go. The recyclables are close to the entrance and residual waste further in.

ACCESS

The Circular Room allows for people to donate and find new belongings

Facilitate a circular economy and owning of less stuff

LOCATION

Locate the Circular Room and a Stuff Library where people walk by

Increase use

VISIBILITY

Mobility Hub is visible from the street, entrance and staircase

Low threshold to for example borrow the cargo bike



Figure 58. View over the Circular Room, shared laundry and Mobility Hub (A)



Figure 59. View from recycling room (B)

ATTRACTIVENESS

Hand sanitizer, sink and pedal bins available in waste room

WAYFINDING

A floor mural highlights the bins for recyclables. It also reduces littering and keeps the space tidy

ORDER

Bins for recyclables are placed close to the entrance and residual waste bins further in

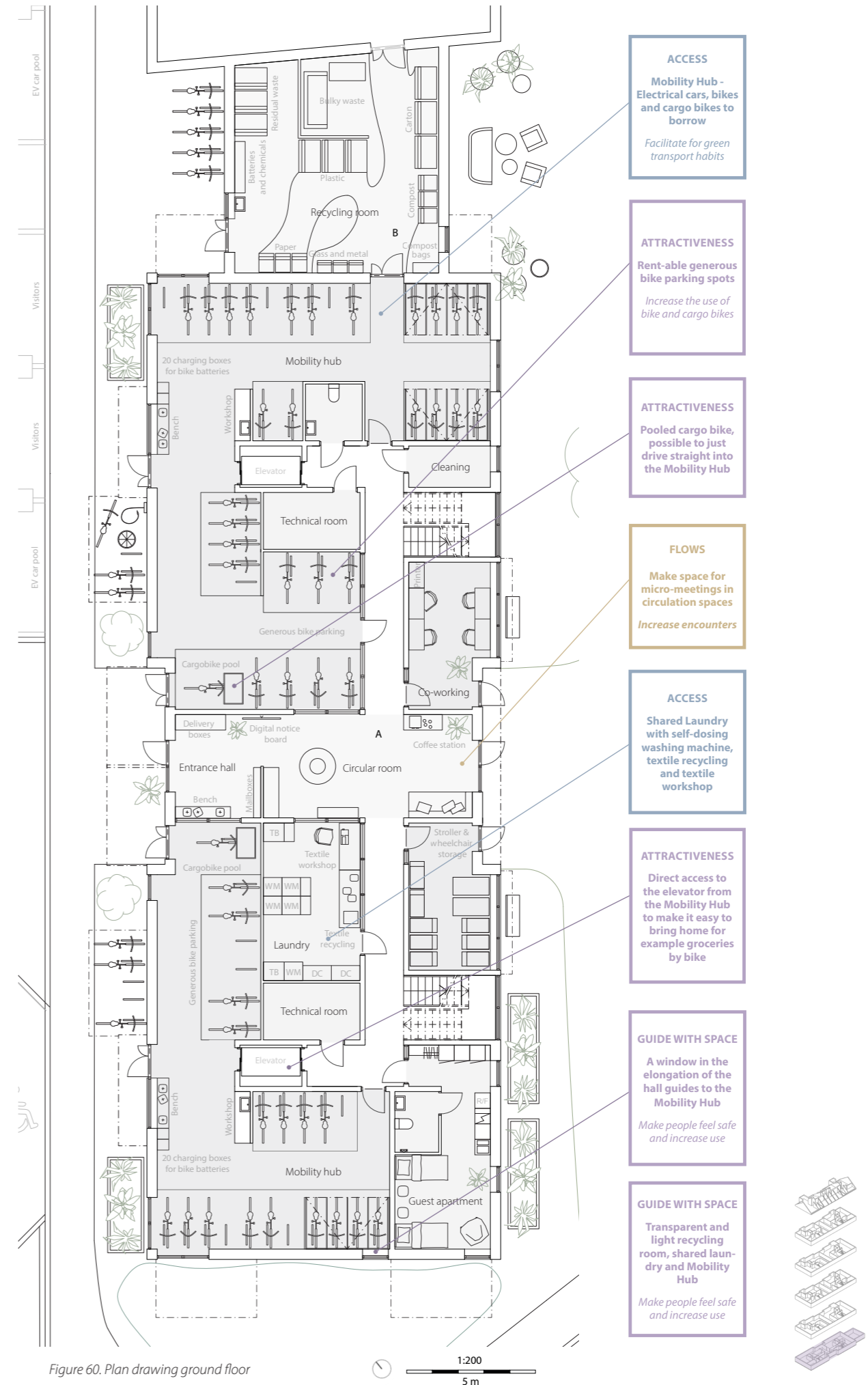
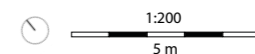


Figure 60. Plan drawing ground floor



The unheated green house facing south

In the unheated green house there is room for both **cultivation** and **socializing**. Movable cultivation beds are combined with different seating groups to design a flexible and useful area. The work benches with sinks are perfect for dirty activities and can also be used to prepare plants and seeds for the private apartment. The generous space allow for both private and communal growing and small cultivation teams can be organized to help out with watering during the busy summer weeks.

The heated green house for socializing

The heated area holds a kitchen and a big seating group that can be used all year round. It is an ideal place for birthday parties or private gatherings, and makes it possible to have a smaller private apartment. From here, it is possible to borrow extra cutlery, plates, chairs or tables to your own apartment, reducing the need for big private set-ups.

Storage

In a Nudging Home, one will have access to more stuff compared to many households, but in a circular way. The private storage area in the building has been actively reduced to instead increase the space for sharing of tools, vehicles and equipment. This is to boost the circular economy and stop wasteful consumption. A private storage space on the top floor is therefore not given by default and one has to actively rent one if needed.

The private storage rooms are located next to the social areas and is provided with daylight and entrances from two directions to increase security in the space.



Figure 61. Section B-B



Figure 62. View from heated green house (A)

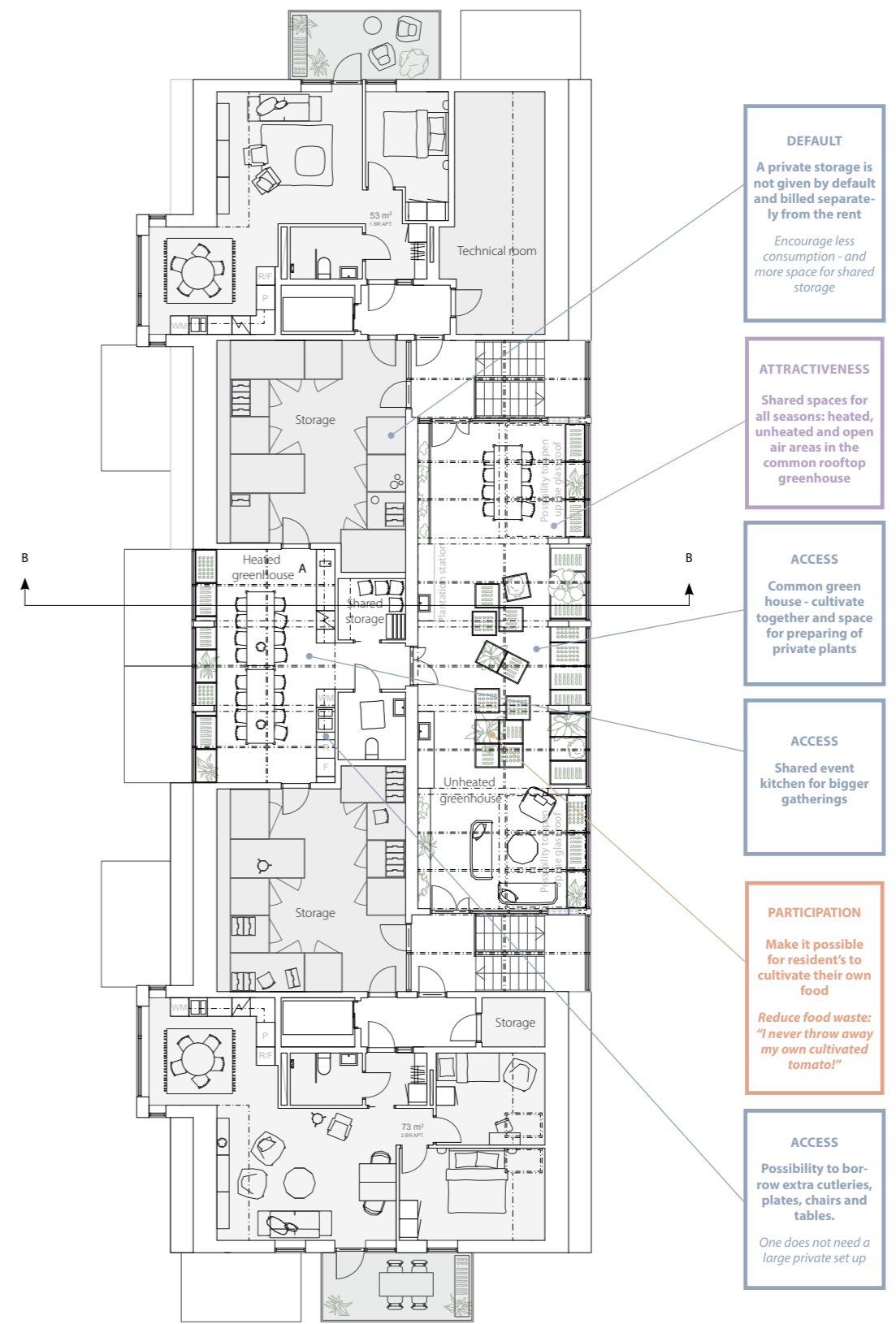


Figure 63. Plan drawing Top floor

Living floors

The Quarters and the Quarter Room as the social core.

One building, two stairwells

From the building's main entrance on the bottom floor, one takes one of two staircases, which divide the building into two parts. Each staircase reaches 13 apartments, creating a closer social context for the residents. Recognizing the people in your stairwell creates a sense of security and a better social neighborhood (Olsson, et. al. 1997).

Two types of living floors

The building has two types of living floors: one with two larger apartments around each stairwell (Type A), and one with four smaller apartments around each stairwell (Type B). The floor plans are designed to be interchangeable. Since the two types are completely symmetric, even a half of a floor can be type A and the other one type B. In this proposal, and floor 2 and 4 are of Type A (family apartments) and floor 3 and 5 are of type B (small apartments), to meet the target group of the area.

The Quarter and the Quarter Room

The closest social context outside of the apartment consists of the residents on the same floor, sharing the same stairwell. This is called "the Quarter". The Quarter shares a Quarter Room, marked with purple in figure 64 and 65 above.

The Quarter Room is provided with sliding glass doors and a french balcony facing the yard in southeast. It is up to the residents of the Quarter to furnish and take care of the room. When one gets the opportunity to decide what the room should be used for, the ownership is increased as well as the will to take care of the place. It can for example be used as a play room for the kids, where they can keep their toys, share them with the other kids in the Quarter and make friends that are as close to home as can be. The adults can also take turns watching the kids in this room, making time for other tasks. Another Quarter can use their room to host game nights or have dinner together with the Quarter every Monday evening.



Figure 64. Living floors type A - Family apartments

Figure 65. Living floors type B - Small apartments

The Quarter room is placed next to the stair, to make people pass it by on their way to their apartments. A window allows for a peek into the room to see what is going on before committing to entering. The Quarter room is directly connected to the Quarter's hallway, to create a defined, calm and safe place. The Quarter Rooms offer immense daylight, a panoramic view to the yard, and a homely feeling. These are factors that increase the incentive for the residents to use the room, even if they don't rely on them.

By providing this shared living space in addition to the private apartment, the neighbors' lifestyle becomes more transparent due to increased contact between the residents. This can nudge people to live more sustainable as a result of inspiration of others as well as an increased feeling of accountability of one's everyday actions.



Figure 66. View of Quarter Room 1 - The game room



Figure 67. View of Quarter Room 2 - The play room



Figure 68. View of Quarter Room 3 - The workout room

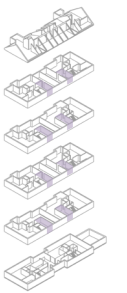
ACCESS
 Quarter Room: A shared "undefined" area for residents to furnish after their own wishes and needs
 Increase community within the Quarters, more space for hobbies and activities

ACCESS
 Shared freezer in Quarter Rooms
 Decrease food waste

ATTRACTIVENESS
 French balcony and panoramic view towards the yard in southeast from the Quarter Room

GUIDE WITH SPACE
 Strong connection between yard, nature and the indoor spaces

FLOW
 The Quarter Room is located next to the stair where residents pass by





ACCESS
Provide space for a wet wardrobe in shared hallway
Facilitate for biking in rain - a place where the clothes can dry outside of the apartment

PARTICIPATION
Possibility to decorate the entrance and entrance window
Increase ownership feeling and community within the Quarters

ATTRACTIVENESS
A clear sight-line towards the outside when entering the apartment
Compact, but spacious apartments

Figure 69. Apartment entrances from the Quarter (A)

The window to the apartment

To smoothen the transition between the private unit and the shared Quarter Room, each apartment has a narrow entrance window next to the apartment door. The window can be decorated with a lamp or Christmas lights in the winter. The residents can influence the greeting of their own front door and they get a head start in getting to know their neighbors. Like a building with access balconies or a row-house, the window creates transparency and allows for glimpses of the life inside of the apartment. The sight line of the window ends up in a wall or a wardrobe in the entrance, ensuring the residents privacy.

To be able to decorate the entrance empowers residents, an important condition for a well-functioning community (Olsson, et. al. 1997).

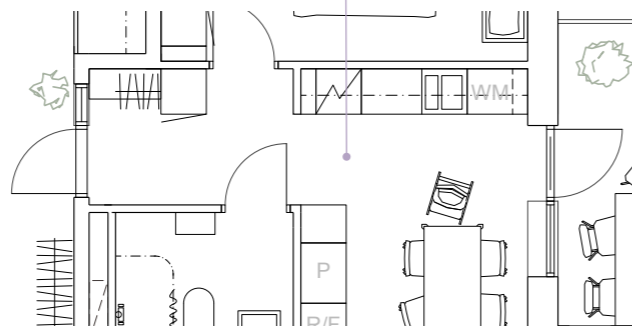


Figure 70. Zoomed in entrance situation (1 BR apartment, 49 m²)

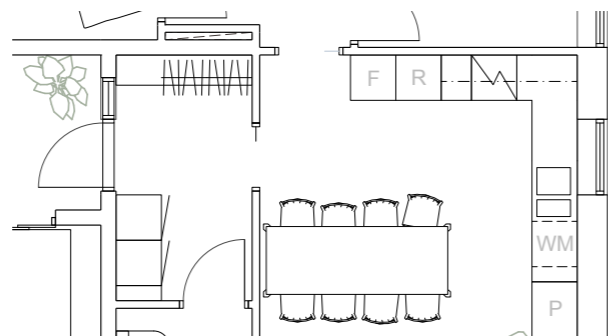


Figure 71. Zoomed in entrance situation (3 BR apartment, 81 m²)

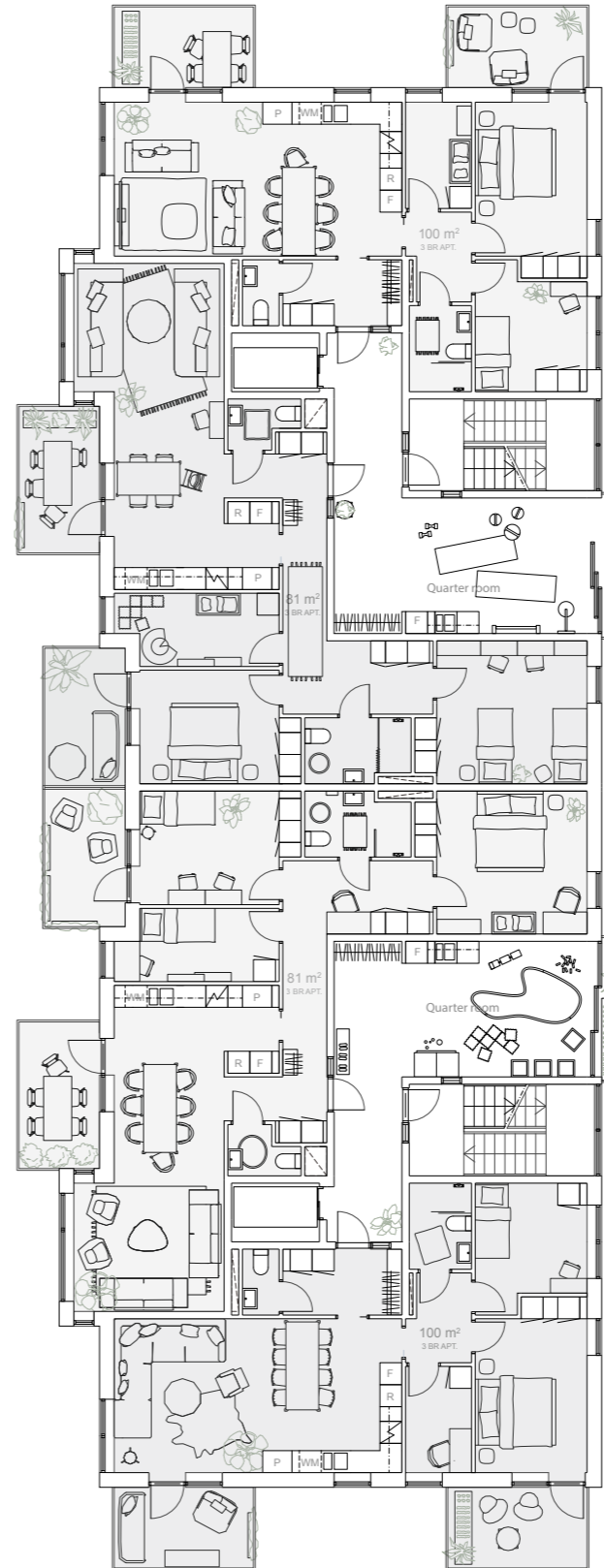


Figure 72. Plan drawings type A - Family apartments

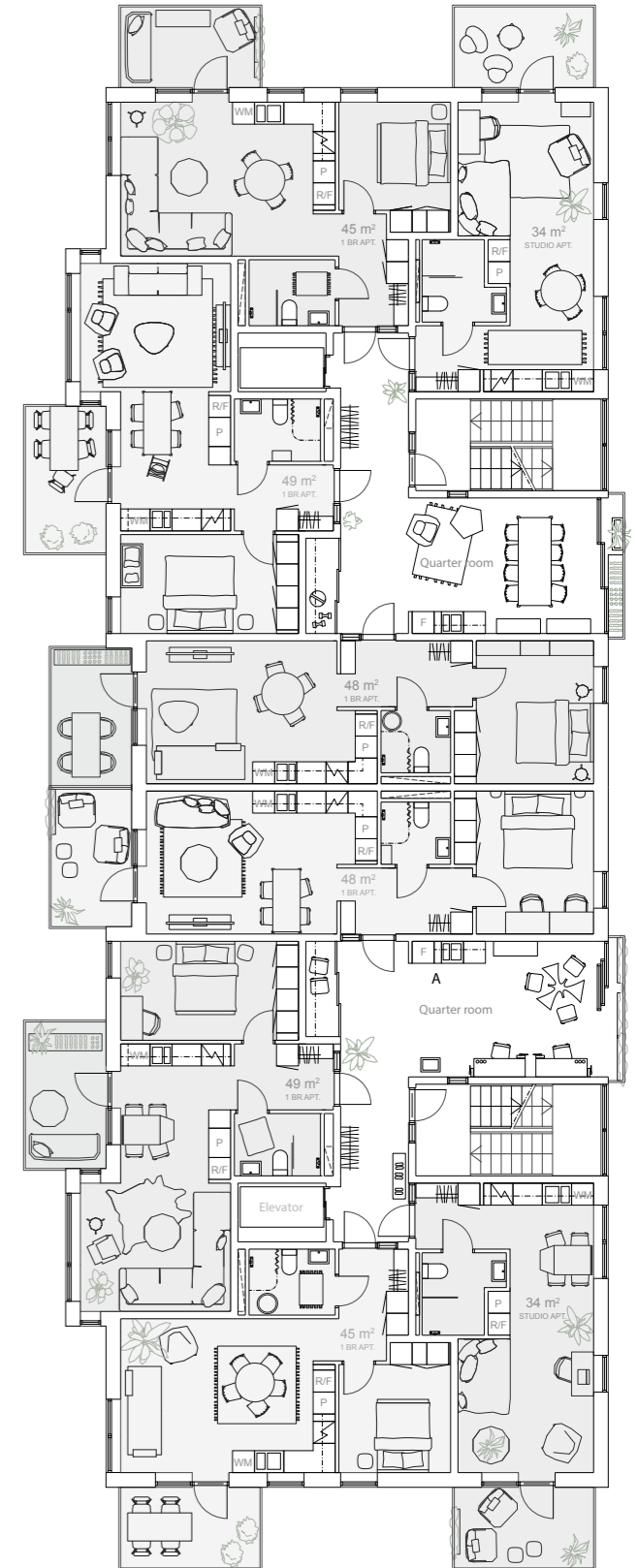


Figure 73. Plan drawings type B - Smaller apartments

Apartment scale

Spaciousness, the sustainable kitchen and the multi-functional balcony.

Spaciousness

All apartments have a generous ceiling height of 2.7 m and a low window sill height to create spacious apartments. The apartment sizes are below the average in Öster Mälarstrand, which heightens the importance of spaciousness. When entering the apartments, one has a clear sight line to the outside in almost all units.

Kitchen and pantry

The kitchens are generous and light and the pantry has been given more space than the Swedish Standards requires to encourage residents to cook their own food and increase the use of sustainable food stuffs. The pantry is placed closer to the stove than the refrigerator to further promote these options. The kitchens are equipped with generous and easy recycling under the sink with built-in, sliding bins for sorting. The home appliances give direct feedback on the energy use to make people aware about their own resource consumption.



Figure 74. View from one-bedroom apartment, 41 m² (A)

Storage

To promote sustainable consumption and circular economy, the amount of wardrobes have been slightly decreased compared to Swedish regulations. Every Quarter is provided with a wet wardrobe where one can hang jackets and clothes to dry. This frees up space in the private entrance. It also facilitates for residents to bike even on rainy days and keeps the apartment floor dry.

Balcony

All units have their own balcony with space for a seating group and plants. The steel net balcony railing can be used to support for climbing and tall plants. The balcony emphasizes the feeling of spaciousness, increases the apartment size during summer and makes it possible to store food during colder days.

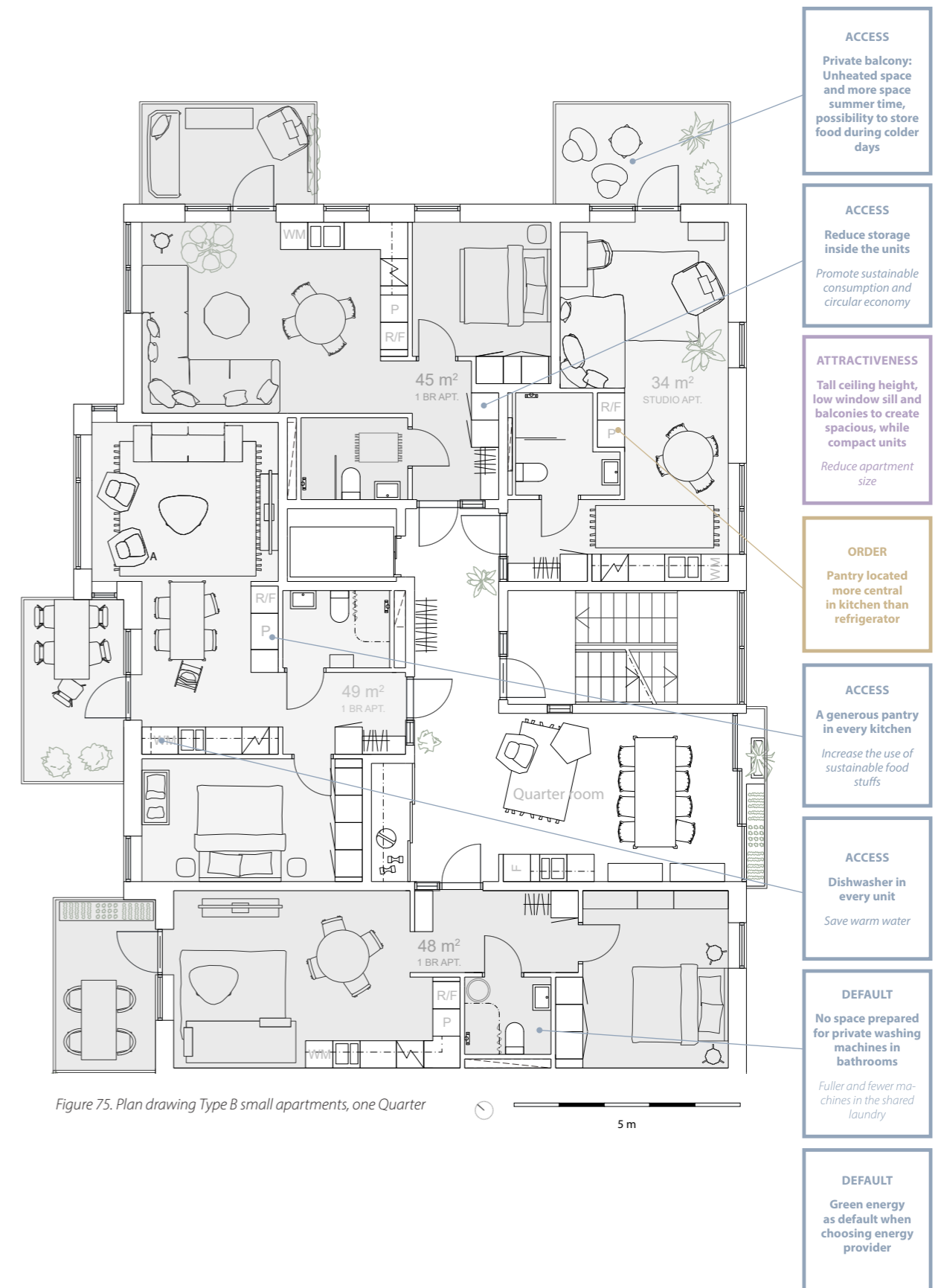


Figure 75. Plan drawing Type B small apartments, one Quarter

Reflection on method and process

The thesis work semester consisted of two major parts: *developing the toolbox* and *applying the toolbox in the building at the project site in Västerås*. The work has been truly iterative, changing focus between the two parts and different scales of interventions throughout.

Toolbox

In the early stages, research and organization of nudging strategies and examples of interventions were dominating the work. The examples of interventions were of big importance and guided the process of defining the overarching strategies. However, the deeper and the further into the design project we got, the more important the strategies and tools became for us. In the final result, the strategies and tools are most prominent in the toolbox, and the interventions are mostly showcased in the design project as examples, grounding the theory in practice again.

In the beginning, examples of nudging were collected broadly: from large scale to small details, architectural design to technological solutions, as long as it was applicable in the home or the places we move about in our everyday life. A turning point was reached when we classified the groupings of interventions and their strategies according to which stakeholders were responsible for them. It was a key insight that collaboration between actors is needed to achieve a Nudging Home. This made it possible for us to fully focus on the parts where we can contribute with our profession's knowledge.

Another important mark, closely connected to the stakeholder division, was to divide the toolbox into the design and user phase. Many of the exemplified interventions are implemented during the design process, but in order for them to work, well-functioning social and organizational frameworks are needed. These are set up during the user phase. The architect can only plan for and facilitate these, but not strictly design and execute them. Therefore, a division between the two phases was drawn, and emphasis was put on the design phase. Since the toolbox includes both phases and all stakeholders, the design project still takes them all into account, but focuses on the parts where the architect has the greatest influence. We (and the reader of the toolbox) are still aware about the importance of them both for achieving a well-functioning sustainable home.

Design project

Before starting the thesis, we discussed the possibilities of to test the toolbox. The options we were choosing between were:

A nudging toolbox

- , applied in a completely new building, where we design it from scratch on a specific location.
- , applied in a building of a common, existing typology of housing in Sweden (fe. Miljonprogramshus).
- , applied in a new planned housing project on a specific location.
- , applied in a completely new building, a model house (sw: "typhus"), with a non-specific location (fe. A future multi-family house)
- , with (several), non-specific, examples of how to apply each strategy in existing stock and new construction.

In the end, we chose to design a completely new building in a specific location. However, we used the building permit drawings to kick-start our process. Since we had developed the basis for the toolbox when we started sketching, we could quickly see how the building permits did not follow the nudging strategies for a sustainable lifestyle at all. For example, to get to the bike room, one had to go outside two times, go down a stair and in total pass six doors. It was clear that other design principles and aspects had been more important than facilitating for the resident. This was the opposite to what we wanted to do. Starting with the building permits got us inspired and motivated to start designing.

The decision of how and where to test the toolbox turned out to be a great choice. The design project and toolbox earned dignity and feasibility from the specific location and the set boundaries given by the general plan and the area. The plot we chose in the developing neighborhood of Västerås provided good conditions for the Nudging

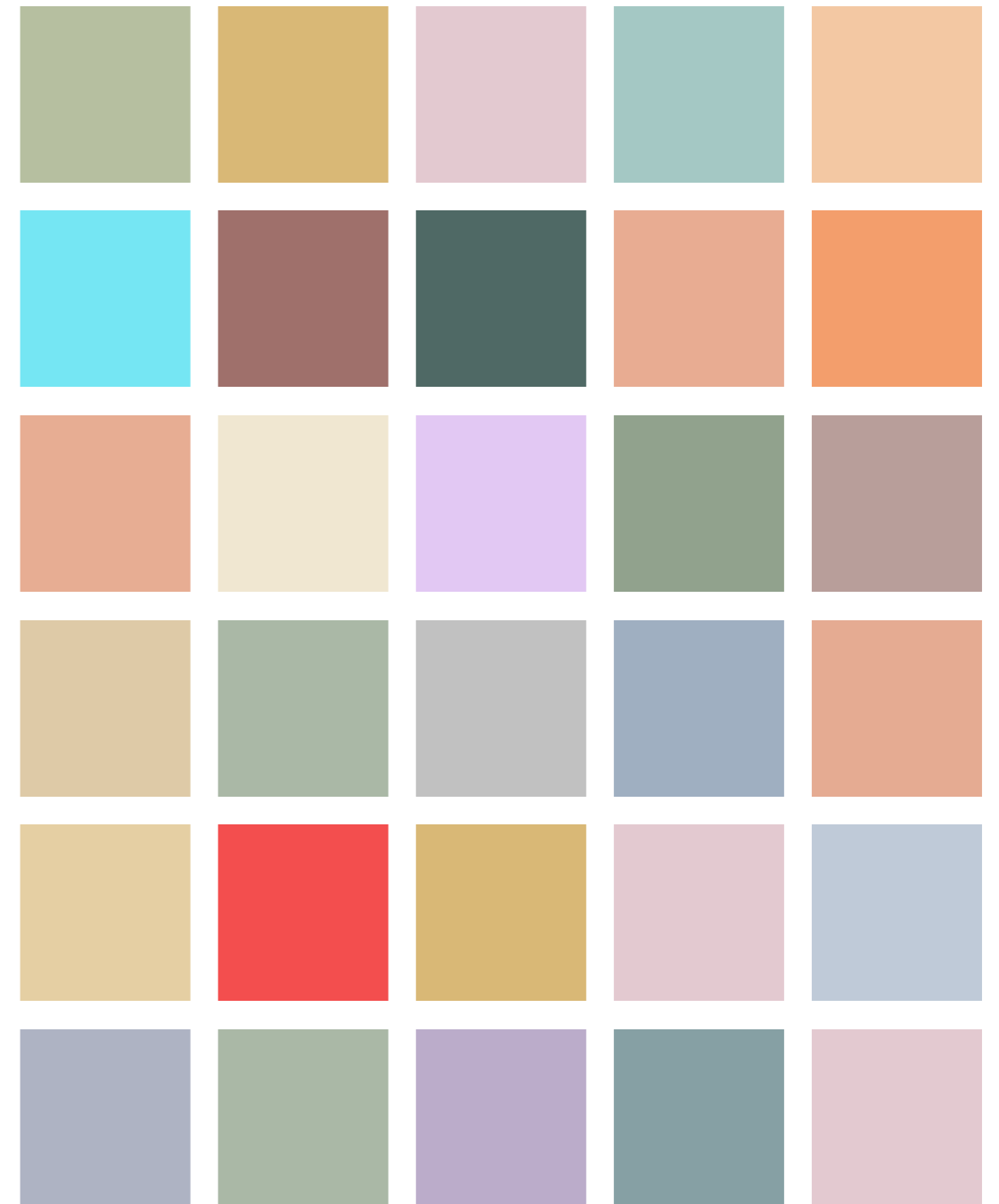


Figure 76. The process of translating and defining a nudging toolbox for architecture took many turns throughout the process, a bit like the choosing of a color representation for the toolbox.

Home. For example, the location and the functions in the neighborhood makes a car free lifestyle a viable option, and with the nudging towards green transport habits in the building, a car free lifestyle might be the preferred way of living. Furthermore, the area is filled with housing projects trying out new sustainable materials and ways to build in sustainable functions. The Nudging Home fits well in this context. Another positive with the choice of site is that similar sites are found in several cities in Sweden, proving that the Nudging Toolbox can be applied in several, relevant places.

The bike and the social structure of the building have been two driving factors for the configuration and expression of the building — two aspects we identified early as vital for a sustainable home.

Reflection on result

This thesis provides both a toolbox for architects to use when designing and motivating design decisions, as well as a reference project with specific, tangible examples of how to facilitate a sustainable lifestyle in a multi-family residential building.

Toolbox

The Nudging Toolbox covers the most used nudging strategies and is clearly linked to architecture and a residential context. The division between user and design phase as well as the mapping of responsibilities for different stakeholders make the toolbox broad and useful for many expertises. At the same time, the detailing of the architect's role gives it depth. The structured presentation of the strategies and tools provide the architect with arguments for design decisions. We are happy with the result of the toolbox and will bring it into our future work as architects.

Design project

When looking critically at the result of the design project, we see that some tools were easier to use than others. Many interventions in the design project are connected to the tool "access". However, it is not enough to propose these functions under the tool "access", they also need to be located where people pass by and designed in a visible and appealing way. Therefore, "access" should be combined with "arrangement" and "visibility and attractiveness". As stated in the toolbox, the strategies work best together, and location and design of the function is almost as important as that it exists.

As identified in the beginning of the project, a difficulty has been to delimit the design project and focus on nudging, but incorporating enough of the other aspects to design a feasible proposal within the given time frame. It has been difficult to draw the line between aspects we should fully evaluate and which we only regarded loosely. The design project has not gone into detail regarding fire safety, technical systems, technical optimization and acoustics. The delimitation to not focus on aspects outside of our expertise was set up early on in the process to be able to deeper dive into the nudging topic. However, we have aimed to design apartments and the shared facilities according to the Swedish standards and all spaces meet accessibility requirements. When we have actively departed from laws and recommendations on, for example, storage area, number of

bicycle parkings, washing equipment and amount of waste bins, we have carefully checked the requirements and then changed them accordingly. This to keep us at a reasonable level but at the same time follow our own set up nudging strategies and challenge the norm.

The effect of a lot of the nudging strategies can diminish over time. For example, being reminded that taking the bike is an option by walking past it on one's way to the car works as a reminder the first couple of times, but can in the long run blend into the background. During the user phase, smaller changes within the bike room are recommended once in a while to renew the reminder.

The implementation of the toolbox

In some parts of the project, we have had difficulties to implement the toolbox fully, due to space requirements and the chosen plot. The balconies have more potential to provide integration between the indoors and outdoors and space for food storage.

Sometimes certain interventions contradicted each other such as reducing the private space and increasing the size of the pantry. In these cases, we had to prioritize and strike a balance. In the case of the pantry, we increased the size of the pantry compared to Swedish recommendations, but kept it as a tall cabinet with pull-out shelves.

To get the biggest effect out of nudging, we had to design apartments that appeal to many people, which made us avoid collective housing solutions. For a long time, the proposal put the traditionally private apartment entrance in the shared space in the Quarter. This was proposed to increase the encounters and communication between the residents and to decrease apartment sizes. In the end, this intervention was regarded as too big a deviation from the standard apartment. We still think this solution has social and ecological benefits.

To conclude, how much Nudging is visible in the final design project? Many of the developed strategies and interventions such as mobility hubs and shared facilities are already part of new building projects. Our contribution was therefore to compile and put together these examples of design solutions into a toolbox and showcase how they manage to nudge people to more sustainable lifestyles. We then explored how architecture and design can be used to highlight and increase the use of these.

Feasibility

Economical concerns

Today, cost is a driving factor in multi-family housing projects. When adding social spaces, cost increases, which makes the Nudging Home more difficult to sell to a developer. On the other hand, during our process we have found that several housing companies, for example the public housing companies Mimer in Västerås and Familjebostäder in Gothenburg, have a strong interest and ambition to implement new solutions and design from a sustainability perspective. During interviews, we have learned about the prominent sustainability efforts made by both Mimer and Familjebostäder.

The design proposal cut costs by avoiding a basement and underground garage. The floor space given to the Quarter Rooms could have been used as apartments, but that would contradict the aim of the thesis to incorporate nudging strategies towards a sustainable lifestyle. The Quarter Room is one very important example. At the same time, floor space has been saved by gathering the laundry on the ground floor in the social common laundry room, instead of providing space for a washing machine and dryer in each private bathroom. This also cuts costs from one of the two most costly components of the bathroom — the kitchen and the bathroom.

Inter-professional cooperation

Designing and planning the construction of a multi-family housing building is a complex process with a large number of stakeholders and professions involved. The regulations and laws which are in place to ensure that the building is accessible, that it can limit the spread of a fire and allow for safe evacuation is limiting the possibilities for placement of functions and keeping the common spaces open. The design project is not the most rational in these senses, but it is questioning the norm and the priority of functions, putting the social possibilities in the center. Part of the goal with the thesis is to question the prevailing building norms and driving factors, to contribute to discussion of what the future of multi family housing looks like. When society and technology evolves, the legislation needs to evolve too.

Future prospects for the Nudging Home

It might be difficult to find a short-term gain for the developers and housing companies to nudge their residents to a sustainable lifestyle. However, it is crucial for all of us

that we abandon our unsustainable practices, within every field. When the consequences of climate change, depletion of resources and a socially broken society continue to arise, people might get more interested in changing their lifestyle. Then, the demand for an apartment where the sustainable lifestyle is the easiest one would increase. This would lead to more developers and housing companies being interested in building a nudging home and other similar solutions. Another possible trajectory is issuance of new laws, regulations and/or economic incentives towards either companies or individuals which can boost the demand for multi-family housing such as the Nudging Home.

Nudging as one part of the solution

Nudging is not the single answer to the challenges we are facing, but it can be one important puzzle piece. Politicians and non-governmental organizations need to push on their end to achieve big change and influence the market for structural changes by legislation and subsidies. The individual also has a responsibility, both in their private life and their professional life. Architects need to design buildings that facilitate sustainable lifestyles. Some of the key learnings from the conducted master's thesis in this regard is to design for more exchange between neighbors, a circular economy and green transport.

Does the architect have the mandate?

As every professional, the architect has a responsibility to contribute to our common sustainable future. The question is, to what extent? Since we are designing the environments where people live their lives, the question of personal autonomy arises. We think that the responsibility is large and that architects have unique competences which can have a huge impact. A residence should not force anyone to live a certain way. However, every apartment that is being built — today, tomorrow and historically — has built-in allowances, barriers and motivators which influence the resident to act a certain way. The question we need to ask is if the housing being built today is facilitating or obstructing the development towards a sustainable society. We think that the sustainable lifestyle-aspect often comes in second, or even last hand, when designing a multi-family-housing today. With the Nudging Toolbox, these aspects are lifted. They should be discussed equally in conjunction with other aspects in the complexity of building a house.

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The authors



Sofia Löfgren

“Sustainable architecture is the only architecture. Sustainability has permeated every course and project I’ve done at the master’s level. However, I know how difficult it is to take the right, sustainable decision in my everyday life. Especially when it’s requiring more of an effort from me — even though I’m convinced that climate change and depletion of our ecological and social resources are threatening our society as we know it. Therefore, I want to study how architects can use nudging to make it easier for people to live a sustainable lifestyle.”

Architecture and Engineering, Chalmers, Bachelor degree in 2020

**Architecture and Planning Beyond Sustainability, MPDSD, Chalmers
Master’s program (2020- 2023)**

Studios:	Courses:
Design & Planning for Social Inclusion	Sustainable Development and
Social-Ecological Urbanism	the Design Professions
	Architecture and Gender

Erasmus exchange at TU Wien, Vienna, Austria 2022

Design Studio Pula and Excursion Urban Design
Architecture — Construction — Settlements
Planning and Development in Agglomerations
International Urbanisation
Integrated Regional Development in Developing Countries

Free standing courses

Universal Design
Architecture and Gender
Multiple courses in graphic design

Architecture and Engineering, Chalmers, Bachelor degree in 2020

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Sustainable Architectural Design	Crash course: Beyond Sustainability
Sustainable Building: Competition	History, Theory and Method 5 -
	Dealing With Inequalities
	Design and Performance Optimiza-
	tion for Buildings

Internships:

Dall & Lindhardtsen, Helsingör (2020-2021)
Ekeblad bostad (summer 2022)

Ida Ylenfors

“Incorporating nudging strategies in the design of our homes interests me first of all because the home is an important part of my own life and well-being, but also because I know how much of an impact our homes have on both ecological and social sustainability. This topic is simultaneously important from a sustainability perspective, but also a topic close to my heart.*

Special thanks

Sofia’s thanks

I want to thank our supervisor Kaj for challenging us throughout the process and our supervisor Jakob at White for guiding us through the complexity of working with methods and processes in architecture. I am also very grateful for the support and interest we have gotten from everyone at White, especially from Bruno and Erik, and the time we spent with you all at the office.

A special thanks to Margareta for your never ending architectural and emotional support and to August for reminding me of the importance of the thesis subject, giving me new perspectives on the project and doing the dishes in May.

Ida, I’m proud of what we have accomplished, and that we did it with such joy and curiosity throughout the whole process. Thank you, for being in this together and thank you for being my friend. I’m so happy we found each other before time was out.

Ida’s thanks

A special thanks to Kaj for leading us through this process and for fruitful discussions, thoughts and ideas. Also a big thank you to Jakob and all colleagues at White. I am so grateful for the guidance we have gotten and the possibility to hang out with you at the office.

Last but not least, thank you Sofia for doing this semester with me. I’ve had a blast and are so happy for what we have achieved, but also our friendship.

Would you like to live in a home where the sustainable lifestyle is the easiest one? A home where a shortcut results in an ecologically and socially sustainable action?

A Nudging Home explores and answers the two research questions:

How can nudging strategies be used in residential architecture to support and promote sustainable lifestyles?

What would such a nudging home look like?

Have a look inside to see what the future of residential architecture might look like!