DEVELOPING A CREATIVE TOOL AS A STEP TOWARDS STRONG SUSTAINABLE URBAN DESIGN

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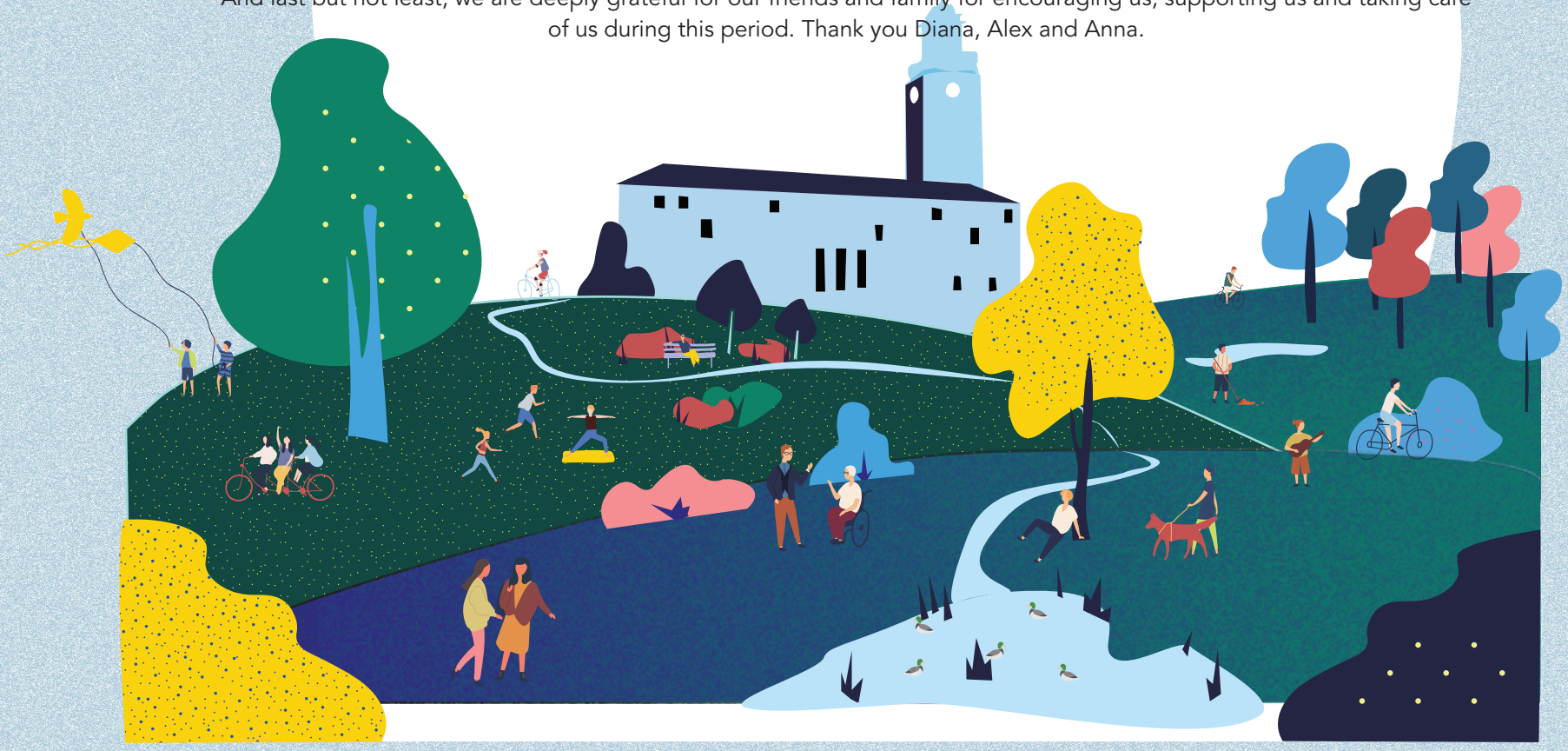

READING GUIDE

The following master thesis report consists of two documents. A main report and an appendix collection with our interviews and other relevant documentation. All interviews and field work that are referred to in the report can be found in the appendixes.

The use of theory and theoretical concepts in this report are based on the work of other authors. Throughout the report we have been using the APA reference system to indicate their contributions and will refer to the author with surname and year of the publication as such: (Surname, year). If more than two authors contributed to the publication, we will reference the source as such: (Surname, et al., year). The reference list is structured in alphabetical order and can be found at the end of the report.

The report will entail a number of illustrations and images in order to communicate our findings and our final product. These illustrations and images are made by the authors of this report unless it is specified.

Our interviews were performed in english with native dansih speakers. They would sometimes use words in danish that we have translated into english, to the best of our capabilities as sometimes there is no exact translation. Our case also concerns the development of a space in a danish context, thus we have found it necessary to translate some danish words related to the case. An example is how we translated the temporary name of the square from 'Pladsen bag Rådhuset' to 'The square behind the Town Hall'. The exact translation of 'Pladsen' is 'The Place', but we find that using the word Square communicates the purpose of the development better. Every time we translated a word or sentence from danish the original danish expression was put in brackets next to the translated sentence.

ABSTRACT

Cities will always face many challenges, both today and in the future. In order for cities to face these challenges in an inclusive way, it is important that all Citizens, be them future or present, human or non-human, are taken into account. Within this report we provide a way to include multiple types of citizens in the planning process in hope of answering the challenges in a proactive way. During the research for this report it was identified that Frederiksberg Municipality is pursuing a sustainable agenda however its carbon lock-in on car-based mobility is stopping it from reaching it adequately. By looking into the distribution of space within the city our investigation identified that it's at risk of becoming a tragedy of the commons. This report combines information provided by Frederiksberg Municipality, collected from interviews and observed in situm. The information collected provided the base to use different tools like an affinity diagram, a morphology chart, SCOT map, visions and scenarios. This was all used to analyze how the development of public spaces can vary greatly depending on who the planners choose to include in their process. To do this the report shows how a possible closure can be reached by relevant social groups around an artefact by using SCOT proactively combining it with agonistic design to develop the Square behind the Town Hall. The final product of this project is a tool designed to assist planners in their planning process by making them identify the needs and problems of actors and relevant social groups that support a strong sustainable agenda in relation to the Square behind the Town Hall.

Key words: Frederiksberg , Agonistic Design , Design Game , SCOT , Weak and Strong Sustainability, Voices of the Future

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1 Introduction

Cities will always face many challenges, both today and in the future. They have to uphold the systems which constitute a good and livable city while also transforming these systems to accommodate a sustainable future and adapt to the impacts of a changing climate. In light of these challenges it becomes evident that cities need to radically transform and restructure their systems. Despite this need for transformation, development within cities is often path dependent and supports a neo liberal urban agenda (Broomhill, 2001). There are many voices who criticize this type of development for having disruptive social and bio-physical consequences. These voices further argue for the value of alternative possible paths such as citizen participation and sustainable development (Moulaert et al., 2007). The criticism points to the many possible futures that are being silenced in technical planning processes and by the planners' perceived neutrality (Munthe-Kaas, 2015). Stakeholders such as politicians and planners aim at incorporating citizen participation and sustainability into development projects. However, navigating these agendas and aligning them with requirements from the legal act can be a challenge since urban development is a political process (Mouffe, 2007). Furthermore, the planners are not trained at listening to the wide variety of voices who can contribute with their opinion on what constitutes a good and sustainable city, causing the voices to be silenced in the process of technical planning.

The above tells us that developing a city is a constant prioritization process, where decision makers listen to the majority and their version of what constitutes a good future city. In the following report we will present how this is also true for our case study which concerns the development of a square in Frederiksberg Municipality. The project behind this report was conducted in collaboration with Lene Stolpe Meyer, a planner in Frederiksberg Municipality's Climate Team and Bo Rasmussen, one of Frederiksberg Municipality's project managers of the Square behind the Town Hall.

The city of Frederiksberg is the most densely built city in northern Europe and is located in the region of greater Copenhagen (Vej, Park og Miljø, 2021). Due to its density, the planners of Frederiksberg Municipality are always looking to create synergies between different elements of the city. This entails finding new opportunities for development and one such new development project concerns the redesign of a parking lot located behind Frederiksberg's Town Hall.

The parking lot located there, and the square that the municipality intends to build in its place do not have a name yet and the space is referred to as 'Pladsen bag Rådhuset' by planners and politicians, which in this report will be translated to the 'Square behind the Town Hall'. The square is 7.900 m2 (Juul Frost, 2017) and is being redesigned to accommodate recreational needs and climate adaptation. It is Frederiksberg Municipality's plan to build a parking basement underneath the square with room for 275 cars. This prioritization of car-based mobility is part of the carbon lock-in which defines Frederiksberg's development trajectory. However, the development of the Square behind the Town Hall constitutes an opportunity for the politicians and planners of Frederiksberg Municipality to reconsider the trajectory they are leading the city of Frederiksberg onto and review what the future city needs in terms of sustainable development. However, such a review is absent and the main citizen dialogue only presented two versions of managing car-based mobility: a parking lot on ground level or a parking lot below ground level (Schulze+Grassov, 2020). Thus, this citizen dialogue did not give citizens a chance to vote on a more sustainable alternative. Nor did the citizen dialogue attempt to bring forward or investigate the many possible futures that lie in the development of the Square behind the Town Hall. These possible futures should not only adopt the current citizens' perspective but also embrace silent voices such as future citizens, flora and fauna.

The concept of Adjacent Possible describes the future as a shadow hovering over the present state of things (Johnson, 2011). Many different alternative paths towards the future hide in the shadows and these alternatives have to be developed and implemented before more radical stages can be reached. Thus, the concept of Adjacent Possible tells us that radical new ideas can't be implemented all at once, but have to be matured through a number of stages. This report will describe how a structured brainstorming tool and visions can act as one of these stages by supporting planners in creating meaningful, sustainable decisions regarding the urban space under development. This report further aims to investigate the development of the Square behind the Town Hall through an agonistic lense and use the theory of Social Construction of Technology (SCOT) to drive an agonistic planning process of an urban space. SCOT was developed to be used retrospectively but this report will explore how SCOT and the concepts of which it consists, can be used proactively in an urban development project. This report will further show how SCOT can be used to include and navigate the different voices present in an urban development context in order to promote a more sustainable agenda.

Thus our research question and our sub-question is:

HOW CAN WE PROMOTE A STRONG SUSTAINABLE AGENDA FOR THE DESIGN OF PUBLIC SPACES IN FREDERIKSBERG MUNICIPALITY USING THE SQUARE BEHIND THE TOWN HALL AS A CASE STUDY?

How can the proactive use of SCOT be developed into a tool that will represent different actors and their relevant social groups in the design of future urban spaces?

In order to answer these questions the report is structured as follows: Chapter 1 includes our motivation for doing the project as well as an overview of its process; Chapter 2 addresses concepts utilized during the development of the project while Chapter 3 refers to the theories on which the project builds; Chapter 4 covers the methodology used to collect and process the empirical research used to describe the context of the project in Chapter 5; Chapter 6 presents our analysis of the gathered empirical material and Chapter 7 elaborates on our process of designing our final product. Lastly Chapters 8, 9 and 10 cover the reflections, the future considerations and the conclusions of our project.

1.1. OUR MOTIVATION TO DO THE PROJECT

Our background and intentions with this master thesis have been a determining factor in the production of the project, which the following report is based on. The theories we chose and their application are affected by our agenda as sustainable designers. Through the master program we have gained knowledge about how socio technical and sustainable theories can be applied to change systems for the good of the environment. Therefore we wanted to apply a selected range of these theories to a real case. The program has also made us aware that social inclusivity is a big part of sustainable design and thus we also developed the project with this scope in mind. What first got us working together on a master thesis was our common interest in including more green and natural elements within cities and how cities can be designed to include a more socially and environmentally sustainable agenda on an international level. Our focus has since shifted and the end result focuses more on how we can work as change agents who aim to hack the system from within, in order to make the people who are planning the cities adopt a more sustainable agenda.

1.2. RESEARCH STRATEGY

This section will present different subjects that the report investigates. Its purpose is to guide the reader through the choices we made to answer the research question and make the reader aware of how our empirical material is connected to the theories that we use.

THE SQUARE BEHIND THE TOWN HALL

After our initial choice to collaborate with Frederiksberg Municipality on the case of the Square behind the Town Hall, we investigated the context of the development project and the state it is currently in. We have investigated the arguments and decisions that both politicians and administrative employees have taken regarding the development of the Square behind the Town Hall. This entails an analysis of the design proposal for the parking basement and the citizen dialogue that was performed in the summer of 2020. We did this in order to understand the process that the development of the Square behind the Town Hall has been through and the background for the choices which Frederiksberg Municipality took.

URBAN DEVELOPMENT IN FREDERIKSBERG MUNICIPALITY

Through interviews and official documents we have gained insight on how Frederiksberg Municipality performs planning and how they argue for their prioritization of elements in the urban space. In order to analyze these prioritizations through a sustainability lense and the impact that Frederiksberg Municipality's development trajectory will have on the future, we utilized theories such as Tragedy of the commons and Carbon lock-in. This enabled us to see the development of Frederiksberg through a different perspective than the one Frederiksberg Municipality presents in its reports and plans. By gaining insight to how Frederiksberg Municipality currently is performing development projects, we can justify a shift in focus.

DEVELOPMENT FOR SUSTAINABILITY

It was our intention from the beginning to lead Frederiksberg Municipality's development projects in a more sustainable direction. To do so we needed to choose one of the many theoretical sustainability frameworks and utilize it in a development process. We chose the theory of weak and strong sustainability since we found the weak sustainable arguments to fit well with Frederiksberg Municipality's arguments for development. This enables us to use the theory of strong sustainability as a counter argument to Frederiksberg Municipality's current development trajectory. Therefore weak and strong sustainability compose a core concept in our repurposing of Social Construction of Technology (SCOT).

REPURPOSE SCOT IN URBAN DEVELOPMENT

SCOT has been the defining theory of our project. We have experimented with and modified the theory. We will present how this was done within the Theory and Analysis Chapters. Our idea behind using SCOT was to show how the final outcome of our case, the Square behind the Town Hall, can look differently depending on who the planners listen to in the development process. We provide more support to this by introducing the concept of agonistic design. Using SCOT in this way produced two visions which formed a barometer through which the planners of Frederiksberg Municipality can evaluate the sustainability of the concepts they have developed in our design game.

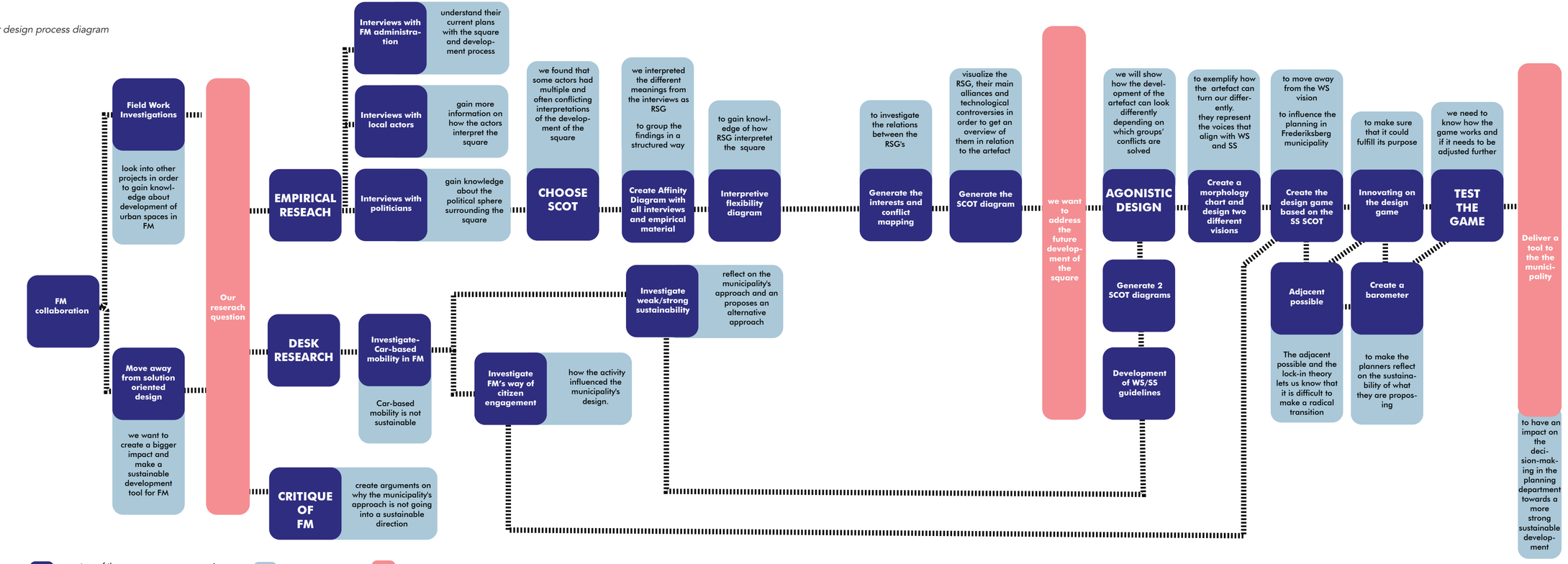
THE DESIGN GAME

Instead of ending our process with a set of visions for a more sustainable proposal for the square, we wanted to produce a second order learning process. Thus we developed a game that is to be used by the planners as a structured brainstorming tool. The tool is based on our work with SCOT and Strong Sustainability. The aim of the tool is to make the planners of Frederiksberg Municipality aware of the perspectives we identified and make them move away from their prioritization of car-based mobility.

1.3. PRESENTATION OF OUR PROCESS

The figure (see figure1) on the following pages explains our process and argues for the choices we took along the way. The model should be read from left to right. The process is explained in overall steps and underneath each step is an explanation of the purpose behind each step.

Figure 1. Our design process diagram



2 Concepts

CHAPTER INTRODUCTION

This chapter presents a combination of concepts that the reader will need to be familiar with in order to understand the background of our project and its final outcome. Each section is a short review of each concept. First we will present the concept of agonistic design which we will use as inspiration for how SCOT can be utilized to guide a design process proactively. The concept of urban transformative capacity is used to gain a perspective on urban development and it introduces two goals which we will use to analyse Frederiksberg Municipality's development of the Square behind the Town Hall. Vision making and the different concepts through which visions can be explored will be introduced since it is important for understanding how we will aim to change the future. The concept of design games will be presented as a solution to the problems we identified during this project. Provotypes and participatory design are concepts which we will use in the design game and they will be explained last.

2.1. AGONISTIC DESIGN

In this section we will describe urban development through the concept of agonistic design. We have done so because the concept of agonism focuses on bringing forward different perspectives as the outset for dialogue. It aligns with our theoretical framework (SCOT) which also has technological conflicts as a center for development. Even though the concept has its origin in political philosophy, it can also be used to describe development processes in the urban space. Mouffe (2007) uses the concept to define the public space as a political battleground where different projects are in conflict without any possibility for a full reconciliation. However, conflicts can also show the need for alternative solutions. Following this line of reasoning, planning is never objective but constitutes a political process, which will result in the exclusion and inclusion of choices. Munthe-Kaas (2015) agrees that there is a multiplicity of stakeholders involved in the development of the urban space and that they all have diverging opinions and interests concerning the artefact under development. According to Munthe-Kaas & Hoffmann (2016), the controversy can be seen as centered around the question of what constitutes a sustainable city. This is also true for our case study where different stakeholders have different ideas of what to prioritize in order to make the best possible future version of the square that is to occupy the space behind the town hall in Frederiksberg.

Different stakeholders have different images of 'the good city'. These images can be seen as different versions of the future. Agonism in the context of urban development allows us to open up for these different perspectives and recognize that there is not just one future in play but several of which the outcome will be determined by how the conflicts are resolved (Mouffe, 2007). Mouffe (2007) argues that the outcome of the conflicts will happen as an inclusion or exclusion of existing possibilities and thus this will determine the development. This is a contrast to the widespread conception that the public space is where consensus should emerge, but Mouffe (2007) argues that the agonistic model sees public spaces as where conflict happens without any possibility of a final reconciliation. We can thus come to the conclusion that there is no right answer for what a certain public space should look like. Hence, it makes more sense to see the development processes as a constructive political process which is packed with controversy (Munthe-Kaas, 2015).

The concept of agonism in the context of urban development tells us that a development project can't be neutral and neither should it be. Realizing that there is no right solution argues for a change of focus: Instead of trying to find the best future, efforts should be used on exploring the many different possible futures (Pløger, 2004). Munthe-Kaas (2015) argues that these potential futures are often silenced in the technical urban planning process, where planners follow their usual procedures. By adopting the concept of agonism, planners can open up the city for discussion and consider a wide variety of these possible futures (Munthe-Kaas & Hoffmann, 2016). This approach engages planners in a new role where they will need to reconfigure themselves to be somewhere between a planning authority and innovators (Munthe-Kaas & Hoffmann, 2016). In this new role the planners will become designers where the act of designing will be a process of knowledge creation. A design process with knowledge creation at the center will focus on engagement rather than aesthetics (Munthe-Kaas & Hoffmann, 2016). Adopting the concept of agonism will shine a new light on the urban development processes and it is through this concept that we will view the conflicting interests that are in play during the planning and development of the square behind the town hall.

2.2. URBAN TRANSFORMATIVE CAPACITY

This section is introducing the concept of transformative capacity in relation to urban spaces. The reason for introducing this concept in our approach is to create a foundation for understanding different ways of creating future sustainable developments. By taking into consideration the interrelationships between ecosystems, technologies, social and cultural practices, cities can be framed as complex adaptive systems through design decisions (Marshall, 2012). This is further elaborated on in the concept of Urban Transformative Capacity which can be defined as:

"the collective ability of the stakeholders involved in urban development to conceive of, prepare for, initiate and perform path-deviant change towards sustainability within and across multiple complex systems that constitute the cities they relate to "(Wolfram, 2016, p.126).

The term of transformative capacity was first used in 1994 in the context of company knowledge generation and exploration of innovation for creating competitive leverage (Garud and Nayyar, 1994). However, recently scholars (Broto et al, 2018; Wolfram, 2019) are pulling the concept towards focusing more on human centered systems. They achieve this in the context of urban developments, through shared visions and goals rather than top down actions (Broto et al, 2018).

The root of the urban transformative capacity (UTC) concept derives from a sustainable transition approach and is fostered through reflective and iterative learning (Gaziulusoy & Öztekin, 2018). Studies that tackle sustainable transitions (Gaziulusoy, 2018), acknowledge the urgency of radical change through socio-technical systems that can fulfill humanity's needs (Gaziulusoy & Öztekin, 2018). In order to achieve a sustainable transition in cities, a vision outlining collaborative activities and engaging stakeholders is needed; a vision that can support designers, engineers and planners to create meaningful decisions in regard to the urban spaces (Broto et al., 2015). However, there is no simplified guideline for achieving sustainable transitions and overcoming the challenges that cities are facing today. Unlike the sustainable transitions concept that needs to have the same impact at the societal level, by seeking change at multiple levels (institutional, social and organisational) UTC applies a set of criterias that helps move forward to a space for allied reflection of the situation in practice (Gaziulusoy & Öztekin, 2018). This comprehensive set of criterias are left out of this report since they present a complex approach that falls outside the scope of this project. Instead we will focus on how the UTC framework contributes to understanding sustainable transformations through a new vocabulary and through alternative forms of evaluating the projects in urban areas (Broto et al. 2015).

Even though there is an increased interest in expanding the urban systems' capability there is no clear way of gaining deep understanding of transformation. The reason for this lack of understanding is the inconsistency of existing institutional and material systems that can follow the transformative capacity (Broto et al, 2015; Wolfram 2016; Romero-Lankao et al 2018). Urban transformations are concerned with cross-scalar changes beyond and within administrative boundaries that focus on the capacity to develop processes and institutions to drive radical change towards more sustainable futures (Broto et al, 2018). Scholars like Broto (2015) and Wolfram (2016) argue that cities need two goals in order to achieve a critical transformation (Broto et al. 2015; Wolfram, 2016):

- to allow to actively disrupt and disassemble existing systems
- to build and create viable alternatives simultaneously

By means of the first goal, actively disrupting and disassembling existing systems, cities are being analysed by experts (e.g. sociologists, urban designers, sustainable engineers or environmental engineers) who contribute to acute observations and contributions for creating a better

development for the current and future societies (Broto et al, 2018). The second goal is for decision-makers and relevant actors to take the role of understanding the meaning of the future and the multitude of directions that a city can be shaped and transformed.

Both goals are processual and institutional aspects that can support sustainable transitions when it comes to the concept of transformative capacity. Transformation is not limited to a simple linear process, instead it should be perceived as a cross-scalar, trans-local change within the urban space analysed (Broto et al, 2018). By using the framework developed by Wolfram (2016, 2018), UTC offers a valuable opportunity for researchers and practitioners in identifying the strengths and the weaknesses of sustainable initiatives that are limiting or activating the process of change (Wolfram & Frantzeskaki, 2016; Wolfram et al, 2018). Furthermore, the motivation for using this method would facilitate inclusion and empowerment, close the intermediation gap between professionals, enhance reflexivity and challenge the agenda of urban planning adaptation (Wolfram et al, 2018). Even though in our project approach we don't consider the criterias that Wolfram uses in his framework, we borrow the base knowledge about how an urban space has the capacity to transform to a new sustainable state.

2.3. VISION MAKING

Vision making can be explored through different approaches including concepts like scenarios, trading zone and constructing of the adjacent possible. The following section presents the concepts of visions, scenarios and adjacent possible. We chose these concepts in order to outline the setup of our final product (see chapter 7).

VISIONS

Urban planning's core function is defined by making decisions in the present that will directly influence future activities in order to create livable cities that are economically advanced, culturally active, socially engaged, green and safe (Neuvonen & Ache, 2017). An important role in creating a platform for cooperation between stakeholders and incentivising different actions, is played by planning the future. However, it's hard to predict the future, but assumptions can be developed about what it might look like (Stojanovic et al., 2014). A socio-technical approach is taken to outline future sustainable cities, which can be projected through visions. In her paper, Ingerborgud (2018) argues that visions play an essential role in enrolling in urban sustainability agendas. It is important to investigate how sustainable goals and agendas can be achieved through vision making, especially the ones that are shared by relevant stakeholders. She further states that "(..)visions express an already achieved idea or consensus among the actors involved " (Ingeborgrud, 2018, p.96).

The concept of vision making, within urban development, was first mentioned by Dierkes et al. (1996) as the opportunity to develop a shared goal and direction for the actors that are usually not collaborating. In their opinion, visions are being used as simplifications of complicated issues. Moreover, what Dierkes et al. (1996) are calling a trading zone, can support vision making. The trading zones can be utilized as tools that initiate collaboration between actors. Inside a trading zone, one actros' view can be challenged, improved or completed by other actors (Ingeborgrud, 2018). In a similar fashion, Gjøen (2001) argues that visions need to provide space for trading and negotiating ideas about future developments instead of being used as a building tool guideline. Thus, Gjøen (2001) supports the idea that trading zones can support the creation of visions.

SCENARIOS

Scenario planning is different from most future-oriented approaches. It usually provides a "more qualitative description of how the present will evolve into the future" (Stojanovic, 2014, p. 84). However, scenarios are only useful when the future vision is clearly defined. Therefore it is imperative to acknowledge the difference between a scenario and a strategy, as a scenario is not meant for identifying actions or activities that need to be achieved for reaching a vision (Moriarty et al, 2005).

Callon (1987) introduces the concept of "scenario" as describing the process that guides an actor to support the desired future and a method to assign roles to other actors that are participating in the same process. Callon (1987) emphasizes that scenarios can contribute to realizing the sociotechnical solutions by attracting interested actors, recognised as "sociology of expectations". Furthermore, acknowledging that there can be different opinions, Borup et al. (2006), declare that it is important to have shared and guided expectations in order to bring forward agendas among participating actors.

The actors can use scenarios to describe what a city might look like in the future and aruse methods of achievement through different actions that in the end can identify patterns of the future urban development (Stojanovic, 2014). In order to better understand and identify the factors that are relevant for shaping future urban environments, the scenario building step is an important approach. Stojanovic (2014) and Gaziulusoy (2018), agree that in order to achieve a transition towards sustainable development, scenarios and vision making hold an essential part in the process. Some scholars like Moriarty et al. (2005) proposed five steps to consider when creating a strategy for future urban developments:

1. Develop a shared vision (should relate to the time frame, should be short and succinct and needs to be shared and agreed upon by all relevant stakeholders).
2. Develop short narrative scenarios (identifying possible opportunities and constraints to achieving the vision, needs to be placed in time and be specific by using insights gained from talking to the stakeholders,)
3. Develop the strategies that can achieve the vision by:
    - on the basis of working with more scenarios develop the steps and actions that need to be taken for reaching the vision through the scenarios.
    - select a scenario and develop it into a further strategy)
4. Testing visions, narrative scenarios and strategies (verify the data, create design games, generate prototypes/provotypes)
5. Feedback to stakeholders on results of scenario and strategy development. (Moriarty et al, 2005, p.6)

In order to outline the intentions of our project we are going to use the notions of vision making and scenarios. Both visions and scenarios represent an outcome of our development process (see chapter 7). In line with the literature of this section, we support the idea that the previously mentioned tools are important for creating a space for interaction, empowerment and opening a clear view towards creating future sustainable developments.

We are using vision and scenario building to challenge Frederiksberg municipality, especially the planners, to challenge their current trajectory and development for sustainability.

ADJACENT POSSIBLE

The concept of Adjacent Possible originates as a term in the biology world, introduced by Kauffman (1996). In his theory, he explains how exploration and actualization can be seen as complex adaptive systems in biology's evolution through adjacent possibilities (Björneborn, 2020). Moreover, Johnson (2011) describes adjacent possibilities as a shadow from the future that is hovering on the edge of the present state of things, a map of all the versions where the present can reinvent itself. Moreover, he describes this concept as being able to impersonate both the creative potential of change and limits of innovation.

In order to influence the adjacent possible, some scholars believe that there are various actions that have to be taken: exploring the desired state, discovering all the potential ways to get closer to a desired state, and considering actions to outline the validity of reaching the desired state (Knap, 2017). Knap (2017) defines the current state as the problem and draws the possible solution towards the desired state, the solution to the problem as can be seen in figure 2. Even though the desired space is seen as the solution to the current state, it can be perceived as too much of a radical transition, therefore, a likely state emerges that is more inline with the current state. Between the desired and the likely state, a series of visions and scenarios, consisting of a variety of ideas and concepts, emerge. The ideas and concepts placed closer to the probable line have more chances to be implemented but they are not as radical, or as Knap (2017) describes them revolutionary, while the ones placed closer to the possible line are harder and riskier to achieve (Knap, 2017).

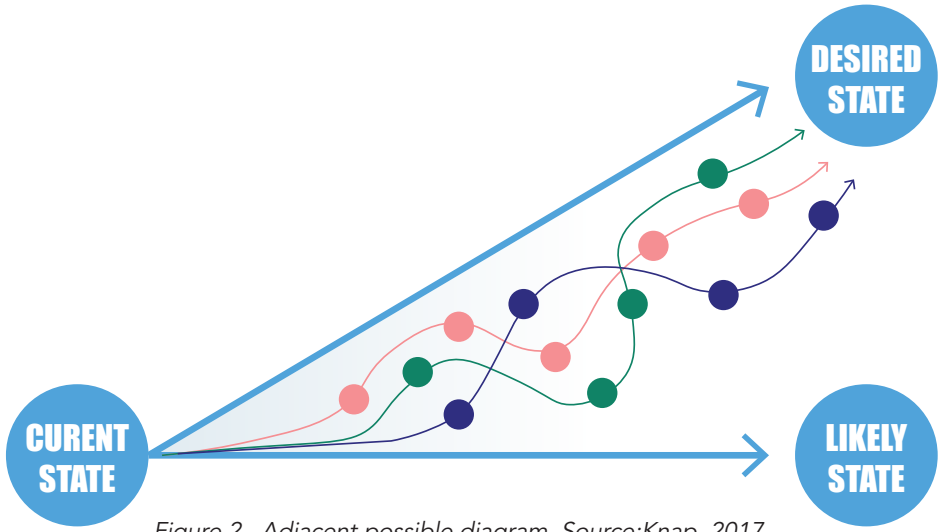


Figure 2. Adjacent possible diagram. Source:Knap, 2017

Moreover, Knap (2017) explains that the moments trapped between the two states are meant to be transformed into a plausible storyline. Each storyline needs to be rationally backcasted from the desired state towards the current state. In order to strengthen the feasibility of the story-line, the goals and micro-goals have to be considered in order to break down the problems that arise on the way. Then, it will be clear that the scenario that has the most relevant step to reach the desired state, will successfully achieve adjacent possible.

2.4. DESIGN GAMES

A design game can be a way of engaging the stakeholders of a project in a creative solution making process and can be seen as one way of staging a design process (Brandt, 2013). A design game can be configured in many different ways, but in this report, we will focus on the specific genre of exploratory board games that involves configuring game pieces on a game board. The purpose of design games is often to create a temporary setting that can facilitate a design dialogue by engaging intended users, various stakeholders and the design team in a joint investigation of possible futures which let the player step out of the ordinary (Brandt et al., 2008). The difference between a game and a free improvisation are the rules or procedures (Gudiksen, 2015); thus the design game must as a minimum have rules. However, the rules can be very flexible and the game itself can, to various degrees, embrace plasticity and ambiguity (Brandt et al., 2008). This means that the players can have an impact on the structure of the game if the game has high plasticity and ambiguity. Another aspect of a design game is the concept of fidelity, which can vary from low to high fidelity. Low fidelity elements invite the players to have a very open discussion about anything, while high fidelity elements invite the players to discuss specific subjects in a certain way (Gray et al., 2016).

The term 'game' can lead one to think of a game element such as competition but Brandt et al. (2008) argue that the intended purpose with exploratory design games is not competition but co-creation. Hence, the different players should work together on exploring possible futures or solving a problem. The element of competition would make players more focused on not making mistakes which can be a drawback since this could hamper experimentation and the creative process (Brandt et al., 2008). What design games draw on from the general concept of games is more related to the creation of, what Brandt et al. (2008) call, the creation of 'as-if worlds'; where the game will create an artificial space in which the players can explore and experiment with different possible futures in an idea generation process. Gudiksen (2015) also describes how this creation of an 'as-if world' can facilitate a safe space for experimentation which is shielded from reality's constraints. We understand the overall scope of experimental design games as experimentation and generation of ideas and that the game must present the best possible conditions for this. Thus, an important lesson to remember in idea generation is to separate the generation of ideas from the evaluation of the same ideas, as this is important in order to prevent premature judgment which can impede the creative process (Brandt et al., 2008). Brandt et al. (2008) defines design games as encompassing the following features:

- A diverse group of players are gathered around a collaborative activity guided by simple and explicit rules, assigned roles and supported by pre-defined gaming materials.
- The game materials typically point to either or both existing practices and future possibilities.
- The games are played within a confined and shared temporal and spatial setting often removed from the everyday context of the players.
- The purpose of the game is to establish and explore novel configurations of the game materials and the present and future practices to which these materials point.
- At the end of the game, the players will have produced representations of one or more possible design options.

We consider the last feature to be important, as the game should have a clear ending and the players should have produced something that they can take with them. It can be anything from new knowledge produced during a discussion to a set of tangible design proposals. Design games have much potential in staging design dialogue between stakeholders and thus we will develop a concept based on this framework.

2.5. PROVOTYPES

Mogensen (1992) coined the term provotypes and argues that it builds upon the concept of prototypes and active theory. The prototype concept supports the idea that a provotype is to be made out of something material and tangible, while active theory supports the idea that the provotype is developed in the base of current practice to later provoke it. Ruecker (2015) supports that a provotype is supposed to challenge presuppositions and aim to change how people think about a situation. Boer & Donovan (2012) describe provotypes as 'provocative prototypes' referring to the fact that a provotype shares characteristics with prototypes since they can be continuously worked to reflect different practices or provoke different reactions from the participants.

We have chosen to work with the concept of provotype as we have the intention of creating a design game that will provoke different reactions from city planners when they approach a new development project. Our objective is to provide city planners with something which is very aligned with how Mogensen (1992) describes provotypes being used; as a bridge between the planners' analysis and design phases. We will accomplish this by providing the planners with a tool that allows them to question their practices or their preconceptions and produce different concepts to apply in the design of future developments.

2.6. PARTICIPATORY DESIGN

Participatory design is often used as a form of research and alternative investigation method by many researchers (Spinuzzi, 2005). Participatory design emerged as a practice in Scandinavia almost 50 years ago (Robertson & Simonsen, 2012) with a starting point in the democratic work practice. Today, participatory design is used in different circumstances and to investigate vast topics of everyday life. The movement of participatory design that we will utilize in this report aims for long-term community involvement, where researchers are performing new approaches, developing new skills and collaborating with new ways of design and innovation (Smith & Iversen, 2018). In our project we want to develop the holistic approach of participatory design, based on democratic and empowerment values, that may provide the influence needed to support sustainable forms of social change in Frederiksberg Municipaliy's approach to design and planning.

Smith's and Ivensen (2018) argue that in order to achieve a sustainable change using participatory design, a set of requirements need to be fulfilled. The first requirement that they refer to is Scoping, which consists of assuring a space for diverse participants to explore and practice potential futures together through goals and aspirations, while cultivating agency and establishing new connections. The second requirement refers to assuring space for development and creating clear steps for procesual development that assures both tangible and intangible outcomes. The last requirement focuses on Scaling, which involves generating multiple possibilities for sustaining and scaling projects from tangible outcomes to sustainable social change (Smith & Iversen, 2018).

Through our design process we first argue against Frederiksberg Municipality's approach towards citizens engagement (see Section 5.5) and then propose a new perspective on how to perceive society's needs and include them in a strong sustainable development. We do this by following the approach proposed by Smith and Ivensen (2018) and including it in an integrative design game (see chapter 7).

3 Theorys

CHAPTER INTRODUCTION

This chapter presents a combination of the theories that constitute the analytical spectacles through which we have made our case operational. These theories are centered around technological development, social interaction, navigation in sustainability and engagement in design processes. We have chosen a mix of theories that enables us to focus on these issues since it is our aim to analyze the planning of the square through a sustainable, technological lense. Social Construction of Technology (SCOT) explains how technology and society mutually shapes each other and how one actor can have many contradictory interests and interpretations of an artefact. The chapter goes on to explain how we will use SCOT proactively in a planning process. It is also our intention to view our case from a sustainable perspective and we support this by using the theories of the triple bottom line with weak and strong sustainability. Lastly this section will introduce the theory on carbon lock-in and the theory of tragedy of the commons which will provide us with a framework for analysing Frederiksberg Municipality's current development trajectory and the effects of it.

3.1. SOCIAL CONSTRUCT OF TECHNOLOGY

The Social Construction of Technology (SCOT) theory presents an analytical approach on how society and its members actively shape the development of technology (Sovacool & Hess, 2017). In being analytical this theory embraces the concept that technological innovation isn't linear and criticizes that history only reflects innovation through development successes and does not consider the failures (Pinch & Bijker, 1984). To accomplish this the theory introduces a set of concepts to assist in the analysis of technological development: relevant social groups, interpretative flexibility, technological frames, stabilisation and closure. It utilises this connection when referring to the development of an artefact, any technology or system that is being studied.

There is the need to acknowledge that the development of the artefact is to be perceived as a process where technology and society shapes each other as in a seamless web (Bijker 1997). This translates into the development of the artefact being influenced by those actors that hold a meaning of the artefact. These actors are encompassed within the relevant social groups and one actor can be part of multiple relevant social groups since the same actor can interpret the artefact in multiple ways (Pinch & Bijker, 1984; Bijker 1997). To identify the relevant social groups Pinch & Bijker (1984) identify two methods: "roll a snowball" and "follow the actor". These two empirical methods allow the analyst to identify the groups and delineate them further. Although this methods can prevent some relevant social groups from being heard as criticised by Clayton (2002), this is then left up to the analyst to discern if this is justifiable or if more groups have to be included (Pinch & Bijker, 1984). The analyst is also the one that interprets what constitutes the relevant social group, deciding if it should split into different or sub-groups (Bijker et al, 2002).

As mentioned in the previous paragraph actors can see the artefact differently, which results in a variety of relevant social groups and this is referred to as interpretative flexibility. This concept describes how an artefact can be interpreted differently by different relevant social groups and thus the same artefact can be perceived as very different artefacts, for example; a bicycle can be perceived as a tool for sport and as a means of transportation. This ability for an artefact to be perceived differently builds upon the idea that technological development can be seen as an open process that will produce different outcomes depending on the social parts involved in it (Klein & Kleinman, 2002). It is important to acknowledge that some degree of interpretative flexibility is always present in relation to the artefact, for example with the automobile as an artefact in agricultural practices when it got the added meaning of being a power source (Kline & Pinch, 1996).

Concerning the interaction within relevant social groups and between these and the artefacts, there are a collection of elements to consider. These elements are grouped within a technological frame which guides how the members of the relevant social group interact with each other and the artefact (Bijker, 1997). As Bijker (2010) explain a technological frame starts building as soon as the interaction around an artefact begins. Which relevant social group the actor joins depends on which technological frame the actor adopts, however, one actor can be part of multiple relevant social groups and thus also adopt multiple different technological frames. The interaction with the artefact can be guided by a multiplicity of items as shown by Bijker (1997) whether it is goals, key problems, current theories or more depending on the interactions within the relevant social groups.

The development of the artefact is intensified until the existing conflicts around the artefact and between relevant social groups start being perceived as resolved (Klein & Kleinman, 2002). However before the conflicts between the different relevant social groups are perceived as resolved,

each relevant social group's interpretation of the artefact needs to align, this process is what Bijker (1997) refers to as stabilisation. Stabilisation is an intragroup process which concerns the artefact, meaning that the degree of stabilisation could be different within different groups. Closure, however, can be seen as an intergroup process and happens when one interpretation of the artefact is accepted by the majority of the relevant social groups (Pinch & Bijker, 1984; Bijker,1997). Once closure is properly reached within the development of an artefact it means that its interpretative flexibility has been reduced and that the artefact is widely accepted by the relevant social groups. It is important to mention that this doesn't mean it can't be opened to interpretation once again; it just means it is harder to do so (Kline & Pinch, 1996).

It is this process in which artefacts are shaped that made SCOT theory attractive to use in our analysis as the design of the Square behind Town Hall is being reopened. The shaping of artefacts is useful in this case because the focus of the project is not introducing a new artefact to a network of users or making a radical change, but a change of a space that is already in use. The change is towards something that can be taken advantage of in different ways by different actors. In addition, the characteristic that an actor can shape the development of an artefact in different ways depending on the meaning they attach to the artefact at a precise moment also proved attractive for the development of the project. This showed the importance of the interpretative flexibility that allows actors to be part of different technological frames and thus different relevant social groups (Bijker, 2010).

3.1.1. OUR APPROACH TO SOCIAL CONSTRUCT OF TECHNOLOGY

Social Construct of Technology (SCOT) theory is centered around the development of artefacts and it analyses the development of them retrospectively. However, we want to use SCOT in a more proactive and designerly way in the development of a future artefact. We do this by opening up the development of an artefact, instead of analysing how an existing artefact came to be, as we aim to influence the future development of the city. In order to do so we take advantage of the concept of interpretive flexibility to bring new and different voices into the development process which are not taken into account in the traditional planning processes. Therefore in our case we are using the transformation of the Square Behind the Town Hall to open up a discussion about it by applying SCOT.

Our opening of the discussion concerning the square has allowed for the inclusion of multiple different interpretations of what the Square behind Frederiksberg Town Hall should eventually turn into. As with modeling clay, the square now holds the potential of changing into an unlimited number of possible shapes depending on how the relevant social groups shape it through their interpretations. In order to include different interpretations, we asked different actors surrounding the square what they think about Frederiksberg Municipality's plans to develop the square. Even though the actors often related the plans to the current square and referred to how they perceived the development of it, we pushed for their interpretation on the future possibility of the square. In addition we, as sustainable designers, decided to also consider actors such as future generations, flora and fauna as we believe these actors have a valid interpretation concerning the development of the square and the possible impact it may have on their future. Investigating the opinions of this varied number of actors allows for different interpretations to surface and for new and different relevant social groups to form in relation to the square. We will take advantage of this situation and the many different interpretations

surfacing in relation to the development of the square, to show how the future development of the artefact can be steered in a more sustainable direction. This new approach to SCOT theory will be further explained and practically applied in the analysis chapter (see chapter 6).

3.2. TRIPLE BOTTOM LINE

The triple bottom line originates from and operates within the Brundtland Report's definition of sustainable development which is: "development that meets the needs of the present generations without compromising the ability of the future generations to meet their own needs" (Brundtland, 1987, p 43). The triple bottom line is meant to create a link between the Brundtland Report's definition of sustainability and corporate responsibility (Norman & MacDonald, 2004). The initial focus of the triple bottom line was to give businesses a tool to navigate the sustainable agenda and measure the sustainability of their actions (Elkington, 1997). The primary idea is that companies have a variety of obligations to their stakeholders that expand beyond economic obligations and that the stakeholders are more than just the shareholders of the company (Norman & MacDonald, 2004). Thus, the notion of 'bottom line' refers to the two additional bottom lines of companies (environmental and social) (i.bid.).

It is widely recognized that sustainability is involved with social equity, economic development and environmental protection (Lombardi et al., 2010; Wilson & Wu, 2016). However, there is some inconsistency in the way the triple bottom line is used and how different scholars prioritize the three sectors (economic, environmental and social) (Alhaddi, 2015). Lombardi et al. (2010) further analyses the relationship between the three pillars and argues that even though there is consensus that all three need to be present, their relation to each other is debated and can be interpreted differently. The most common interpretation is the three interlocking rings (see figure 3), where the sectors exist as independent but connected entities with sustainability existing in their intersection (Lombardi et al., 2010; Giddings et al., 2002). Furthermore, Giddings et al. (2002) argue that this approach can promote a separation of the two human pillars (social and economic) from the environment and that it prioritizes economy; this view is associated with technological fixes to sustainability concerns such as pollution control and greenhouse gas trading. This type of sectoral approach can diverge attention away from breaking lock-ins and the necessary sustainable transformation of our society. The idea that these three sectors are independent of each other is what Giddings et al. (2002) refers to as an illusion since humanity could not exist without the environment and that we are basically a part of nature. Giddings et al. (2002)

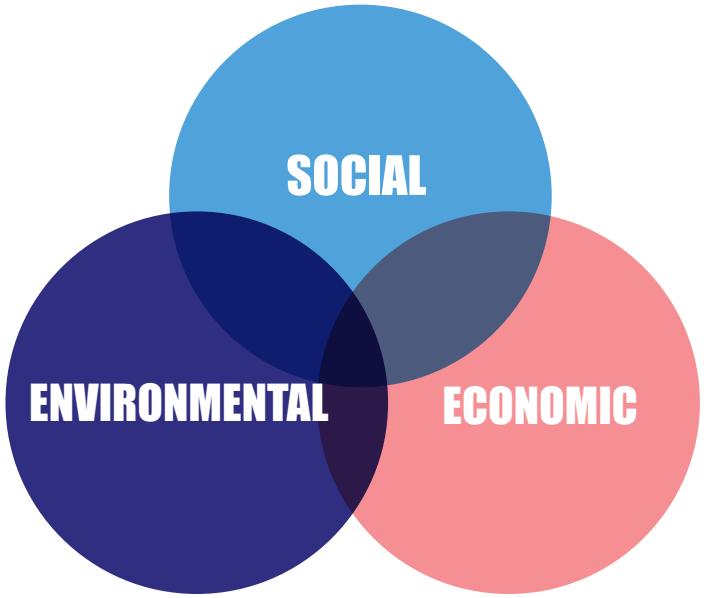


Figure 3. The traditional approach

further argue that the economy is merely a subset of the society since the production and exchange of goods is a social relationship dependent on non-monetary activities. Furthermore, since there is no social sphere without the environment, it is an abstraction to see the economy as separate from the other two. Giddings et al. (2002) then present an alternative heuristic of three nested rings (see figure 4) and argue that this model creates a more integrated, holistic view on sustainable development. This places the economy in the middle and makes it dependent on both the other (social & environment) to exist; the social depends on the environment while supporting the economy and lastly the environment can exist by itself while providing support to the others.

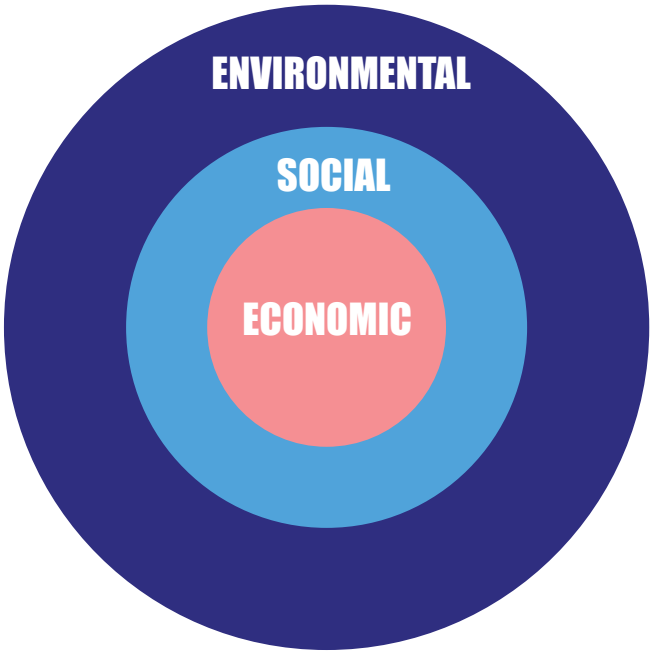


Figure 4. The alternative approach

3.3. WEAK AND STRONG SUSTAINABILITY

We argue that the multi-layered triple bottom line presented by Giddings et al. (2002) is important for understanding the nuances in the theory of weak and strong sustainability. This theory actually represents two perspectives that are in an ongoing debate of whether different types of capital (social, environmental and economic) are substitutable or not (Wilson & Wu, 2016). As expressed by Giddings et al. (2002) the dispute basically revolves around if the three sectors are independent of each other and thus substitutable or if the environmental sector is the basis for the two others. We will present this dispute between weak and strong sustainability in the following section.

WEAK AND STRONG SUSTAINABLE DEVELOPMENT AND THE TRIPLE BOTTOM LINE

As we saw in the previous section, sustainability is a contested subject despite Brundtland's definition of sustainable development (Brundtland, 1987, p 43). Over the years, academics and researchers tried to find a way to define sustainability by framing it in different ways (Wilson & Wu, 2016). However, framing sustainability is difficult, since sustainability has an epistemological overview and can be interpreted in many different ways (Giddings et al., 2002). From these different interpretations we chose the theory of weak and strong sustainability, which can help us justify our intentions of promoting sustainability throughout our case.
We see weak and strong sustainability as representing two different lines of reasoning: weak sustainability is an excuse for continuing the current trajectory and strong sustainability is a framework that has more emphasis on transformation. Our intention is to utilise the theory's holistic approach (Ang & Van Passel, 2012) by looking at the "applicability" of weak and strong sustainability and how it can be considered in the context of urban development. Thus we will focus on the fraction of the theory which we find most applicable to our project.

According to both of the interpretations of the triple bottom line (see section 3.2), there is a fundamental connection between economy, society and environment, when it comes to sustainable development (Ang & Van Passel, 2012). However, understanding the difference between the two interpretations is key for understanding the difference between weak and strong sustainability. One of the interpretations presented in section 3.2 can be understood as an alternative to the traditional triple bottom line. This alternative interpretation is presented by Giddings et al. (2002) and it describes sustainable development as a concept that integrates all three spectrums.

THE DIFFERENCE BETWEEN WEAK AND STRONG

This alternative interpretation proves to be holistic and it describes how the different spectrums rely on each other, which can resemble strong sustainability. The traditional approach opposes the alternative approach by claiming that the three spectrums are equal, interchangeable and separate from each other. Giddings et al. (2002) further critique the traditional interpretation of the triple bottom line and state that: "The oversimplification into the three separate sectors of economy, environment and society risks ignoring the richness and multi-layered-ness of reality" (Giddings et al. 2002, p.192). The authors uses this as an argument for why the traditional interpretation of the triple bottom line resembles weak sustainability and continue to state that the traditional interpretation of the triple bottom line can lead to the assumption that "trade-offs can be made between the three sectors, in line with the views of weak sustainability that built capital can replace or substitute for natural resources and systems" (Giddings et al., 2002 p. 189). In the following section we will elaborate further on this statement and explain the differences between weak and strong sustainability.

The theory of weak and strong sustainability consists of an ongoing debate on traditional economic development versus environmental conservation (Hediger, 1999). Weak sustainability is founded within the body of neoclassical capital theory (Hediger, 1999) and strong sustainability emerged from the basic paradigm of ecological economics, as an alternative to weak sustainability (Ang & Van Passel, 2012). The dispute essentially boils down to whether manufactured capital (equipment, infrastructure, skills, knowledge etc.) and natural capital (forests, biodiversity, clean air etc.) are substitutable for one another within the framework of human wellbeing (Ang & Van Passel, 2012). Supporters of weak sustainability claim that the two are substitutable, for example the fact that the generation of CO2

emissions and the use of natural resources can be justified by creating more room for humans in a dense city, since it generates more wellbeing. On the opposite side, supporters of strong sustainability claim that the two are not substitutable and that manufactured and natural capital can't be compared, for example CO2 emissions from building a parking basement are affecting the atmosphere negatively and that the increased space in the city can't make up for the irreversible negative impact. There is much more to this debate and we will try to cover the most basic differences between the two perceptions of sustainable development in the following paragraphs.

Weak sustainability is a value principle with the necessary condition that some suitably defined value of aggregate capital, that includes manufactured capital and the initial endowment of natural resources, needs to be maintained intact over time (Hediger, 1999). From the weak sustainability perspective, a loss in natural capital is acceptable if it leads to an increase in manufactured capital as long as human wellbeing is maintained or improved (Ang & Van Passel, 2012). In broader terms, weak sustainability requires that the welfare potential of the overall capital base remains intact. This leads to some critique of weak sustainability for being a quick fix to problems that humanity faces (Biely et al., 2018). This is because of the weak sustainability advocates faith in technological developments future ability to improve human well being despite environmental damage (Ang & Van Passel, 2012).

Unlike the weak sustainability paradigm, the strong sustainability paradigm claims that the economy is an open subsystem and that the environment is a finite and non-growing global ecosystem and that the two are not interchangeable (Hediger, 1999). Treating the environment as if it doesn't have a limit to its resources would lead to a depletion of the natural resources that human wellbeing depends upon (Pelenc et al., 2015).

Weak sustainability	Strong sustainability
Path dependency (Lombardi et al., 2010, p.5)	Transformation (Lombardi et al., 2010, p.5). Fundamental reassessment of values and lifestyle choices(Lombardi et al., 2010, p.5)
Substitution of nature by man-made capital (Pelenc et al., 2015).	Some Actions are irreversible (Pelenc et al. 2015) Limited substitution of natural and man-made capital (Pelenc et al. 2015)
Economic sustainable arguments have priority or are at the same level as environmental and social sustainability (Giddings et al., 2002)	Integrated holistic approach to the three dimensions (Giddings et al. 2002, p. 192; Lombardi et al., 2010, p.55).
Nature is a source of raw materials or aesthetics (Ang & Van Passel, 2012)	Nature's role is more than raw materials, it provides a service. Nature is a critical capital. (Ang & Van Passel, 2012)
Technology can eventually solve all problems (Ang & Van Passel, 2012)	Technological skepticism (Lombardi et al., 2010, p.5).
Current generation needs to conserve or increase the total sum of values for future generations (Ang & Van Passel, 2012; Pelenc et al. 2015).	The current generation needs to conserve environmental values for future generations (Ang & Van Passel, 2012; Pelenc et al. 2015).

Table 1. Weak and Strong sustainability

Thus, the strong sustainability paradigm regards natural capital as providing functions that are not substitutable by manufactured capital (Gutés, 1996); on top of this, adherents of strong sustainability are also generally pessimistic about the ability of technological progress to correct any damage to the environment. As a minimum necessary condition, the strong sustainability paradigm requires that the substitution of natural and man-made capital is kept to a minimum, allowing for a critical amount of natural capital to be upkept over time (Hediger, 1999).

There is no clear definition on what weak and strong sustainability is but we have attempted to interpret the most important characteristics in the following table(see Table 1) in order to better explain the main ideas of the theory.

CRITIQUE OF WEAK AND STRONG SUSTAINABILITY

One thing the paradigms have in common is that they embody an economic perspective on both manufactured and natural capital, thus assuming that natural capital is only natural capital if it can be consumed. Another line of thought within ecological economics puts emphasis on discussing natural capital in physical instead of monetary terms (Özkaynak et al. 2004). According to this line of reasoning no substitution of any critical natural capital is allowed and the physical presence of critical natural capital must remain intact (Ang & Van Passel, 2012). The weak-strong sustainability discussion also falls short in other ways in that it assumes that different types of capital can be equally substituted without considering that the physical items which constitutes the capital can be valued differently on different parameters (Ang & Van Passel, 2012). E.g.: Can a tree be substituted equally with another tree if the first one created better shade while the latter was younger and thus had more years to live?

Despite its limitations, the theory of weak and strong sustainability is able to make sustainable development a meaningful and operational theory (Biely et al., 2018). It is our aim to use this theory as a tool to show the opposing interpretations of sustainability and how these two interpretations can affect the design of an urban environment. We hope to achieve this by defining a clear structure that can support our creation of future urban spaces that address the needs of existing and future generations of Frederiksberg Municipality. Thus, we avoid valuing different items as capital and we avoid discussing how different types of capital can be substituted for another.

3.4. TRAGEDY OF THE COMMONS

The tragedy of the commons is a now famous metaphor used to bring some attention to the over exploitation of resources by an increasing population until the resource has been depleted and the space degraded (Hardin, 1968). For a situation or space to be considered within a possible 'tragedy of the commons' it has to fulfil four criterias. First, there has to be a common space that can be accessed and taken advantage of by various people. Second, there has to be a resource that is being depleted. Third, the resource has to lead people to overuse it or exceed its sustainable limits. Lastly, there is not to be a technical solution (Patt, 2017). All this has to be accounted for if it is to be considered a problem framed from the 'tragedy of the commons' perspective. However as explained by Feeny et al. (1990) there are two possible paths to prevent this sort of tragedy where it's aim is to constrain consumption and ensure sustainability (Frischmann et al., 2019), privatisation or socialism. Harding (1968) recognises that globally there has been a move towards both directions, where the benefit has been privatised while the cost has been distributed; Hardin (1968) exemplifies these two directions by referring to the fencing of land in name of private agricultural and the disposal of waste in common spaces, for example carbon dioxide from car-based mobility into the atmosphere.

Many have described the 'tragedy of the commons' as the ultimate representation of global climate change, relating it mostly to the depletion of resources such as fish and pasting grass (Brown et al., 2018). Nonetheless the case of the Square behind Frederiksberg town hall can also be considered a 'Tragedy of the Commons'. The resource being depleted in our case specifically is surface area, as it is distributed between recreational activities, buildings, car-based mobility and others. What makes the concept of 'tragedy of commons' attractive for our case is the consideration of possible paths to follow by the distribution of space, especially when considering the competitive exclusion principle as explained by Harding (1960) as: when two species that require a similar resource are bound to compete and one is to result in elimination. However, instead of species, we will look at how different sociotechnical systems compete for space in Frederiksberg Municipality. Hardin (1960) continues to explain that when adhering to the axiom of inequality, no two competing species, or systems in our case, are truly equal as there is always some feature that gives one the advantage. When considering this we identify within Frederiksberg the axiom of inequality acting in favour of car-based mobility to an extent that we fear the city will become a 'tragedy of the commons' in time.

3.5 LOCK-IN

In order to understand why it can be so difficult to build a sustainable future we must first understand what keeps us locked into a non-sustainable present. This can be explained through the theory of carbon lock-in, which describes path dependent processes and reasons for resistance towards large scale systemic transformations. Seto et al. (2016) states that "There are many examples of path dependence that entrench technical, institutional, and behavioral systems with known technical and environmental disadvantages." Some of these disadvantages result in carbon emissions and are thus referred to as carbon lock-in. Industrialized societies are especially experiencing carbon lock-in due to their infrastructure's long-time reliance on fossil energy (Seto et al., 2016).

Seto et al., (2016) identifies three major types of carbon lock-in: Technological, institutional and behavioral. To start with a Technological lock-in refers to what constitutes the materiality of the system such as built infrastructure and street layouts. An Institutional lock-in on the other hand, describes the networks, policy and regulatory bodies. According to Seto et al. (2016) a feedback loop can take place within the institutional lock-in. This can happen when those actors who support the existing infrastructure push for institutional changes that benefit their own agenda and allow them to stay in power. Thus, the actors in power will aim to shape institutions to their advantage, strengthening the lock-in. Lastly, Behavioral lock-ins are lifestyles, habits, routines and preferences that can cause carbon intensive behaviors. The behavioral lock-in can happen through individual decision making or through social structures (Seto et al., 2016). According to Seto et al. (2016) the behavioral lock-in in the transport sector is a significant obstacle for reducing carbon emissions (i.bid.). These are for example the routines and expectations that are related to car-based mobility. These three types of lock-in are mutually reinforcing and create collective inertia which means that an attempt to break with one will create more resistance in the others (i.bid.). Or said in another way: Greater change creates greater resistance (Unruh, 2002).

These types of lock-ins stabilize a dominant design that determines the trajectory of which technological development happens. Such lock-ins can limit the available alternative design choices and once an institution is locked-in on the development trajectory their maneuverability is decreased significantly and making it difficult to switch trajectory. Furthermore, changing development trajectory might not be seen as an option

by the institution (Unruh, 2000).This is because the inertia of the three types of lock-in (technological, institutional and behavioral) increase the limitations on the rate of systemic transformation (Seto et al., 2016). Later, in our analysis we will present how Frederiksberg municipality is committed to the prevailing development trajectory of car-based mobility.

The establishment of a dominant design can create what Unruh (2000) calls Techno Institutional Complex (TIC). TIC can be explained as a positive feedback loop that systems can end up in. This feedback loop can be hard to break due to the lock-in mechanism presented earlier. Unruh (2002) explains how TIC is not necessarily bad since they can create stability and predictability, however from a sustainability perspective TIC in fossil energy systems is undesirable. TIC is present in many fossil energy dependent systems, an example could look like this: Users grow accustomed to and dependent on the state of the system; Technological development supports the user's needs; in response to the increased need, the governance institutions develop and approve construction of more capacity within the system.

It is difficult but not impossible to break a TIC. Unruh (2002) describes three ways in which existing technological systems can be disrupted: End of pipe, continuity and discontinuity. An 'End of pipe' would treat emissions of the system and only aim to reduce the negative output as much as possible. While a 'Continuity' would modify selected components or processes of the system, but maintain the overall system architecture. Lastly a 'Discontinuity' would replace or introduce a new system entirely. This last method for disruption might also prove to be the most difficult to implement. Whether a solution to a problem is either of the three depends on the perspective of the problem. An example is how the parking basement is a continuity solution for the planners since it is interrupting their current way of planning for parking spaces while still keeping the overall system of car-based mobility in Frederiksberg. On the other hand, the citizens who drive a vehicle in the finished parking basement see it as an end of pipe solution because there is room for their means of transport. It is important to remember that planners can also be citizens and thus both perspectives can be embodied in one actor (Unruh, 2002).

The theory on carbon lock-in and its different mechanisms provides us with a framework through which we can analyze the current mobility trajectory in Frederiksberg Municipality and their prioritization when they develop the urban landscape. It is our aim that our final product will aid in changing the current behavioral and institutional lock-in within the municipality.

4 Methodology

CHAPTER INTRODUCTION

In the following chapter we will describe the methods we applied throughout this project. The section on case studies describes the method we used to approach our research topic and how we applied it. The collection of empirical material was performed through ethnographic fieldwork and desk research. The section on ethnographic fieldwork will describe how we performed interviews and engaged with stakeholders. We further used the method affinity diagram to structure our findings and see them through our theoretical lense. Design methods such as brainstorming and morphology charts were used to produce the visions which we will use in our final solution. Lastly, prototypes were used to drive and explore the iterations of our solution to the problems identified.

4.1. CASE STUDY

A case study is a research method that is set to collect real and context-dependent information about the discipline being studied (Flyvberg, 2006). It is used in a variety of disciplines, mostly social science studies, which have a need to understand complex social phenomena (Yin, 2018). A case study then involves a real-world case in which a social phenomena is the subject of study and it has a context-dependent characteristic, needing for variable points of inquiry and a theoretical framework to guide the study itself (Yin, 2018). Yin (2018) continues to add that case studies are a preferred research method for qualitative studies. However they are not limited to qualitative data sources but can also include quantitative references that support the studies being done.

We have chosen to treat our project as a case study as it is focused on the development of the Square behind Frederiksberg Town Hall. The project takes into consideration qualitative information collected from questionnaires and interviews, as well as quantitative data obtained from official reports and documents provided by the administration of Frederiksberg Municipality. The case study approach provided a real life case which we could study academically in our project. The case study approach can fulfill this purpose since it lets us investigate and consider a variety of evidence such as documents, interviews and observations (Yin, 2018).

4.2. ETHNOGRAPHIC FIELDWORK

During our process we used ethnographic methods in order to better understand the knowledge systems and the challenges of knowledge gaining concerning theory and practices (Seligmann & Estes, 2019). In accordance with the ethnographic fieldwork, the foundation of our knowledge was gathered by investigating our case, the square behind the town hall in Frederiksberg and about Frederiksberg Municipality itself.

Ethnographic work also relies on participation, personal experience and close-up investigation rather than just observation (Genzuk & Michael, 1999). Our work pushed us to explore the meaning and needs of the people that are influenced by the future urban development of the Square behind the Town Hall. In order to achieve this, due to the present circumstances (COVID-19) we conducted digital interactions, by using social media platforms to reach out to the citizens that reside around the square, dorm students that live adjacent to the space in question and the museum. Our main purpose during our fieldwork investigation was to gain as much qualitative information as possible that will further support our intentions and construct arguments for our proposals.

4.2.1. INTERVIEWS

Interviews are a tool for collecting qualitative data and can vary on the degree of flexibility depending on the researcher's study objectives. When an interview has a high degree of flexibility it is normally led by very open questions to which the subject is free to answer as desired exploring a variety of topics (Stuckey, 2013). These interviews are normally referred to as Narrative Interviews and can be used by the researcher to gain some degree of confidence with the subject or to further explore in a general sense the topic of study (Stuckey, 2013; Thaagard, 2004). On the oth-

er hand, interviews that have very closed questions, or have a very low flexibility, are called Structured Interviews and are normally used when the researcher is in need of very specific details around a specific topic (Stuckey, 2013; Thaagard, 2004). When the researcher already has some knowledge on the topic but is looking to investigate more on specific topics while being open to topics or details brought up by the subject, the more flexible method of Semi-Structured Interview is used. These types of interviews can contain very open questions that would allow the subject to open up and explore different topics but it will be up to the researcher to guide the subject into the desired direction (Leech, 2002).

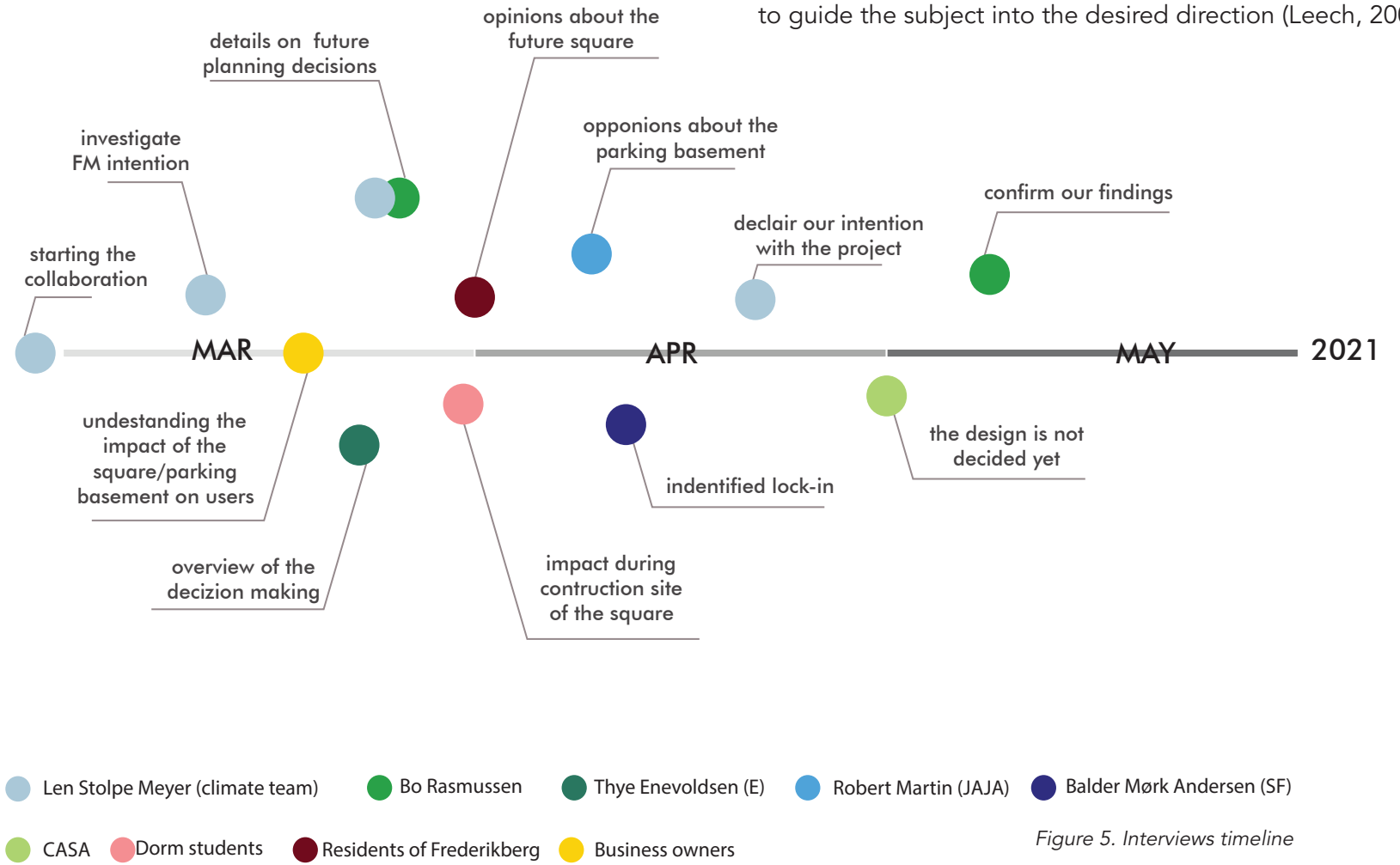


Figure 5. Interviews timeline

In the research for this project we utilised both the Narrative Interview and the Semi-Structured Interview. We used the former when looking to interact with different members of the community of Frederiksberg. We interacted with the community through social media, specifically three group posts on Facebook, to reach a great number of subjects while upholding the recommendations passed in face of the current COVID-19 pandemic. We additionally applied a virtual questionnaire to the students living in the dorm, which resembled the form of a Semi-Structure. The majority of the interviews with actors from Frederiksberg Municipality, relevant experts and local businesses, were done through the method of Semi-Structured Interviews. These were 16 in total and were done through a combination of video conferences over Zoom or in person following recommendations on social distancing and mask wearing. Figure 5 shows the timeline of all the interviews performed during this project and the key points we obtained from them. The methods utilized to identify the actors to be interviewed were in line with our main theory and consisted of "roll a snowball" and "follow the actor" as mentioned by Pinch & Bijker (1984). The first method mainly concerns asking at the end of the interview who the subject believes should be introduced next while the second method involves following the actor to gain more detail around their relevant social group or their attached meaning to the artefact. All the interviews provided valuable information that allowed us to identify key aspects in relation to the Square behind Town Hall. The information obtained from interviews will be utilized in the chapters where we present the context of the project and the analysis.

4.3. DESK RESEARCH

We performed desk research, also known as secondary research (Guerin et al., 2018), to get a better grasp on the different concepts and theories used in this report. Further research was done on several theories and methods utilised, as to give the report a solid structure on which to justify the actions taken and the information acquired first hand. Additionally a significant amount of desk research was done considering our collaborator, Frederiksberg Municipality. This provided us with a variety of documents and knowledge which have been utilized throughout the report. All this was within what is to be expected of ongoing desk research within a project according to Hoover Green & Cohen (2021). The authors of the theories and concepts utilised and the sources of the information employed are adequately referenced, as well as any possible agenda entangled within them taken into consideration (Guerin et al., 2018).

4.4. AFFINITY DIAGRAM

The affinity diagram is a simple and collaborative way of organizing field data (Holtzblatt & Beyer, 2017). It's a method to organize, make sense of and externalize large amounts of information (Lucero, 2015).

The affinity diagram is a bottom-up approach since the categories are not predefined but builds up as more information is added to the diagram (Holtzblatt & Beyer, 2017). We started by listing our insights and quotes from the data collection process (see section 6.3.1) followed by assigning a color to each source so we could trace it back after completing the affinity diagram. This technique helped us maintain the connection between the insight generated by each actor and the categories that we were developing. We gathered sources in groups depending on how they interpret the Square behind the Town Hall. The result was 15 relevant social groups (see section 6.3.1).

This method was an important milestone in our design process. Based on the categories of insights that we agreed upon, we acknowledged relevant actors that are influenced by and can influence the development of the Square behind the Town Hall. Moreover, the affinity diagram gave us a means to produce the relevant social groups that we based our analysis on.

4.5. DESIGN METHODS

MORPHOLOGY CHART

The morphology chart presented by Cross (2008) proposes a tangible and structured approach to doing design. The morphology chart can establish and structure solutions to all the essential features that a design must consist of. This number of features can also be seen as functions which describe all the things the design aims to achieve. Each feature can be achieved in several different ways, which are called sub-solutions. The sub-solutions responding to each feature in the morphology chart can be combined in different manners, when successfully done solutions are formed. We used morphology as a creative tool to structure part of our design and determine the sub-solutions that it would consist of. However, we had to adapt the method to our process as the morphology chart is intended to be used on product design. Some of the adaptations we did concerned the features, as they were not rigid functions but alliances between relevant social groups and technological controversies.

Cross (2008) recommends that the designer only chooses one sub-solution from each feature, when combining them to form a solution, in order to avoid solving the same issue twice. However, we believed that there was enough room within the square to hold multiple sub-solutions from each feature and that the different sub-solutions originating from the same feature would often complement each other.

BRAINSTORMING

The sub-solutions from the morphology chart were derived from a brainstorming session which was based on the tangible items each alliance would need. Idea generation can be understood as a way of structuring innovation and creativity (Lichtfield, 2008) and we did a brainstorm session in combination with the morphology chart to generate ideas in a structured way. Both the Morphology chart and the brainstorm were performed in Miro, so each member of the design team could see the others' contributions. By working this way we were able to spark creativity and build on each other's ideas. We brainstormed on one section of the morphology chart at a time and focused on generating as many sub-solutions as possible.

4.6. PROTOTYPES

Prototypes can be a very abstract term that can vary in definition depending on the audience, their background and the intention of the prototype itself (Houde & Hill, 1997). They are generally utilised to represent different stages within a design process and to explore different options or modifications that might be available. Blomkvist & Holmlid (2011) align with this definition of prototypes since they describe them as embodiments or manifestations of ideas in a way that allows them to be tested. The testing of an idea through a prototype can serve three different purposes: exploring, communicating and evaluating (Blomkvist & Holmlid, 2011). Considering this, it is understandable that the method of prototyping is not self explanatory and that it is important how the designer puts it to use (Houde & Hill,1997). When it comes to utilising the prototype, normally by testing, there are two things to consider: the degree of fidelity of the item and the audience on which it is tested. Fidelity itself refers to the level of precision or resemblance between the prototype and the final product (Blomkvist & Holmid, 2011). There is an inverse relationship between fidelity and openness to modification of the prototype, meaning that the higher the fidelity then the less modifications can be made to the prototype. Houde & Hill (1997) recommend adjusting the degree of fidelity according to the audience the prototype is being tested with. These audiences can be separated into various categories depending on their connection with the team constructing the prototype, generally they are divided into clients, users and colleagues (Blomkvist & Holmid, 2011).

We have used the concepts of prototype and prototyping in close relation with the development of our final product, the design game. In accordance to Blomkivst & Holmid (2011), we have tested our prototype with colleagues and users. Additionally, following Houde & Hill (1997) we have adjusted the level of fidelity with each test. The initial test with colleagues involved a higher degree of fidelity, which later gave way to another test involving a different audience and with a lower degree of fidelity, as can be seen in Figure 6. Eventually we produced a third prototype with a higher degree of fidelity that was tested with random users (see figure 7). These various prototype tests allowed us to adapt the game while maintaining the core idea of our final product. Our final prototype is to be tested with an audience of clients, the city planners and designers of Frederiksberg Municipality.

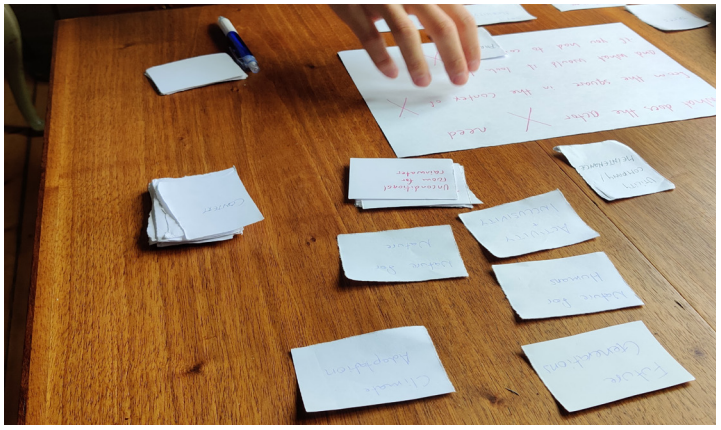


Figure 6. Prototype two



Figure 7. Prototype three

5 Context of the project

CHAPTER INTRODUCTION

In the following chapter we will describe the context of our case study. The research presented in this chapter builds on several meetings with a planner, the project manager, politicians, observations in the field and several official documents published by Frederiksberg Municipality. First we will present an introduction to Frederiksberg to provide background information on the city, the municipal structure and the goals Frederiksberg Municipality aims to achieve. Second we will introduce Frederiksberg Municipality's plans for the development of the square behind the town hall. The third section will give an insight into how planning processes in Frederiksberg Municipality are structured and how the Climate Team have been working on developing the Square behind the Town Hall. This section will also describe the newly constructed Langelands plads and use it as an example of what Frederiksberg Municipality aims to do with the Square behind the Town Hall. The last section in this chapter will describe how Frederiksberg Municipality engaged with users through outsourced interviews and a citizen dialogue.

5.1. INTRODUCTION TO FREDERIKSBERG

The city of Frederiksberg is located in the eastern part of Denmark and is entirely enclosed by the larger city of Copenhagen. However, it insists on maintaining its own identity as a city and a municipality. Terms such as "The Frederiksberg solution" and "The identity of Frederiksberg" are commonly used in plans, strategies and among employees in the administration (Frederiksberg, 2020a; Appendix 1, extract from Nanna's internship diary) to position Frederiksberg Municipality as an independent city. Frederiksberg is the most densely populated city in northern Europe (Vej, Park og Miljø, 2021) with 104.351 citizens living on 8,7 km2 (Danmarks Statistik, 2020). The high concentration of people has resulted in a city where every square meter is utilized. As a consequence of this, Frederiksberg Municipality is constantly on the lookout for synergies in order to make every space fulfill as many purposes as possible. According to Lene Stolpe Meyer from the Climate team, this has made the municipality move further away from sectoral thinking (Appendix 2, Lene, interview with climate team). When a new development is proposed everyone involved has to think in terms of cloudburst, heat island, recreational space, parking and many more concepts. (Appendix 2, Lene, interview with climate team). An example of this way of planning is how the municipality performs climate adaptation. The Municipality sees climate adaptation as not only preventing the city from drowning in rainwater, but also as means to create more livable spaces with green and blue elements. Our collaborator, Lene, contributes to the development of climate adaptation strategies and argues for the importance of synergies by saying it optimizes the relation between money spent on a project and the value the project has for citizens (Appendix 2, Lene, interview with climate team). In short, the purpose with creating synergies between the different elements of the city is to do what creates the most value for citizens.

FREDERIKSBERG AS A CLIMATE CITY

The development of the municipality is guided by several documents of which one of the most important is the Municipal Act and it is based on the Frederiksberg strategy (Frederiksberg Kommune, 2021a). One of cornerstones of the Frederiksberg strategy is that Frederiksberg should be a climate city (Frederiksberg Kommune, 2020a). This goal states that the city has to be CO2 neutral in 2030 and that Frederiksberg should be the electrical vehicle city "number one". It emphasizes increasing green mobility such as biking, public transport and walking. An ambitious goal for green mobility specifically is that Frederiksberg should be the danish city in which most people use bicycles as a mode of transport (Frederiksberg Kommune, 2020a).

Frederiksberg's ambition to develop a more sustainable city is present in other documents and actions by the city. Frederiksberg has recently released their new climate plan (Frederiksberg Kommune, 2020c) in which Frederiksberg participates with 20 other municipalities in a climate network named DK2020. The purpose of the network is to collaborate on achieving the Paris agreement's 2°C goal. In order to do this, Frederiksberg Municipality, has set the goal for the municipality as an organization to be CO2 neutral in 2025 and for the rest of the city in 2030 (Frederiksberg Kommune, 2020c).

The goal of creating a green city is not just a metaphor for sustainability. Frederiksberg Municipality aims to become the green heart of the capital. This statement refers both to sustainability and Frederiksberg's historical connection to trees. This connection is evident in the tree policy "Træpolitik" (Vej, Park og Miljø, 2018). Trees and greening are also prioritized high in the local act (Frederiksberg Kommune, 2021a; Frederiksberg Kommune, 2021b), and the Frederiksberg Strategy (Frederiksberg Kommune, 2020a). Among the Tree Policy's goals are to protect trees above 25 years, ensure that every citizen can see at least one tree from

their residence and that at least 70% of the citizens are satisfied with the nature experiences available in the city (Vej, Park og Miljø, 2018).

The above paints the picture of Frederiksberg Municipality as an actor who is ambitious regarding a broad range of sustainable factors. The Frederiksberg Strategy even insists that Frederiksberg should be a role model when it comes to climate solutions and making Denmark independent of fossil fuels (Frederiksberg, 2020a). The city's strategy for becoming independent of fossil fuels revolves around incentivizing electric vehicles. This strategy will also help reduce emissions and help the city become CO2 neutral (Frederiksberg Kommune, 2020d). However, electric vehicles will address CO2 emissions within the city but not the distribution of space or emissions generated outside the city.

It is written in Frederiksberg's municipal act of 2021 that an investigation into distribution of road space showed potential for 1600 new parking spaces on the surface of which 600 are already implemented (Frederiksberg Kommune, 2021a). In contrast Frederiksberg, which aims to be the danish city in which most people use bicycles as a mode of transport, only plans to implement 1200 new bicycle parking spots (Frederiksberg Kommune, 2021b). The plan to make 1600 new car parking spaces is also a huge contradiction to the following statement from the Main Structure Document of the Municipal Plan: "Cars need to take up less space in the streets and we will achieve this by moving parking spaces underground and by constructing fewer parking lots around new dwellings" (Biler skal fylde mindre i gadebilledet blandt andet ved at flytte parkering under jorden og ved, at der anlægges færre parkeringspladser ved nybyggeri) (Frederiksberg Kommune, 2021b). There are two problems with this statement. First, Frederiksberg is so dense that only very few new dwellings are built (Frederiksberg Kommune, 2021a), thus this part of the plan can be considered insignificant when it comes to reducing the number of cars in the city. Second, parking basements will remove cars that are parked on the surface, but it won't decrease the amount of cars as it has little effect on moving cars through the city. We will argue that Frederiksberg's support for car-based mobility will contradict the municipality's goals of being the green heart of the capital and becoming the danish city in which most citizens use bikes as a mode of transport.

ORGANIZATIONAL STRUCTURE

Frederiksberg Municipality consists of two organizational structures: the political and the administrative. The people within the political structure are elected every four years by the citizens of Frederiksberg. It is these politicians that determine what goals and visions the municipality should aim to achieve. The initial decision to redevelop the square and build a parking basement is also a political decision (Appendix 3, Balder Mørk Andersen) (Vindfeldt, 2021). The administration is not elected and its employees work on achieving whatever goals and visions the politicians decide on, such as the Frederiksberg Strategy (Frederiksberg Kommune, 2020a) or the Climate Adaptation Plan (Frederiksberg Kommune, 2012). So, when the politicians decided to redevelop the square, it was the administration's job to make it happen and make sure that all plans, strategies and possible synergies were included in the project. The administration's employees can impact the politicians by applying for funding to projects they find relevant. Employees in the administration can also choose to be critical towards the politicians' intentions. An example is a recent change in plans for the square: in the beginning the plan was to incorporate a food hall on the top of the square behind the town hall (Schulze + Grassov, 2020; Appendix 4, Interview with Thyge Enevoldsen). However, The City, Culture and Environmental office (By- Kultur og Miljø området), which is conformed by administrative employees, asked the politicians to reconsider it. Their argument was that the food hall and its appurtenant facilities would

affect the square in a negative way by dictating its use instead of allowing it to be multifunctional. They also argued that a square without buildings would provide better facilities to support the recreational use of the square (By- og Miljøudvalget, 2021). In response to this inquiry, the politicians decided to cancel the food hall. This is proof that the internal structure in the municipality is not just 'top down', but that the administration can impact the decisions of the politicians, as long as they have valid arguments.

5.2. INTRODUCTION TO THE MUNICIPALITY'S PROJECT



Figure 8. The Square behind the Town Hall

The space which our case study is concerned with is situated in the city center of Frederiksberg, next to the town hall. It is 7.900 m² (Juul Frost, 2017) and is defined by Smallegade to the north, the town hall to the east, Frederiksberg Have to the south and a residential area to the west. The road Bredgade crosses the square diagonally(see Figure X). Currently the square functions as a parking lot for approximately 230 vehicles (Frederiksberg byudvikling, 2021) but during Saturdays from April to October, half of the square is transformed into a flea market on a weekly basis (Loppemarked.nu, 2019). Users of the parking lot are Frederiksberg Municipality employees, nearby shop customers and local residents.
The town hall itself was completed in 1953 with the original plan to create a town hall garden with a minor parking facility next to it (Juul Frost, 2017). The square was never properly developed according to the original plan and remains an anonymous parking lot.

DESIGN OF THE SQUARE

The idea to redevelop the square is not new, as the elaboration of the cloudburst plan from 2013 (Rambøll et al., 2013) depicts the Square behind the Town Hall as a central delay area. In 2015 politicians in Frederiksberg's City and Environmental Committee (By- og miljøudvalg) decided to discontinue the parking lot and build a parking basement and a recreational urban space instead (By- og miljøudvalget, 2015). The initial idea, which has since changed, was to construct a square similar to Israels Plads in Copenhagen with a food hall and urban sport facilities (i.bid.). The motivation for redevelopment is not to get more parking lots, but rather to create more synergy by embracing the many functions that a dense city like Frederiksberg requires. One of the main objectives is therefore to make the space contain as many different functions as possible.

A lot of actors from Frederiksberg Municipality, both administrative and political, are involved in the development of the square. All actors have their own interpretations of the square. An example is our collaborator Lene who is focused on climate adaptation and according to her, the square should showcase how rainwater can be managed locally with the help of smart city solutions. According to politician Balder Mørk Andersen from the Socialist Folkparty (Socialistisk Folkeparti), the parking basement should make room for a green recreational public space (Appendix 3., Interview with Balder Mørk Andersen). However, the design process is steered by car-based mobility and the construction of a parking basement. According to Lene, the process first focuses on the parking basement, then climate adaptation and lastly recreational elements (Appendix 4, Interview with Lene Stolpe Meyer). The final design of what is to go on the surface of the square, and which takes in consideration the prioritization mentioned before, is created by an external partner. The project managers in the administration provide the external partner with a list of what to consider and include in the design. The current sketch of the project is shown in Figure 9.

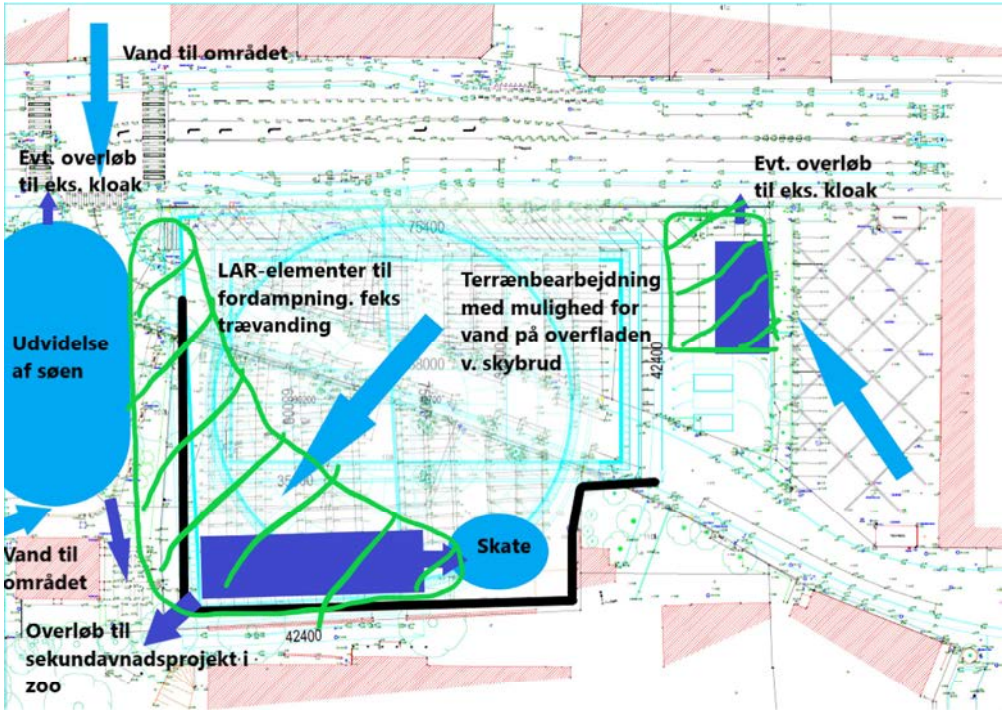


Figure 9. Design guideline for the square

There are various elements visible within Figure 9, which are described next. There is to be a green element in one corner which should both manage rainwater from the square in nature based solutions and act as a connection to Frederiksberg Have. Rainwater magazines are placed underneath the green area and will provide water to trees and greens. The green area embraces the lake which is extended towards Smallegade. There are not to be any trees on top of the parking basement because the soil top layer is too thin for the trees. But there is room for smaller vegetation (Appendix 5, interview with Bo Rasmussen). In the other end of the square there is to be a smaller green area. One of the project managers, Bo Rasmussen, hopes that the rainwater from the parking lot next to the square can be managed in this smaller green area. A small sports or skate track is located in the corner closest to the dorm (4. maj kollegiet).
Included in the project is the development of a parking basement beneath

THE PARKING BASEMENT

the square which is being entrusted to an external partner of Frederiksberg Municipality. According to Bo Ramussen the parking basement has an unconventional shape which aims to optimize the underground space and make its navigation easier for the users (Appendix 5, Interview with Bo Rasmussen). The parking basement is being designed with a capacity to hold 275 cars, it is planned that 55 spots should be prepared for private companies to install electrical charging (Appendix 6, Interview with Bo Rasmussen and Lene Stolpe Meyer). It is also included in the design of the parking basement that it should double as a rainwater retention magazine because rainwater is to be stored in large magazines under the parking basement. The access to the parking basement is to be from Bredgade, which is to be moved so its connection with Smallegade is closer to the town hall, and there is to be a traffic light at the new intersection. These changes can be seen in Figure 10.

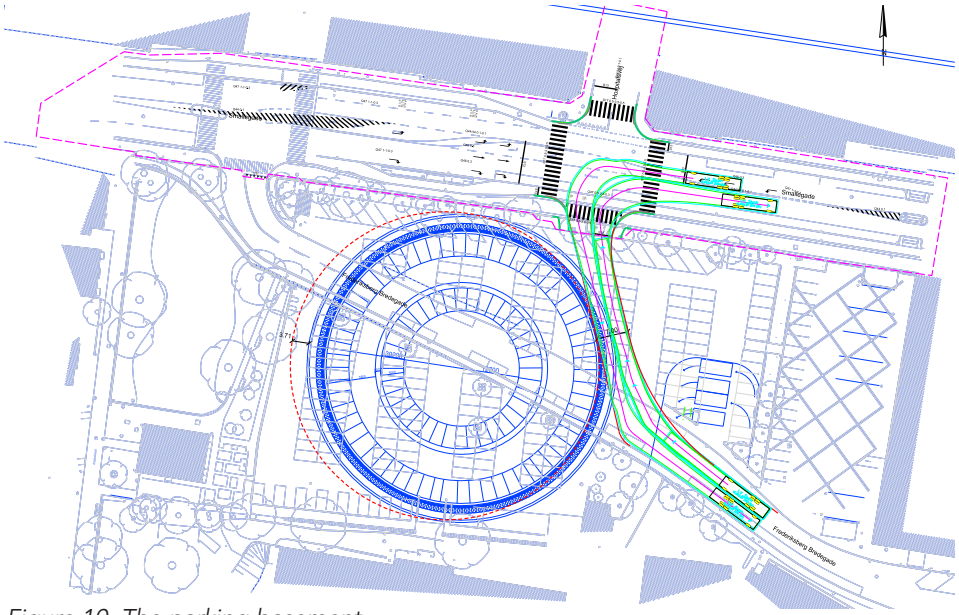


Figure 10. The parking basement

THE FLEA MARKET

Frederiksberg Municipality considers the flea market to be a crucial part of the redevelopment of the square. It was confirmed, from our interview with Bo Rasmussen, that the flea market is very popular (Appendix 7, Interview with Bo Rasmussen and Lene Stolpe Meyer) and from our field research where we identified that citizens valued the development of the square as long as the flea market stays (Appendix 8, Facebook posts). Currently the flea market takes up a lot of space, using approximately an area equivalent to the top of the planned parking basement. Even though the flea market only takes place once a week it requires pavement that supports cars and an open space that allows for the installation of booths (Appendix 5, interview with Lene Stolpe Meyer). Making sure that the Flea Market has its space places a big restriction on what can be done on the square as there can't be built skating, playgrounds or structures that will support biodiversity and recreational activities (Appendix 7, Interview with Bo Rasmussen and Lene Stolpe Meyer). This is very restricting on the flexibility of the square as it is not an option for the Frederiksberg Municipality to cancel the flea market.

SMART CITY SOLUTIONS

It is the politicians' intention to also use the square as a showcase for smart city solutions. According to Lene, an option could be to apply technology for monitoring rainwater flow and managing its use (Appendix 1, Nannas internship diary). However, Alderman Thyge Enevoldsen from the Red-Green Alliance (Enhedslisten) also claims that the purpose of using smart city solutions on the square is to improve the efficiency of the city and benefit a wide range of citizens. He continues to propose that these smart solutions could be for example smart lighting, information on available parking lots and more (Appendix 4, interview with Thyge Enevoldsen). The smart city concept is often mentioned by employees within Frederiksberg Municipality but they don't seem to have a clear image of

what problem this application of technology is solving. The main purpose seems to be promoting Frederiksberg as a smart city (Appendix 5, interview with Lene Stolpe Meyer).

RAINWATER

Within the design requirements it is set that the square should have a capacity of 5000m3, collecting rainwater falling on the square and from the areas around Smallegade and Howitzvej (Appendix 5, first interview with Lene Stolpe Meyer). The rainwater collected is to be stored by using large magazines under the parking basement, magazines under the surface of the square, nature based solutions and possibly the duck pond next to the square (Appendix 5, first Interview with Lene Stolpe Meuer). The overall vision from the Climate Committee involves managing all rainwater locally and avoiding that it goes into the sewer system completely. To accomplish this, all rainwater collected by the different solutions utilized should be put to work on the new square (watering of plants, irrigation of paved surfaces to cool down the square, cooling down the EV chargers, replenishment of the duck pond and more) (Appendix 5, Interview with Lene Stolpe Meyer). Providing a function for the rainwater being collected creates a demand for storing as much rainwater as possible within the magazines under the square. If weather forecasts predict a cloudburst any water that is stored will be led to the sewer or the duck pond. The balance between stored water and capacity for cloudbursts was one of the biggest challenges according to our collaborator Lene Stople Meyer (Appendix 5, Interview with Lene Stolpe Meyer).

CONCLUSION

The parking basement and the change in the road leading to it are the only items that have their design complete and are starting construction in May 2021. The remainder of the items in the new square are still in the ideation stage and are just sketches. This last part of the design is set to begin construction less than two years later in 2023.

There is currently a debate on whether the undefined recreational space is enough to justify spending 110 million kr. on the development of the parking basement. One opinion comes from Mayoral candidate Michael Vindfelt from The Social Democratic Party (Socialdemokratiet) who claims that the need for parking is greater in other places of Frederiksberg and that the investment should be done somewhere else (Vindfelt, 2021). We observe another issue with the current development plans: If the layout of the square is to be dictated by the flea market, then it can be questioned if the 110 million kr are well spent on moving the cars below ground. Another opinion comes from Alderman Thyge Enevoldsen from the Green-Red Alliance (Enhedslisten) who questions the overall use of the square by saying: "Now that this torvehal [food hall] idea has disappeared, it's a little bit difficult to see what we are going to use the square for." (Appendix 4, Interview with Thyge Enevoldsen 00:22:13). These very different opinions contribute to showing that the square still lacks identity and it seems to be difficult for actors in the municipality to imagine just what this new recreational space could look like.

5.3. PLANNING IN FREDERIKSBERG MUNICIPALITY

When looking into how Frederiksberg Municipality does planning, we interviewed one of its project managers, Bo Rasmussen. He is one of the project managers of the development of the square behind the town hall. During other projects, he and other colleagues from other disciplines within Frederiksberg Municipality make decisions that affect the design and development of public spaces. Among the colleagues involved there are other planners and the city architect, who influence how the physical space is developed, for example developing the green profile of a project.

The case of the square behind the town hall is different, as the politicians of Frederiksberg Municipality decided on the main features of the future square's design, Bo Rasmussen mentioned that this happened because of the location of the square and its relationship with the town hall. Thus the politicians have a special interest in the development of the square and it is their intention that the square should act as a showcase for climate adaptation. The square should furthermore represent what Frederiksberg Municipality is capable of. To accomplish this, the politicians have very general suggestions for features that should be included such as more green areas, a food market, a connection to Frederiksberg Have, smart technology, EV chargers and water elements. Even though the politicians decide the main features, Bo and his colleagues make the final decisions on the details of the elements on the square and are in charge of communicating with the design company, who are doing the final design of the square (Appendix 6, interview with Bo Rasmussen). However, in order to implement these wishes proposed by politicians, the local act for the square had to be changed to allow for construction on the square (Appendix 6, interview with Bo Rasmussen). This shows how the politicians have the power to basically change the square into whatever they want without taking into account their decisions' the long term impact on the city's development.

As mentioned in section 5.2, the square was chosen as a central delay area for rainwater in 2013. The development of the square is seen as an opportunity to showcase climate adaptation efforts by Frederiksberg Municipality. To contribute to this idea, a multi-department team was created, called 'Climate behind the town hall' (Klima bag Rådhuset), with members specialized in climate adaptation, biodiversity and smart technology. A member of our team participated in the initial meetings during an internship in Frederiksberg in the fall of 2020 and observed their solution development process. The work the team did for designing and developing certain features of the square will be used here to exemplify Municipality's process. The first step in their process included brainstorming on wishes for constituent elements (Appendix 1, extract from Nannas internship diary). They based their brainstorm on the municipal goals for climate adaptation (Frederiksberg kommune, 2012) and a presentation document from the politicians. These documents were used as guidelines for what to achieve. One example is how they created the vision of local water management on the square, where all water should be treated in a centralized system, based on Frederiksberg's goal of using water as a resource. In addition to having the square showcase climate adaptation solutions, the politicians had special interest in incorporating smart city solutions. Thus the project team tried to incorporate as many smart city solutions in the water management as possible. The process was very focused on technical elements with problem descriptions and goals set by the politicians in official documents (Appendix 1, extract from Nannas internship diary).

The members of the working group only constitute one perspective of what the new Square behind the Town Hall have to encompass. However other departments , not included within the team, also had inputs for the design of the square. The description of the project The Square behind the Town Hall was sent out internally in the administration to get other departments' perspectives and wishes for the square. This process was conducted simultaneously with the team's work on the design for climate adaptation in order to achieve what Frederiksberg municipality describes as synergy (see section 5.1). These inputs were then gathered by a project committee, which Bo Rasmussen is in charge of. However, all these different inputs had to be accommodated around the design of the parking basement as it's the main feature from the perspective of Frederiksberg Municipality (Appendix 6, interview with Bo Rasmussen). This is in line with Frederiksberg Municipality's strategy of moving more parking lots underground (Frederiksberg Kommune, 2021b). Bo Rasmussen describes how the parking basement and its access through Bredgade has a huge impact on how the square can be designed. Therefore car-based mobility infrastructure was designed first and then all the other elements of the square just had to be arranged around it (Appendix 6, interview with Bo Rasmussen). We interpret this as Frederiksberg municipality has prioritized the parking basement in the development of the Square behind the town hall.

It's worth pointing out that during the process discussed above there was no citizen participation, and the entirety of the design was created within Frederiksberg Municipality. This is due to the planners' limited knowledge on how to do citizen involvement and the lack of a practice for how to do so. This proves that the approach on the square focuses on technological solutions and not social needs. As a way to generate citizen input, Frederiksberg Municipality hired a consultant to investigate the social aspect of the future square through a citizen dialogue. However, the process of development focuses on creating a design that lives up to the require goals and expectations from the politicians and various plans and documents, while the citizen dialogue focuses on affirming the choices made by the politicians. We interpret the citizen dialogue as having minimal impact on the final design, since the outline for the design had already been decided on before the citizen dialogue was initiated.

5.3.1. DESIGN OF LANGELANDS PLADS

The city renewal project of Langelands Plads (see Figure 11 & 12) has been perceived as a success with regards to both climate adaptation and a recreational urban room. It is the intention of Frederiksberg Municipality to replicate what was done with Langelands plads in a larger scale with the square behind the town hall (Appendix 1, extract from Nanna's internship diary).

One of the main points of focus for Langeland Plads focus point was creating a space which would mitigate climate impacts. One solution was to cover Langelands Plads with a special type of tile which eliminates Nox particles. The tiles are permeable so that rainwater can percolate to the magazines which will store and delay water underground (Frederiksberg Kommune, apr. 12. 2019). The purpose of these functions is to protect the area from particles generated by the burning of fossil fuel and flooding during cloudbursts. The other focus point was on creating an urban space for kids. To accomplish this the design of the square includes a ball cage, a playground and a kids' pool.

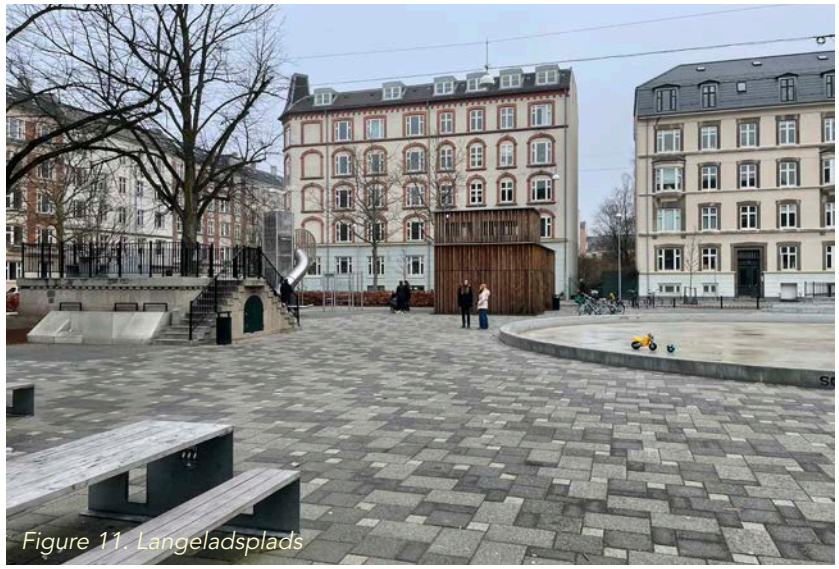


Figure 11. Langeladsplads



Figure 12. Langeladsplads Parking entrance

One feature that is important to mention about Langelands Plads is that underneath the square there is a parking basement with capacity for 207 cars (Frederiksberg Kommune, apr. 12. 2019). As described in the Municipal Plan's Main Structure, the intention of building the parking basement was to hide the cars away underground (Frederiksberg Kommune, 2021b). However, the 207 cars that are able to park in the basement have not been hidden away entirely as the cars must circle the square in order to get to the parking basement's entrance (see figure 13). A field trip to Langelands Plads during rush hour revealed how it is surrounded by traffic and that there is no safe crossing for pedestrians.

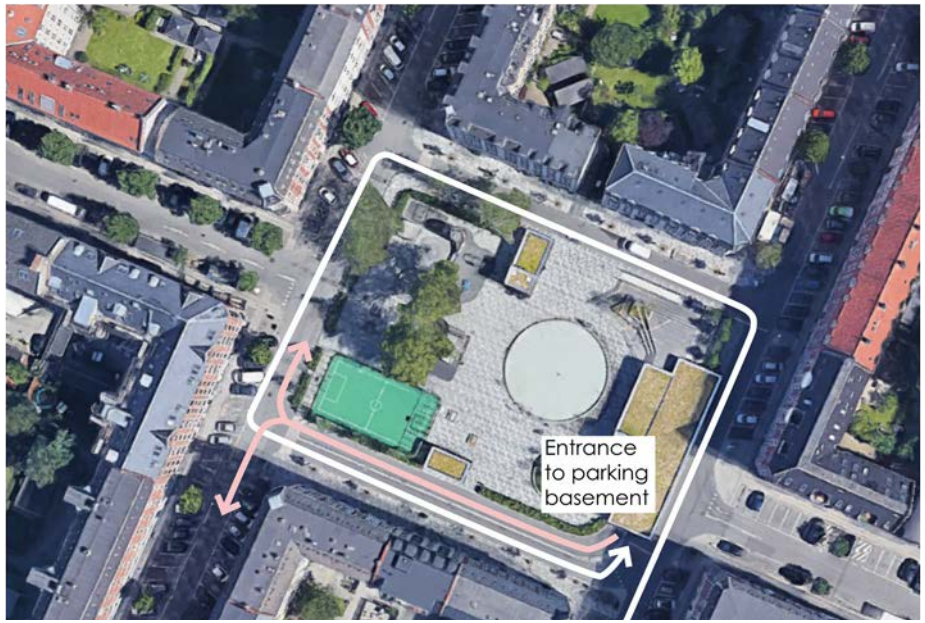


Figure 13. Plan view. Traffic flow Langelandplads. The picture shows how cars will drive around Langelands Plads

From our field trips to Langelands Plads we observed how the different features don't coexist properly. The design of the square gave us the idea that the road to the parking basement and the recreational facilities were planned during separate processes. From visiting the square it is evident that the planning of the car-based mobility infrastructure has not been seen from the perspective of a pedestrian, a bicyclist or kids playing. Instead when Frederiksberg Municipality speaks of Langelands Plads as a success, it refers to how it solves the problems and reaches the goals described in the municipal plans. These are goals such as more parking underground (Frederiksberg kommune, 2021b), protection of old trees (Vej, Park og Miljø, 2018) and efficient technological mitigation of climate change impacts (Frederiksberg Kommune, 2012).

5.4.CITIZEN DIALOGUE

Citizens are a key part of cities today and they should play a role in shaping the future cities. Because of this, new development projects often borrow approaches from the field of participatory design, such as citizen engagement, in order to improve their final product. Citizen's participation is an action that offers an opportunity to influence public decisions, by including the notion of the democratic decision-making process. Moreover, this participatory design approach is used today as a new form of designing by using people's agency in order to help shape an environment (Robertson & Simonsen, 2012).

Frederiksberg states in their strategy for development that they aim to create solutions with the citizens (Frederiksberg Kommune, 2020a p4). In line with this Frederiksberg Municipality has included citizen participation in their process to develop the Square behind the Town Hall. The first stages of citizen engagement took place in 2017-2018, when the idea of restructuring the square was first brought in discussion by the politicians. The Masterplan Report (COWI, 2017), mentions this step as a "temperature check" (temperaturmåling) of the citizens opinion towards the proposed project. Frederiksberg Municipality, together with the consultancy companies Juul & Frost and COWI, conducted short unscheduled interviews with passersby at the square. These interviews were very structured in nature and later gave way to initiating steering meetings. The purpose of these activities was to collect information about how square is used today, and how it could be used in the future. It needs to be mentioned that the sample size of the interviews was not statistically representative for the whole area. The performed interviews were later used along with urban planning analyses and technical requirenements to develop scenarios for how the square could be developed (COWI, 2017, p. 7). The sum up of this phase is concluded in a series of findings that the municipality investigated further:

- The flea market must be preserved
- The space needs to be flexible and multifunctional
- The square should be a reception space that connects the city and Frederiksberg Have
- There is the possibility to build a food hall but the use of it must not cause too much noise
- The bicycle and car parking are a very important for the square
- The access to Frederiksberg Have is to be improved
- The coherence and access to Møstings Hus and the lake are to be strengthened

Frederiksberg Municipality initiated a new engagement process in June 2020 to follow up on the criterias found in the first round of engagement. The focus of this new engagement activity was to investigate the citizens' opinions about the parking basement and their vision for the future development. This activity was conducted by the consultancy company Schulze+Grassov, who are specialized in citizen engagement processes. The consultancy company called their citizen engagement process a "citizen dialogue". It consisted of a series of activities and events at the square where they would focus on the future of the Square behind the Town Hall (Schulze+Grassov, 2020). This approach was used to increase the dialogue between the users of the square and the Municipality's planners. The overall scope of this activity was to test the scenarios that the consultancy developed and make citizens discuss and vote on them.

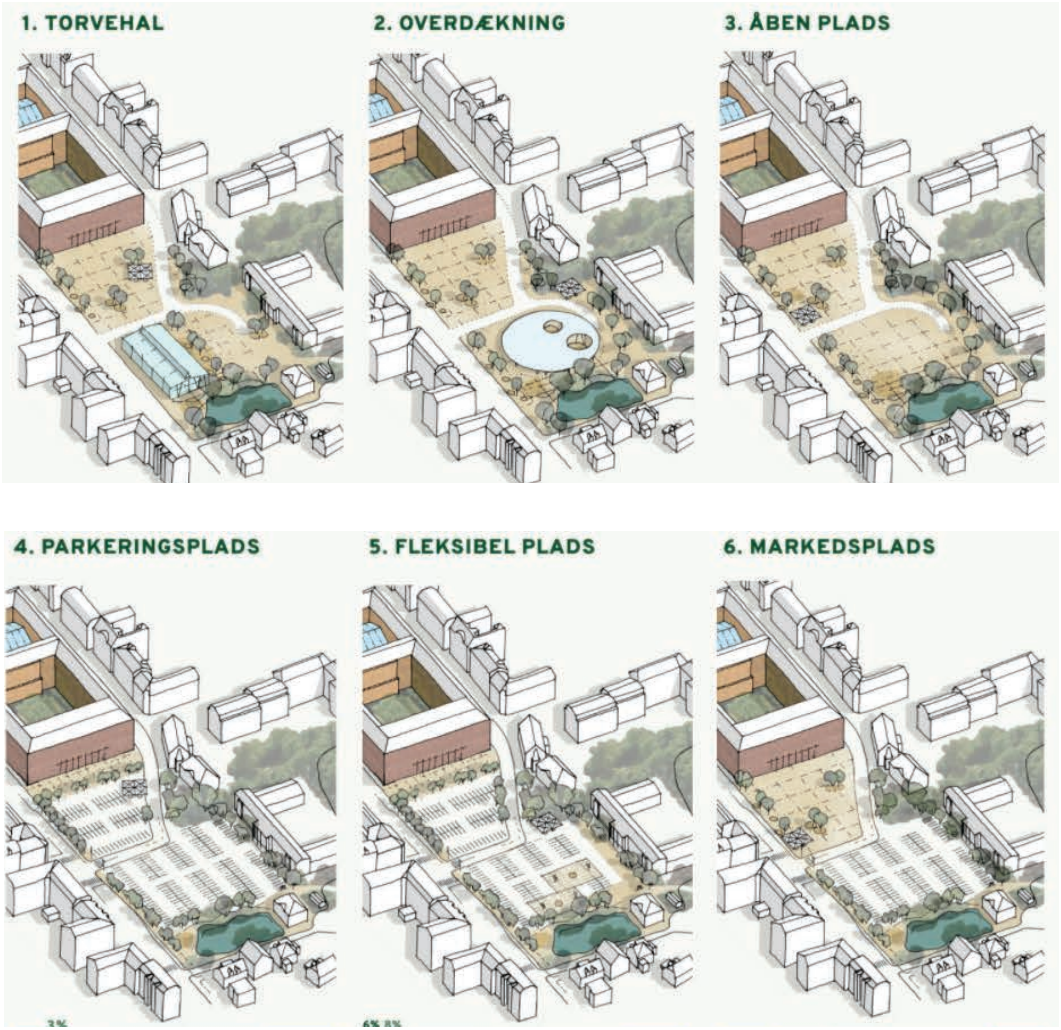


Figure 14. Scenarios. Source: Schulze+Grassov, 2020)

The consultancy company based the scenarios on the previous citizen engagement processes and the political discussions about the Square behind the Town Hall. Schulze+Grassov developed six scenarios for the citizen dialogue. The scenarios had two main categories with the first three scenarios centered around the idea of parking below the surface, while the last three scenarios were centered around parking on the surface, Figure 14 shows the central idea behind each of the six scenarios. All the scenarios were presented in the pavilions of the urban space exhibition for the citizen dialogue. The participants could ask questions, express their ideas and vote on their preferred scenario. The participatory process sorted the citizens by age and gender. In order to examine the overall trends for the citizens' wishes for the square, Schulze+Grassov had planned different events and activities:

- A questionnaire related to the six scenarios for the square. (see figure 15).
- Vox-pop interviews conducted by Schulze+Grassov.
- Postcards where the participants could write or draw their wishes for the Square behind the Town Hall.
- Opinion polls with colored balls, which the participants used as a way to vote for the preferred scenario. This method presented a visual barometer of the participants' interest in each scenario (see image 16).
- A workshop focusing on capturing the children's perspectives and wishes for the development of the square.

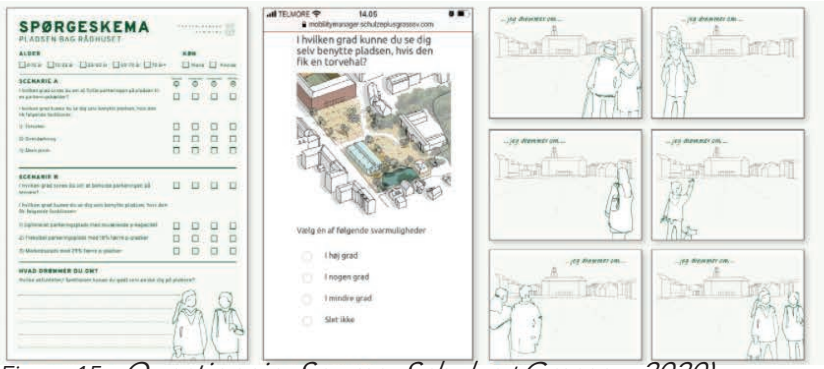


Figure 15. *Questionair. Source: Schulze+Grassov, 2020)*



Figure 16. *Barometer Source: Schulze+Grassov, 2020)*

These multiple methods of engaging with the citizens produced a variety of results. Certainly, not all statements and opinions have been relevant to the case and some answers have therefore been assessed not to be included in the summary. The questionnaires show that there is overwhelming support for the establishment of a parking basement with an indication of 79% to a large extent, 8% to some extent and 1% to a lesser extent, while only 10% are against the establishment of a parking basement.

Additionally, a number of concerns were raised as a result of the' citizen dialogue'. These concerns revolved around the parking spaces lost during the three year construction period; possible future nuisances as consequence of the change in use of the square and the visual expression of the space. Concerns related to the effect of the investment would have on Frederiksberg Municipality's economy and the effect of the market hall would have on the local trade. The consultancy produced the following conclusions out of the citizen dialogue:

- There is an overall positive picture in relation to developing the Square behind the Town Hall for more elements apart from parking.
- There is comprehensive support, 80% of respondents, for the parking to be moved to a basement under the square so the square can be used for other purposes.
- Most citizens report positively on scenario 1 (food hall) and scenario 3 (open space) with the possibility of different activities.
- It is broadly agreed that the flea market should at least be preserved in its current form with the possibility of it being held during several days each week in the summer and occasionally hosting a food market.
- The overall citizens wanted more of the following in the square are: Greening, Events, Food stalls, Sitting options, Recreational space.

We will argue that the participatory process performed did not fully bring forward the different opinions and interests related to the square and it did not focus on taking advantage of this essential step in the urban development process. The participatory design process and related activities embody the ideals of democratic participation, inclusion and advance social justice (Gaber, 2019). But when it comes to the reason behind doing the citizen engagement, often the intentions are different. Throughout the years, Frederiksberg Municipality, often struggled with the process of citizen participation (Appendix 1, extract from Nanna's internship diary). From the analysis of Schulze+Grassov's citizen dialogue we see that Frederiksberg Municipality is mainly searching for a particular direction or validation of their vision for the squaret. Moreover, we argue that the intention with the citizen analysis needs to be changed. In the second engagement activity conducted by Schulze+Grassov, the facilitators did not focus on what the participants need and how the decision to built the parking basement could impact the Square behind the Town Hall. Instead, they only test the vision created from their own empirical perceptions, without allowing the users to truly influence the visions. We identify this approach as similar to what Gaber (2019) describes as a "manipulative" approach. Lastly, we want to highlight that this type of investigation should not focus only on the age of the participants (Schulze+Grassov, 2020), but also focus on their identity, their needs and meaning they ascribe to the square.

6 Analasys

CHAPTER INTRODUCTION

In this chapter we will apply our theoretical spectacles to analyse the research presented in the previous chapter. The first section will analyse Frederiksberg Municipality's current planning of the Square behind the Town Hall and argue for the limitations in their current vision. The second section will engage in a larger discussion of Frederiksberg Municipality's carbon lock-in and argue for how their current mobility policy brings the city close to a tragedy of the commons. The last section of this chapter will present how we used SCOT in a proactive way to process our findings from engagements with stakeholders. The purpose of this process was to develop two visions where each vision represents a possible future.

6.1. LIMITATIONS OF THE CURRENT VISION

Within the development of this project we are pursuing to make Frederiksberg Municipality change the design of the Square behind the Town Hall by addressing their perception of sustainability, their approach on citizen engagement and the urban transformative capacity of the square.

We interpret Frederiksberg Municipality's perception of sustainability as leaning towards the concept of weak sustainability. We find the evidence for this interpretation in the analysis of the current ideas that the planners have when discussing the design of the Square behind the Town Hall. One of the strongest points we identified from our empirical data is that the parking basement is seen as a way to provide more space for nature and recreational activities. This follows the idea that technology will provide a solution that will contribute to maintain the utility for the citizens, as it allows them to continue to use the space to support car-based-mobility while increasing the surface area to increase natural and recreational elements. Another element that contributes to the Municipality's inclination towards weak sustainability is their way to address the management of rainwater. This is to be done by storing rainwater in underground magazines to be utilized later.

Frederiksberg Municipality has as their goals to achieve a sustainable transition towards a CO2 neutral city, adapt the city to the future climate and enforce sustainable mobility and high accessibility (Frederiksberg Kommune, 2020a). Taking into consideration how Frederiksberg Municipality is currently aiming to achieve those goals, we will argue that the municipality's approach of addressing urban transformative capacity is still lacking. By following the goals described in section 2.2, we want to highlight that Frederiksberg Municipality doesn't fulfill the goals of urban transformative capacity. Referring to our study case, only one goal is partially achieved. We argue that Frederiksberg Municipality only partially achieves the disruption and dismantling of existing systems as it aims to make the city CO2 neutral but the methods to do so can be questioned. An example is how Frederiksberg Municipality aims to transform the system of car-based mobility by introducing more EVs. The problem with this approach though, is that emissions will still be generated outside the city and that EVs won't free up more space within the city. When it comes to opening the investigation towards alternative scenarios that will address all citizen's needs, they end up creating superficial actions that will only address the prevailing development trajectory and what the politicians and planners perceive as constituting a good city. As we also state in section 2.2, we argue that it's imperative for the decision makers of Frederiksberg Municipality to deeper investigate what impact the future development will have on long-term city liveability. We argue that they can do this mainly by including the future generation's perspective in combination with the current generation's perspective.

Frederiksberg Municipality has hired different consultancy companies to carry out the citizen dialogue on their behalf. These consultancy companies have done the citizen dialogue in a variety of ways in relation to the development of the Square behind the Town Hall. As described in section 5.4. the various engagements with the community have been done to validate the elements that the politicians of Frederiksberg Municipality want to include. The first set of consultant companies, Juul & Frost and COWI, produced four scenarios based on interviews with citizens and urban analysis.

The Municipality used these scenarios to generate six designs which were later used to supplement the citizen dialogue performed by the second consultant company, Schulze+Grassov. They produced a citizen dialogue, in which the citizens could vote on designs. Despite all the work done by the consultancy companies the end result was a validation for constructing the parking basement. However we argue that they reached this result because they didn't really open the discussion of

the development of the Square behind the Town Hall and didn't investigate what different meanings the participants attached to the square. The former would have let the participants push for different needs or possibilities and without being limited to the options presented by the Municipality. While the latter would have brought different ideas and considerations to include in the discussion. This means that Frederiksberg Municipality has a manipulative approach to the citizens' dialogue.

Langeland Plads has been mentioned (Appendix 1, extras from Nanna's internship diary) to serve as something that Frederiksberg Municipality seems worthy of emulating with the development of the new Square behind the Town Hall. As mentioned in Section 5.3.1 Langeland Plads is considered an example of good practice in climate adaptation, recreational space and addressing cars (Frederiksberg Kommune, 2021b). After visiting the square we were able to identify some limitations in relation to the characteristics that qualify it as an example of good practice by Frederiksberg Municipality. Although the square might be successful in managing rainwater and contributing to atmospheric cleaning, it relies strongly on man-made solutions, for example the whole square is covered by tiles and the kids' pool made of concrete. This use of man-made elements makes Langelands Plads' way of addressing issues, like rainwater management or urban heat effect, very inflexible and has created a square that fails at addressing other climate threats like reduction in urban biodiversity. Additionally using these solutions makes for a very grey space even though there is some vegetation in the square. The design of Langeland Plads also includes a parking basement underneath it and the road to access it actually surrounds the square itself. Furthermore, an article from Dansk Arkitektur Center (Ørum, n. d.) points to the paradox that the square that is to mitigate the effects of a changed climate, has been built over a three story parking basement. Hence we come to the conclusion that if Frederiksberg Municipality wants to replicate Langeland Plads then keeping up the status quo is given a higher priority than taking advantage of the opportunity for transformation.

6.2 MOBILITY IN FREDERIKSBERG

Climate change is largely caused by unsustainable patterns in human behaviors and the solutions proposed often focus on technological innovations (Seto et al., 2016). An example is Frederiksberg Municipality's solution to use electric vehicles as a way to eliminate the emissions and particles generated by fossil fuel engines within the city (see section 5.1). This can be seen as a continuity strategy, because the vehicles and the car-based mobility system remain while the emissions generated within the city are eliminated. Citizens of Frederiksberg will no longer be exposed to particles from fossil fuel engines but this is the only difference caused by the change. Cars-based mobility will still produce noise, be a risk to safety and limit the opportunities for more space to efficient and healthier modes of transport such as biking, walking or public transport (Mayor of London & Transport for London, 2017). In other words: changing the car-based mobility system from fossil fuel engines to electric engines will uphold the status quo.

According to Seto et al. (2016) there is a risk in deviating from the status quo. Robert from JAJA Architects exemplifies this by sayng that the politicians perceive it as a risk to adopt a more critical approach to car-based mobility since "...they think there are social economic benefits to having people driving around." (Appendix 9, interview with Robert Martin, 00:20:22). This unwillingness to deviate from the status quo is also what locks Frederiksberg municipality into a techno institutional complex (TIC) that encompass all of the three types of lock-in; technological, institutional and behavioral (Unruh, 2000). The car-based mobility system of Frederiksberg constitutes a TIC which is a positive feedback loop where actors in the city of Frederiksberg have grown used to and dependent on the current system. Vehicle owners can easily use their vehicles to get around and it has become part of their daily behavior. In order to make the system even more easy and convenient, the political government of Frederiksberg is planning the infrastructure development to support this behavior; Traffic

light signals are improved to make a better flow through the city and new parking lots are being constructed (Frederiksberg Kommune, 2021a).

According to Seto et al. (2016) it is the behavioral lock-in that is the most significant in the transport sector. The behavioral lock-in has two mechanisms: lock-in through individual decision making and lock-in through social structures (Seto et al., 2016).

Seto et al. (2016) argues that the lock-in of individual behaviors refers to how decision making becomes more automatic with repetition until it is no longer a conscious process. This tells us that the unsustainable behavior of citizens choosing to use their cars over other forms of transport, like public transport has become a habit and a choice that they no longer question. Studies have shown that if this habit is interrupted by a change in the surrounding system, the citizens who relied on car-based mobility will be more likely to shift to another mode of transport (Verplanken et al., 2008). Seto et al. (2016) further write that a change in travel behavior can reduce CO2 emissions by 50% by the end of the century which makes this behavioral strategy seem more efficient than Frederiksberg Municipality's current strategy of a change towards electric engines. Furthermore, electric engines will prevent CO2 emissions inside the city, but the technology cannot guarantee that emissions are not produced outside the city.

The citizen's behavior in relation to the car-based mobility is not only determined by individual cognitive processes but also by social structure (Seto et al., 2016) which in this case is embedded in the existing transport infrastructure and privatized car-based mobility. Where lock-in of individual behaviors describe the individual's agency over behaviors and habits, the lock-in of social structures describe how practices and contexts have agency over individual behaviors (Seto et al., 2016). Change in a technological and social infrastructure causes a change in routine practices. An example of this can be found in the way technological innovation produces the system of car-based mobility. This new practice of car-based mobility initially competed with and won over the earlier practice of bikes as the most common mode of transportation within cities (Seto et al., 2016). If we follow this argument about behavior being determined partly by social structures, we can assume that an improvement and investment in the car-based mobility system will only push more citizens to use the system. Robert Martin, a mobility expert from JAJA Architects, supports this argument by saying that "The reason you build parking basements is that you allow people to drive" (Appendix 9, Interview with Robert Martin, 14/4 2021. 00.20.22). Seto et al. (2016, p.441) states that "Routines change when (a) the elements required to accomplish them change, (b) the populations practicing them change, or (c) related and interdependent practices change." Thus, we will argue that an intervention against car-based mobility will be a better strategy for reducing CO2 emissions and creating a better city, than Frederiksberg Municipality's current strategy of nudging citizens to change to electric vehicles (EVs).

Frederiksberg Municipality's strategy of pushing the citizens to drive EVs can in the words of Unruh (2002) be defined as a continuity strategy and stands as a sign there is no will to deviate from the status quo by the Municipality. It is no secret that politicians can have a tendency to follow the public opinion instead of doing what is best long term. They see electric engines as a solution to their current problem but according to Robert (Appendix 9, interview with Robert Martin) micro mobility, like electric bikes, is a growing trend. Based on this trend we will argue that it would be more sustainable for Frederiksberg to focus on encouraging other practices than car-based mobility and that the investment in the parking basement would be better spent improving soft mobility. Building the parking basement will only further encourage the carbon lock-in of Frederiksberg.

TRAGEDY OF THE COMMONS

There are multiple sources who state that a city with less car-based mobility will be a healthier and more livable city (Appendix 9, Interview with Robert Martin; Mayor of London & Transport for London, 2017). However, development seems to be going in the wrong direction. According to Robert Martin, during the last ten years there has been a 30% increase in car use in Copenhagen and the situation in Frederiksberg might be similar (Appendix 9, Interview with Robert Martin). If the number of cars within the city exceeds a sustainable level it can become what Hardin (1968) describes as a tragedy of the commons. We claim that the car-based mobility in Frederiksberg is very close to this state. Cars and car-based mobility have become such an integrated part of a modern city, that they are often taken for granted. It is not often that one stops and reflects on how much space car-based mobility actually takes up. In this section we will explain why by responding to what Patt (2017) writes that a space should full fill to be considered a tragedy of the commons:

- a common space that can be accessed and taken advantage of by various people.
- a resource that is being depleted.
- the resource has to lead people to overuse it or exceed its sustainable limits.
- there is not a technical solution.

(Patt, 2017)

First, roads are a common space that can be accessed by various people as long as they use car-based mobility. Second, roads and infrastructure for car-based mobility take up a lot of space which is a scarce resource within a dense city such as Frederiksberg. Frederiksberg has an area of 8.7km2 which is distributed between transport infrastructure (26%), buildings (57%) and recreational space (15%) (Danmarks Statistik, 2021). These numbers show how transport infrastructure, which is mainly dominated by car-based mobility, takes up almost double the area of recreational spaces. Third, since car-based mobility is the largest contributor to the amount of space the transport infrastructure takes up, we will argue that the resource of space in the city is overused by car-based mobility. One could make the argument that buildings also overuse the space but we will consider them necessary while car-based mobility can be substituted by other means of transport. Fourth, there is no technical solution to the problem of cars taking up space in Frederiksberg. The problem will not be solved by optimizing and designing better infrastructure for car-based mobility. The parking basement is perceived as a solution to the problem of space distribution between transport and recreational areas. However, we will argue that it is not a full solution since the cars will end up driving around in the city. Furthermore, the construction of the parking basement also puts constraints to the development of recreational space above it. We argue that the current state of car-based mobility in Frederiksberg is not yet a tragedy of the commons but that it might turn into one if the situation is not managed carefully.

When using the criterias of Patt (2017) to analyze the current state of the Square behind the Town Hall specifically we see that it also aligns with the four criterias. It might not be a full tragedy of the commons but it is very close, depending on the perspective. First, the Square behind the town hall is an area that is of common access to the whole population as it is not privately owned. Second, the resource of space is

depleted since the space has been overtaken by cars, except for Saturdays during the summertime when the flea market takes up half of the square. Third, from a livability and climate perspective, the Square behind the town hall can be perceived as past its sustainable limit as it is mostly dominated by parked vehicles. Lastly, as we argued above, the parking basement can be seen only as a partial technical solution.

The prioritization of car-based mobility in the development of recreational spaces is not questioned by politicians and city planners (Appendix 6, interview with Bo Rasmussen) and this can be seen in the design of the Square behind the Town Hall which has largely been determined by the construction of the parking basement and the rearranging of Bredgade (See Section 5.2). Following the idea of the adjacent possible, we know that we cannot make Frederiksberg municipality turn away from car-based mobility from day to day and we will not attempt to. However, we will try to impact the planners and project managers to embrace a new perspective on planning and make them reconsider how they prioritize sustainability and non-car using citizens. The next chapter will describe how we aim to do so.

6.3 DESIGN SYNTHESIS

During Frederiksberg Municipality's development process of the Square behind the Town Hall, there has been some focus on citizens' wishes, but little attention has been paid to their interests, needs and meanings attached to the square. We will argue that the development of the square favors one group of citizens: those who interpret it as a space for car-based mobility, while neglecting the rest (see section 6.2). This is problematic since these favoured groups of citizens can also interpret the square in other ways and thus have needs and interests that are overlooked if they are only considered as car owners. We argue that investigating all the many different potentials for development that the citizens' conflicting interpretations of the future square holds will give a much more diverse and interesting image of what the final square could look like. We want to give a voice to actors that are not heard in the municipality's planning process and investigate what different outcomes it might produce.

In the following sections, we will present how all the different interpretations of the square can be investigated and structured through the use of SCOT. The purpose is to include all the voices who have something to say about the square - also the ones who are neglected by Frederiksberg Municipality's current development process. We will analyse the relationship between the relevant social groups to see what meanings they ascribe to the square and how they have different conflicts and interests related to its development. Additionally we will look into how these meanings, conflicts and interests can shape the development of the square. Through a structured creative process we will show how the square can develop differently depending on which relevant social groups (RSG) that get to dominate the closure of the square. We will further show how a development guideline based on weak and strong sustainability can steer the process of inclusion and exclusion in the development of an urban space.

6.3.1 RELEVANT SOCIAL GROUPS AND INTERPRETIVE FLEXIBILITY

In this section we will describe the development of the square behind the town hall from the actors' perspective by using SCOT. Bijker (1997) describes that development of a technology can be described by tracing what different actors think of it. If they think of or interpret the artefact in a similar fashion, then they will constitute a RSG. During our field work and empirical research we found that different actors perceived and interpreted the development of the Square behind the Town Hall in many different ways. The empirical material is documented in included as appendix (Appendix 4, Interview with Thyge Enevoldsen; Appendix 5, Interview with Climate Team Lene Stolpe Meyer; Appendix 7, Interview with Bo Rasmussen and Lene Stolpe Meyer, Appendix 8, Facebook post) (Appendix 11, Student dorms and business owners) Some actors had a lot of contesting interpretation of what the square should develop into (see figure 17). As sustainable designers we were aware that we will not be able to contact all actors that could be impacted by the development of the Square behind the Town Hall. We have identified these actors as future generations, flora and fauna. However we still decided to include these actors and their interpretations of the square in our analysis.

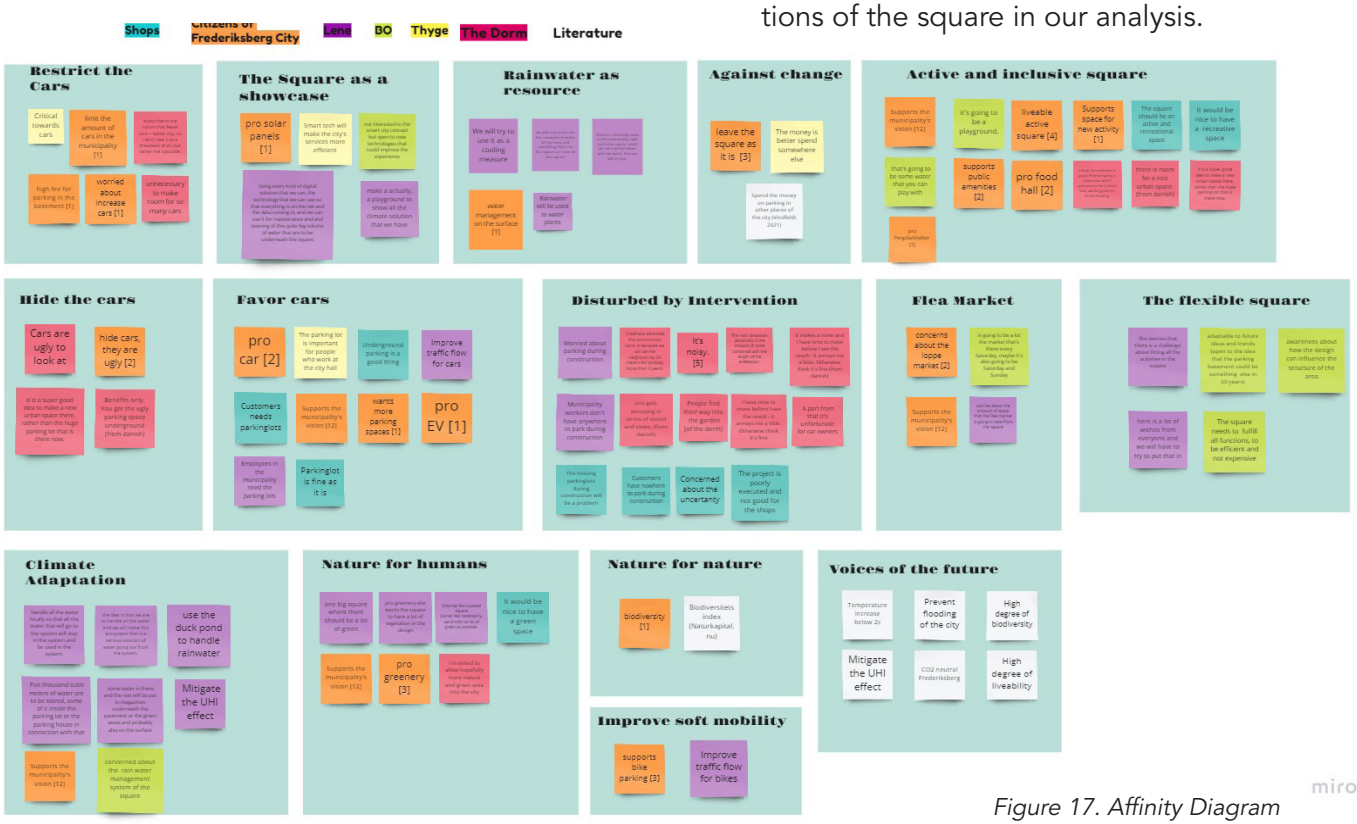


Figure 17. Affinity Diagram

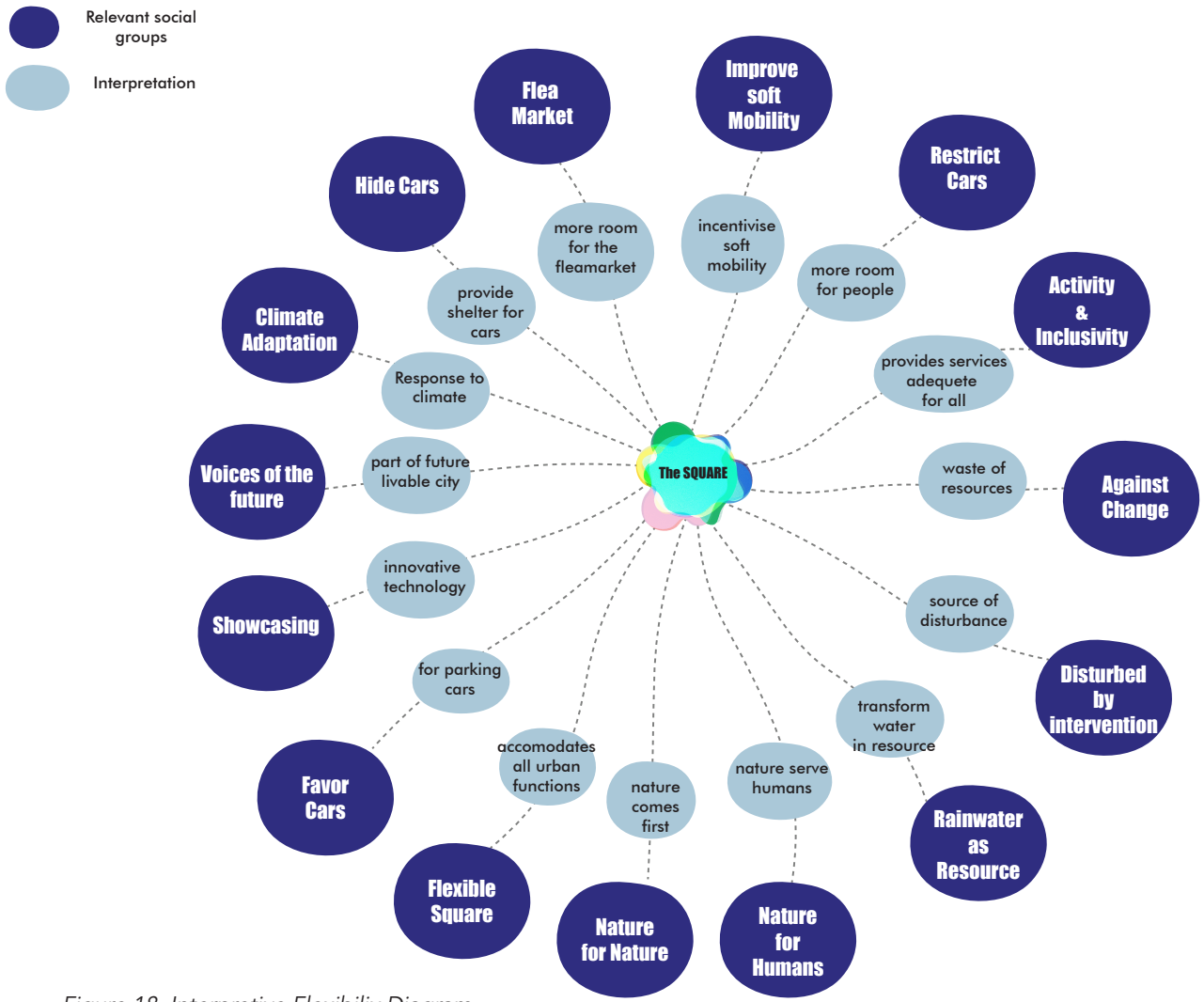


Figure 18. Interpretive Flexibiliy Diagram

Utilizing SCOT enables us to "open up" the actor and see their different intentions. In the following we will describe how this approach enabled us to work with many different perspectives in a structured manner. We used the affinity diagram to group similar statements and these formed into different topics which we later identified as 15 different RSGs. The actors within each RSG attach the same set of meanings to the specific artefact being studied (Pinch & Bijker, 1984). What we have depicted in the affinity diagram is our interpretation of the actors and the context surrounding the square. According to Bijker (1997) the identifying of RSGs have to be rooted in reality; we believe we have achieved this by using the method described above and in section 4.2.

Interpretive flexibility is, according to Bijker (1992) a dispute over how the artefact should be described and how it is perceived differently through the eyes of the RSGs. In this case the dispute regards what the Square behind the Town Hall should develop into or said in another way: What each RSG interprets the square as. In Figure 18 we show a diagram where the interpretative flexibility of each RSG is mapped. We have depicted the RSGs in the outer circle. Between the RSGs and the square in the middle, we have written how each RSG interprets the square. The municipality's intention to redesign the square opens up for a lot of different interpretations of what constitutes a good future square. Thus, the purpose of doing the diagram was to show that the square can be deconstructed into as many artefacts as there are RSGs. Each RSG is presented below as well as how they interpret the future of the Square Behind the Town Hall.

FLEA MARKET

This RSG is constituted by actors that see the activity of the flea market, currently taking place every weekend, as a key characteristic of the square behind the town hall. This group values the flea market and advocates that it should be kept in its present state. The group further argues for increasing the frequency in which the flea market takes place. They interpret the square as an available space for the flea market.

IMPROVE SOFT MOBILITY

This RSG is concerned with how the square will tackle soft mobility. They are concerned with how much room is allocated to the traffic flow for soft mobility. The users of soft mobility are also concerned with personal safety since they are exposed to the more dangerous heavy traffic within the city. We further interpret that this group is also concerned with the safety of users of soft mobility. They interpret the square as a space that should create room for and incentivise soft mobility.

RESTRICT CARS

This RSG is made up by actors who would like to see cars and car-based mobility decrease or be restricted on the square and in Frederiksberg Municipality in general. This RSG does not necessarily oppose the presence of cars, but they take a critical stance towards Frederiksberg Municipality's current development for car-based mobility. They further critique how cars can damage the livability of their surroundings which gives this RSG an interest in liberating the square from cars. They interpret the square as a space that has the potential to make room for more people than just car owners.

ACTIVITY AND INCLUSIVITY

This RSG focuses on how the square should be an active, lively and inclusive space for all citizens in Frederiksberg Municipality. They are mainly concerned with how the square will live up to a wide range of recreational needs. They describe how they see the future square as a space with a wide range of activities that are adequate for a wide range of citizens. In order to achieve this, the future square should provide facilities that can be used all day, and during all seasons of the year. They interpret the future square as a space that creates services adequate for all.

AGAINST CHANGE

This RSG argues that it is unnecessary to spend 110 millions (Vindfeldt, 2021) on a parking basement. They are not against creating a recreational space, but their concern is mainly financial. In their opinion the money is better spent elsewhere and should not be used to liberate the surface of the square from cars. In this group there is an overweight of actors who want to maintain the status quo of the square. They interpret the development of the square and the future square as a waste of resources.
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DISTURBED BY THE INTERVENTION

This RSG relates directly to the three year development period of the parking basement. The actors that are part of this RSG see the development and construction as a source of problems. This is everything from uncertainties such as where local residents and customers should park their car during construction to noise and visual disturbances. They interpret the development of the square as a source of inconvenience and disturbance.

RAINWATER AS A RESOURCE

Rainwater in danish cities is being perceived as wastewater and managed as such. However, this RSG is concerned with the perception and management of rainwater and how the square can be designed to utilize rainwater as a resource. They focus on technological installations and water circuits that will make it possible for the square to store and use rainwater for a variety of purposes. They interpret the future square as a space that is able to transform rainwater into a resource.

NATURE FOR HUMANS

This RSG values the greening of the square and wants the future square to hold as much green as possible. Their overall aim is to get more nature into the city and they see that the development of the square holds potential to create another green recreational space within Frederiksberg. They interpret the square as a space where nature can serve the recreational needs of humans.

NATURE FOR NATURE

The main interest of the actors that make up this RSG is to provide more space for nature and biodiversity. Although this group is very similar to the previous RSG (Nature for Humans), they see the square's main purpose as benefitting nature itself, this means that they see the development of the square as an opportunity to strengthen nature within the urban space. They interpret the square as a space where nature is prioritized first.

FLEXIBLE SQUARE

This RSG is concerned with the overall ability of the square to be adaptable and its ability to permit for different functions of both technical and social importance. That means that the RSG is occupied with finding room for climate adaptation, recreational activities, greening, car-based mobility etc. The aim is for the design of the square to be efficient in both functional and economic terms. They interpret the square as a space that should be able to accommodate as many urban functions as possible in an efficient way.

FAVOR CARS

This RSG holds actors who both think that the parking lot is fine as it is and actors who think that the parking basement is a good idea. They have in common that they see the square as a space that should mainly serve car-based mobility and they have an interest in protecting the presence of vehicles on the square. They interpret the square as a space for parking cars.

SHOWCASING

The main interest of this RSG is to use the space as a showcase to lead the way in future actions concerning smart technology. These topics refer to implementing technologies that align with the municipality's goal of being a smart city. These technologies primarily focus on making Frederiksberg's services more efficient, improve the citizens' experience of the public space and allow for better, more efficient management of rainwater. They interpret the square as a space for applying innovative technology.

VOICES OF THE FUTURE

This RSG is concerned with the sustainable development of Frederiksberg and aims to create a space that supports a sustainable and livable future in the city. From their point of view, the square should be part of solving social as well as environmental issues present in the city. They are interested in transformative climate adaptation, a CO2 neutral Frederiksberg, social inclusion and a high degree of biodiversity. Furthermore they agree with the Paris agreement's goal of a temperature increase below 2 degrees. They interpret the square as part of a future livable city.

CLIMATE ADAPTATION

The actors that are part of this RSG perceive the space as an opportunity to protect the city from the impacts of a changing climate. This RSG has an interest in utilizing different methods to address the projected increase of rainwater, handle rainwater locally and mitigate the urban heat island effect. They interpret the development of the square as a response to climate change.

HIDE CARS

This RSG is made up by actors that do not necessarily oppose the presence or use of cars in the square or Frederiksberg Municipality. However, they do find cars to be the source of some level of aesthetic discomfort. This RSG is interested in utilizing the space in ways that allows for car-based mobility as long as the cars, and especially the parking lot, are kept out of sight. They interpret the development of the square as a space that will provide cover for cars.

From this section it is clear that there are many different interpretations of what the square should develop into and that not all interpretations can coexist. By bringing forward many different perspectives as an outset for dialogue, we are combining agonistic design with SCOT and this dialogue will be analysed further in section 6.3.3 and 6.3.5.

6.3.2 TECHNOLOGICAL FRAMES

Lauritsen (2007) argues that it is through the notion of technological frames that SCOT becomes a theory about the development of technologies. Lauritsen (2007) defines technological frames as: "all the elements which influences the interaction inside a relevant social group and leads to the addition of meaning to technological artefacts – thus an establishment of the technology." In the following section we will describe the technological frames of the 15 RSGs described in the previous section. We will do so to see how they construct the artefact - the Square behind the Town Hall, in different ways. We will take the outset in Bijker's (1997) original list of items which can be contained in a technological frame. This list was originally used to describe the development of a technology in a laboratory. Thus, we have modified the list since the technological frames in our analysis deviates from the example presented by Bijker (1997).

FLEA MARKET

Goals: Preserving the flea market in its current state.

Key problems: The construction of the parking basement, space allocation and development of the square.

Problem solving strategies: Arguing for the flea market as part of Frederiksberg's culture.

Solutions to problems: Room on the surface to keep flea market

Perceived substitution: Relocation of the flea market during construction period.

IMPROVE SOFT MOBILITY

Goals: Safe room for soft mobility, incentivise health.

Key problems: Car-based mobility is prioritized higher than soft mobility

Problem solving strategies: Advocate for more room on the surface for soft mobility

Solutions to problems: Design that will provide a safe and efficient environment for users of soft mobility.

Perceived substitution: Share space with car-based mobility

RESTRICT CARS

Goals: Restriction or decrease in car-based mobility

Key problems: Too much space in the city is allocated to cars and car-based mobility, decrease in livability.

Problem solving strategies: Prioritize mobility differently, don't remove but just limit the presence of cars and car-based mobility

Solutions to problems: Increase future livability, reduced presence of car-based mobility

Perceived substitution: Keeping cars and car-based mobility separate from other functions of the square.

ACTIVITY AND INCLUSIVITY

Goals: To create a square with a wide range of recreational activities for many different citizens.

Key problems: Prioritization of space and needs might not leave enough room for recreational functions.

Problem solving strategies: Argue that using the space for inclusive and active recreational functions will increase livability.

Solutions to problems: Coexistence of recreational functions and other functions of the square.

Perceived substitution: Implementation of greening and the most necessary recreational functions. Getting rid of the parking lot to make a public space.

AGAINST CHANGE

Goals: To keep the square as it is.

Key problems: Frederiksberg Municipality wants to redevelop the square and spend 110 millions on building the parking basement.

Problem solving strategies: Argue that the money is better spent elsewhere and that there is no need for a parking basement.

Solutions to problems: Keep the status quo.

Perceived substitution: The money is better spend on a parking basement in another part of the city

DISTURBED BY THE INTERVENTION

Goals: To experience minimal disturbance from the project.

Key problems: The construction of the parking basement makes a lot of noise. There is nowhere to park during the construction of the parking basement. The intervention is poorly managed by the municipality and the administration is bad at communicating solutions.

Problem solving strategies: Tries to make Frederiksberg municipality listen to their complaints.

Solutions to problems: Frederiksberg municipality should make the development produce a minimum of disturbance.

Perceived substitution: Find alternative spaces for parking.

RAINWATER AS A RESOURCE

Goals: Treat rainwater locally and turn it into a resource.

Key problems: The sewer doesn't have the capacity to manage the increased rain and extreme rain events and it has a negative impact on the city. Rainwater management competes with other functions for space.

Problem solving strategies: Develop and use alternative strategies to manage rainwater.

Solutions to problems: Turn rainwater into a resource and increase livability.

Perceived substitution: Rainwater magazines to delay rainwater until there is enough capacity in the sewer.

NATURE FOR HUMANS

Goals: To implement as much green as possible.

Key problems: The prioritization of space. Trees can't be planted on top of the parking basement. The flea market needs a paved surface.

Problem solving strategies: Argue that greening increases livability and mitigates the urban heat island effect.

Solutions to problems: Alternative use of greening such as raised garden beds or raised beds with soil so trees can grow on top of the parking basement.

Perceived substitution: Less greening and trees. An area of the square is designated to be a green space.

NATURE FOR NATURE

Goals: To preserve and support nature and biodiversity.

Key problems: Nature and biodiversity is prioritized below anthropic elements.

Problem solving strategies: Argue that nature and biodiversity is important to a city. Argue for ecosystem services.

Solutions to problems: Prioritize nature and biodiversity higher and designate space for it.

Perceived substitution: Coexistence of natural and anthropic elements.

FLEXIBLE SQUARE

Goals: To create a space that can accomodate all urban functions.

Key problems: Prioritizing space. All needs are valid but they all require space.

Problem solving strategies: Build a parking basement to create more room on the surface. Listen to the actors with the strongest voice.

Solutions to problems: Negotiate needs. Innovative solutions that can encompass as many needs as possible.

Perceived substitution: Prioritize the functions that are perceived as most important.

FAVOR CARS

Goals: Create room for parking cars. Support car-based mobility.

Key problems: There won't be any parking lots on the square during construction.

Problem solving strategies: Argue that citizens and the employees of Frederiksberg municipality need parking lots.

Solutions to problems: Finding alternative parking spaces during the construction of the parking basement.

Perceived substitution: The construction of the parking basement will eventually create better parking facilities.

SHOWCASING

Goals: To transform the square into a showcase for smart technology.

Key problems: How to find ways to implement more smart technology in the city.

Problem solving strategies: Argue that smart technology can make Frederiksberg better and more efficient.

Solutions to problems: Use smart technology to manage rainwater on the square.

Perceived substitution: Use the square as a testing space for smart technology

VOICES OF THE FUTURE

Goals: Frederiksberg should be a livable city in the future.

Key problems: Frederiksberg Municipality's lock-in on car-based mobility.

Problem solving strategies: Argue for sustainable solutions to mobility, development and climate adaptation.

Solutions to problems: Sustainable, future oriented solutions that are in line with the goals of the Paris agreement.

Perceived substitution: Gradual transformation instead of radical transformation.

CLIMATE ADAPTATION

Goals: Adapt the city to a changing climate.

Key problems: Increased rain and the urban heat island effect threatens Frederiksberg and its citizens.

Problem solving strategies: Develop mitigation strategies and implement them in the city.

Solutions to problems: Manage the effects of climate change.

Perceived substitution: Accept some degree of harm from climate change impacts.

HIDE CARS

Goals: To keep parked cars out of sight and utilize the square for other purposes.

Key problems: Cars produce aesthetic discomfort.

Problem solving strategies: Find alternative space to park cars. Argue that cars should be parked out of sight.

Solutions to problems: Build a parking basement to keep cars underground.

Perceived substitution: Limit the amount of cars that are parked in Frederiksberg.

As we have seen in this section, the 15 RSGs have very different goals, key problems, problem solving strategies, solutions to problems and perceived substitutions regarding the development of the square. We will use the technological frames and the RSGs interpretive flexibility to investigate the conflicts and interests among the RSGs. This will be presented in the next section.

6.3.3. CONFLICTS AND INTERESTS

Mapping the RSGs interpretive flexibility and their technological frames produced a thorough description of each RSG. Following this we wanted to explore how the different RSGs interact with each other and to do so we produced a matrix (see figures 19, 20 and 21) where we mapped each RSG's conflicting or matching interests with each other. The purpose of this matrix is to show any common interest the RSGs hold and to locate any technological controversies they might have regarding the development of the square. Technological controversies are what keeps the artefact from finding a relatively stable meaning and shape (Lauritsen, 2007). In order to achieve stabilization and closure the technological controversies must be solved. In our interpretation of SCOT, shared interests, or alliances, between the RSGs can help stabilize the new artefact in development if the solutions created overcome these technological controversies.

Even though the use of the matrix shows only two possibilities for the relationship between RSGs, the result is not always unambiguous. Some RSGs can share interests while also being in conflict. Other RSGs don't share any interests or conflicts since they exist on different terms and require different things. The following will focus on describing the conflicts and interests identified between the RSGs. Every conflict and interest is only described once in order to avoid repeating every conflict and interest twice. As with the RSGs, this is our interpretation of the interests and conflicts.

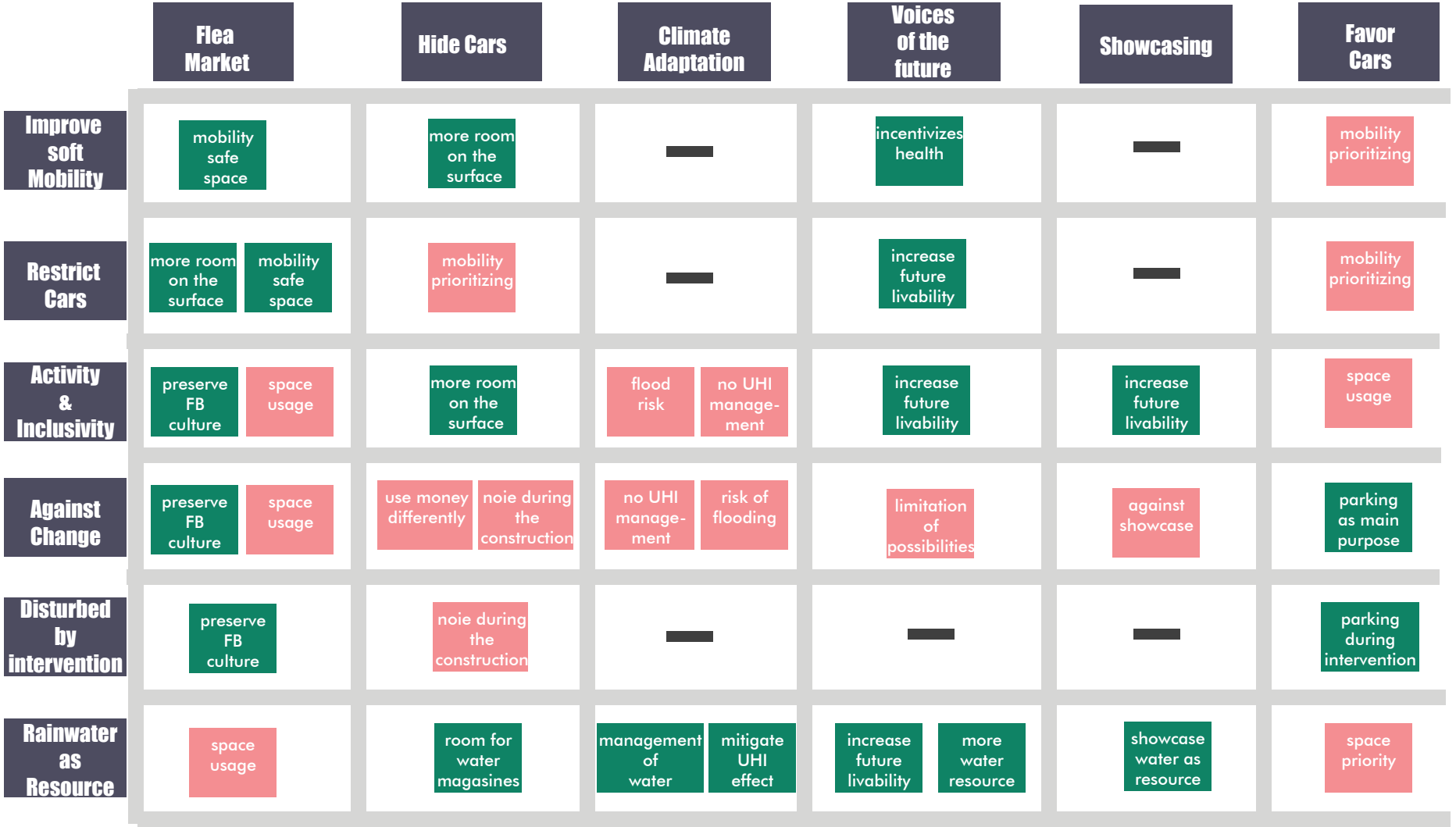


Figure 19. Matrix 1

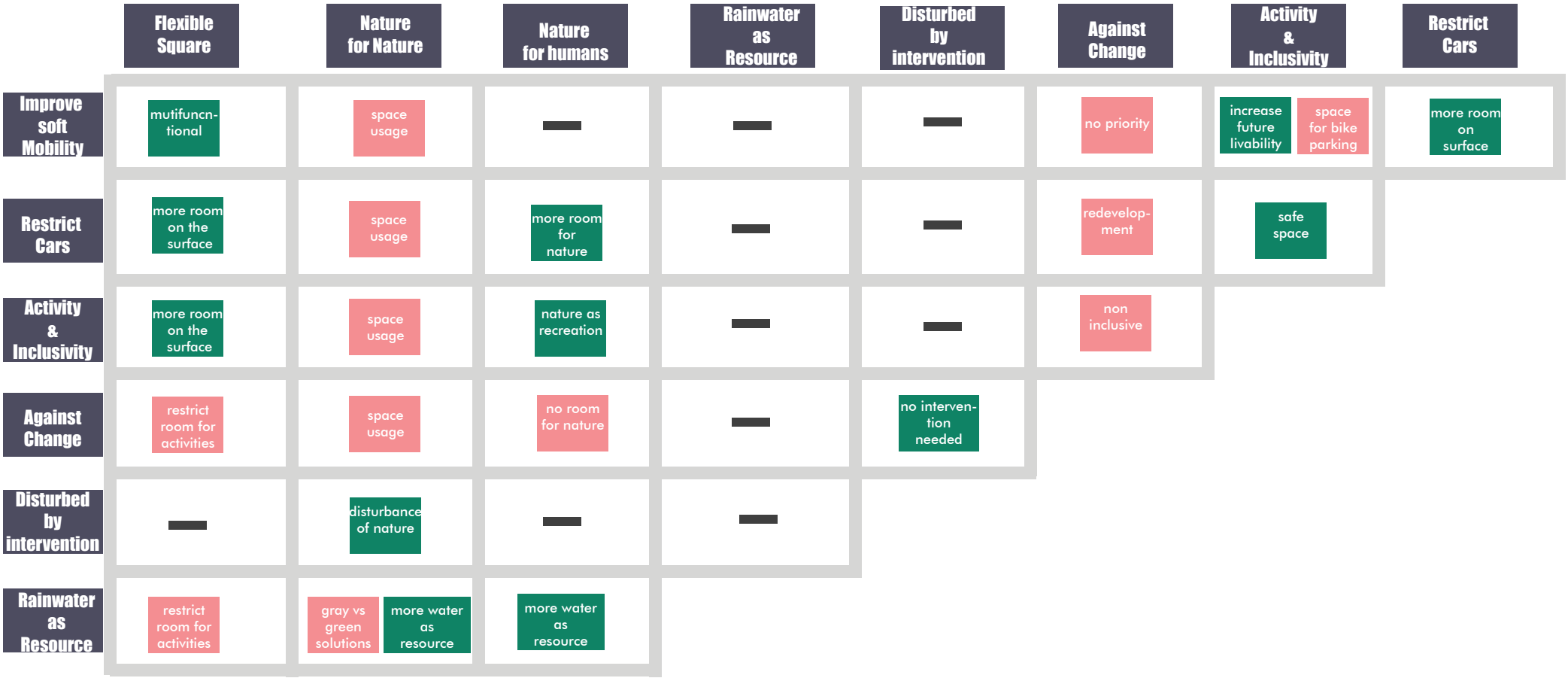


Figure 20. Matrix 2

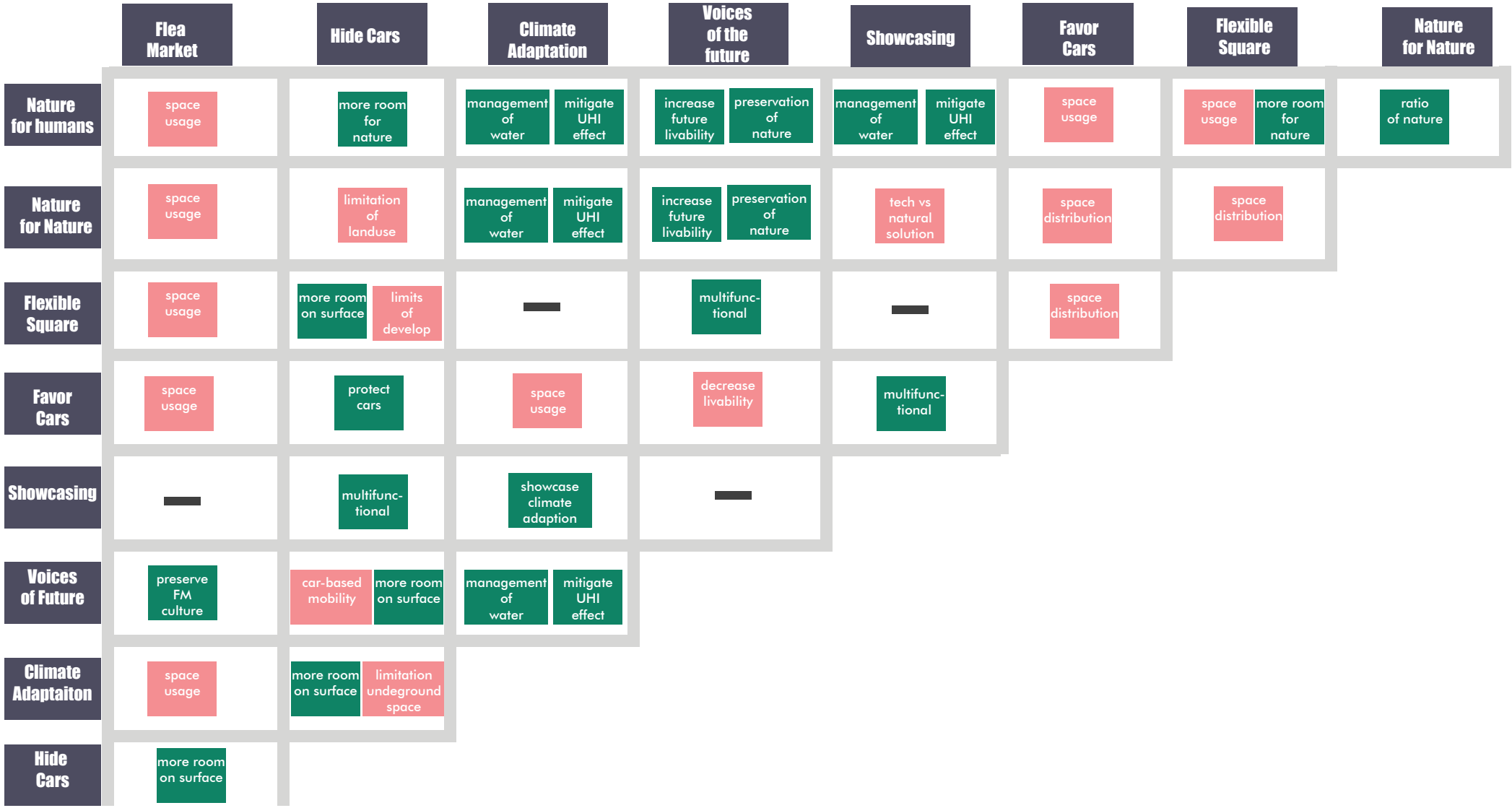


Figure 21. Matrix 3

FLEA MARKET

'Flea Market' is in conflict with 'Activity+Inclusivity', 'Against Change', 'Rainwater as a Resource', 'Nature for Humans', 'Nature for Nature', 'Flexible Square', 'Favor Cars' and 'Climate Adaptation'. All conflicts are on space usage. 'Disturbed by the Intervention' shares an interest with the 'Flea Market' because the 'Flea Market' will suffer the negative effects of the intervention. The other shared interests are with RSGs who want to preserve the flea market as part of Frederiksberg's culture. They are 'Voices of the Future' and 'Activity+Inclusivity' and 'Against Change'. It also shares an interest with 'Restrict Cars' and 'Improve Soft Mobility' since a restriction of car-based mobility can generate a more safe space for the flea market.

IMPROVE SOFT MOBILITY

The main conflicts this RSG faces concerns the allocation of space as well as how mobility within and around the space is prioritised, this means that it can find itself in conflict with the RSGs Favour Cars, 'Nature for Nature', 'Activity+Inclusivity' and 'Against Change'. All because they either prioritise cars, nature or other activities, making it difficult to guarantee a safe and adequate space on which to apply soft mobility. However, 'Improve Soft Mobility' and 'Activity+Inclusivity' share an interest in improving livability. 'Improve Soft Mobility' also shares interests with other RSGs as it benefits from them or they benefit from it. 'Hide Cars' and 'Restrict Cars' agree with this RSG since they aim to make room on the surface. 'Flexible Square', as soft mobility has less rigid structure so it fits really well in allowing the space to be more flexible towards other activities. This RSG also shares an interest with 'Voices of the Future' as it has an effect on the health aspect.

RESTRICT CARS

The main conflict of 'Restrict Cars' is represented by the prioritisation between means of mobility. First we see a conflict with Hide Cars and 'Favor Cars' since they both advocate for creating a parking basement that will serve the needs of the citizens who own a car. The second conflict is with 'Against Change' because this RSG wants to keep up the status quo. The last conflict is with 'Nature for Nature' which requires radically less presence of car-based mobility, which 'Restrict Cars' does not provide. However, 'Restrict Cars' can align with the interests of 'Nature for Humans' since this RSG requires less space. The main argument is that by restricting the cars on the square there will be no more room for nature and activities and thus this RSG also shares interests with: 'Voices of the Future', 'Flexible Square' and 'Activity+Inclusivity'.

ACTIVITY AND INCLUSIVITY

This RSG is focusing on creating space for everyone, therefore it creates a space usage conflict with 'Favor Cars', 'Climate Adaptation' and 'Nature for Nature' since they all require space on the surface. This RSG shares interests with 'Voices of the Future', Showcasing, Hide Cars and 'Flexible Square', by focusing on the possibility of increasing livability of the square, and creating options for the future needs in a safe space. Furthermore it aligns with the interests of 'Nature for Humans' who see nature as a recreational element. 'Activity+Inclusivity' supports development of the square and thus they form a conflict with 'Against Change' who don't want any development to happen.

AGAINST CHANGE

Limitation of possibility for intervention is the main conflict that this RSG has with 'Voices of the Future', 'Climate Adaptation' and 'Flexible Square'. 'Nature for Nature' and 'Nature for Humans' are in direct conflict with 'Against Change', meaning that nature cannot exist without changing the environment that exists today. Another conflict with Showcasing is about the development of the square. The only shared interest this group has is with 'Disturbed by the Intervention' which has the same interest of not having any intervention on the square and with 'Favor Cars' who also perceive the square as a place for parking.

DISTURBED BY INTERVENTION

'Disturbed by the Intervention' conflicts with 'Hide Cars' since the building of the parking basement will produce noise and inconvenience. 'Disturbed by the Intervention' shares an interest with 'Favor Cars' which is uncertain of where cars should be parked during the intervention. Finally it shares an interest with 'Nature for Nature' since nature and biodiversity will be impacted by the building of the parking basement.

RAINWATER AS A RESOURCE

This RSG is mostly in conflict with other RSGs when it comes to the allocation of space as it requires space in order to collect and redistribute rainwater properly. This puts it in conflict with the 'Flexible Square' and 'Favor Cars'. Finally it conflicts slightly with the 'Nature for Nature' if grey solutions are used to change rainwater into a resource. However, it also shares an interest with 'Nature for Nature' and 'Nature for Humans' since they both are interested in utilizing rainwater for watering plants. There is also an interest with 'Climate Adaptation' since they are both interested in utilizing the increased amount of rain to mitigate the urban heat island effect. 'Hide Cars' provides an opportunity to install rainwater magazines in the parking basement where rainwater can be stored for future purposes. Treating rainwater as a resource and showcasing how it can be done through smart technology are priorities of 'Flexible Square' and Showcasing, thus they also share an interest with 'Rainwater as a Resource'. 'Voices of the Future' and 'Rainwater as a Resource' are both interested in increasing the livability of the square.

NATURE FOR HUMANS

The main reason this RSG can be in conflict with others is due to the allocation of space. It conflicts with both 'Favor Cars' and 'Flexible Square' on space usage. However, it also shares an interest with 'Flexible Square' since they both aim to make room for more green elements in Frederiksberg. There are multiple RSGs with whom 'Nature for Humans' share interests: 'Climate Adaptation', 'Nature for Nature', 'Voices of the Future' are interested in increasing a varying degree of nature and ensuring livability; Showcasing is interested in showing how nature can be used to manage rainwater and the urban heat island effect and 'Hide Cars' frees up space for green elements.

NATURE FOR NATURE

This RSG puts nature before antropic elements and thus conflicts with other RSG. First it has two conflicts with 'Favor Cars' and 'Flexible Square' concerning the use of space, since 'Nature for Nature' requires a lot of space. Building the parking basement puts restrictions on where trees can be planted on the square and thus 'Nature for Nature' conflicts with 'Hide Cars'. Showcase relies on technological solutions to

manage the impacts of climate change and this collides with the viewpoints of 'Nature for Nature'. Instead it finds a shared interest with 'Climate Adaptation' since natural systems can be used to mitigate the impacts of increased rainfall and the urban heat island effect. 'Voices of the Future' shares an interest with 'Nature for Nature' since they both want to preserve nature and biodiversity. Furthermore, 'Voices of the Future' sees 'Nature for Nature' as a possibility for increasing livability.

FLEXIBLE SQUARE

This RSG has a conflict with 'Favor Cars' since Bredgade takes up a large portion of the square's space and puts limits on the distribution of space. It shares interests with 'Hide Cars' since freeing the squares surface from cars will make it possible to create a square with many functions. However, there is also a conflict with 'Hide Cars' since the parking basement will put limits on how the square can be developed. Lastly it shares an interest with 'Voices of the Future' since the flexible square will create a multifunctional room that accommodates the future needs of a livable city.

FAVOR CARS

Showcasing in combination with 'Favor Cars' shares an interest in how the multifunctionality of smart technology can be used to efficiently manage car-based mobility. It also shares an interest with 'Hide Cars' since it advocates for a parking basement which can protect the cars from the weather. It conflicts with 'Climate Adaptation' on space usage and with 'Voices of the Future' on a decrease in livability.

SHOWCASING

This RSG shares interests with 'Hide Cars' enables the development of a multifunctional square where smart technology can be implemented. It further shares an interest with 'Climate Adaptation' where smart technology can be used to manage the water circuit of the square.

VOICES OF THE FUTURE

It shares interests with 'Climate Adaptation' because they both want to mitigate the urban heat island effect and manage rainwater in order to protect the city. 'Voices of the Future' shares both a conflict and an interest with 'Hide Cars'. The conflict is over the implementation of the parking basement. The interest regards the freed up space that the parking basement will provide. Despite the parking basement, this environment is perceived as more livable than the current parking lot.

'Climate Adaptation' shares both an interest and a conflict with 'Hide Cars'. The interest is that the parking basement creates more room on the surface for water management while also providing an opportunity to install rainwater magazines below ground. The limitation is that other sorts of rainwater magazines can't be installed because of the parking basement being too close to the surface.

6.3.4. DEVELOPING GUIDELINES

We want to show how the same development project can look differently if it is designed with different degrees of sustainability in mind. For this we used the theory of weak and strong sustainability (see section 3.4) to develop two sustainability guidelines. The same issues are present in both guidelines and are addressed in the same order. The two guidelines contain either weak or strong goals for the design of the Square behind the Town Hall and answers to issues we found during our research. These proposed guidelines made us able to divide the RSGs into two groups: One supporting Weak Sustainable Development and one supporting Strong Sustainable Development. When pursuing possible closure on the development of the Square behind the Town Hall we want to experiment with listening to different RSGs. Depending on which type of closure is being pursued, Weak Sustainable or Strong Sustainable, indicates which group of RSGs is allowed to speak. This will be presented in the next section.

WEAK	STRONG
• 1 Human and technology centered	• 1 Nature and people centered
• 2 Technology is in charge of climate adaption	• 2 Nature is in charge of climate adaptation
• 3a Car based mobility is accepted	• 3a Car based mobility is not accepted
• 3b Low prioritization of soft mobility and public transport	• 3b High prioritization of soft mobility and public transport
• 4 Rainwater is stored underground and unseen	• 4 Rainwater is stored on the surface
• 5 Remote water management (Rainwater overflow to sewer)	• 5 Local water management (no Rainwater overflow to sewer)
• 6a Protecting status quo (path dependency)	• 6a Sustainable transformation of the urban space
• 6b Climate change Resilient	• 6b Climate change mitigation
• 7 Majority of the surfaces are grey and impermeable	• 7 Majority surfaces are green and permeable
• 8 Perceived as a safe space by the most privileged	• 8 Perceived as a safe space no matter the privileges
• 9 Non-Inclusive space (Gender, disability, age and culture)	• 9 Inclusive space (Gender, disability, age and culture)
• 10 Nature is more used for aesthetics purposes	• 10 Nature is used for ecosystem services and aesthetics
• 11 Environmental impact of materials is not considered	• 11 Environmental impacts of materials are important
• 12 Emphasis on technological solutions	• 12 Emphasis on ecosystem services

6.3.5 THE TWO SCOT MAPS

In this section we will present our two SCOT maps, how we developed them and how we used them to simulate different closure processes. The purpose of doing two SCOT maps is to show how applying different sustainable frameworks to the development process, can produce different outcomes. Also the artefact has multiple possible futures depending on who gets to dominate the closure process. This approach is inspired by the concept of agonistic design and from section 2.1 we learned that planning is never objective, but constitutes a political process (Mouffe, 2007). In this section we will bring in the different interpretations of the Square behind the Town Hall and create a dialogue between the different RSGs in order to see how different dialogues result in different outcomes.

Bijker (1997) argues that closure and stabilization are complicated processes that can be hard and almost impossible to steer. Thus, our two maps do not attempt to develop a strategy that can control the closure processes of the square. Instead by simulating a room where we can explore the different common interests between the RSGs and investigate the different outcomes of these interests we aim to show what a possible closure could look like. Thus, we will experiment with possible closure processes as a way to exemplify the future. In the following we will describe in detail how the two maps were produced by referring to technological controversies, silencing and alliances.

TECHNOLOGICAL CONTROVERSIES

Technological controversies exist when an artefact is not yet closed (Lauritsen, 2007), hence when approaching closure the technological controversies decline. We included these technological controversies in the map to show what controversies needed to be solved in order to achieve closure. In the Interest and Conflict matrix (section 6.3.3) we observed that each RSG has conflicts that recur with the other groups, regarding how the square should develop. These recurring conflicts can be seen multiple times in different versions throughout the Conflict and Interest matrix (see figure 19-21). We used these conflicts together with the technological frames to produce the RSGs' technological controversies. Each RSG has one or two technological controversies which constitute an issue they have with the development of the square. In order for a technological controversy to be closed, the RSG must reach some kind of consensus. Their problems do not have to be solved. They just have to experience them as being solved (Bijker, 1997).

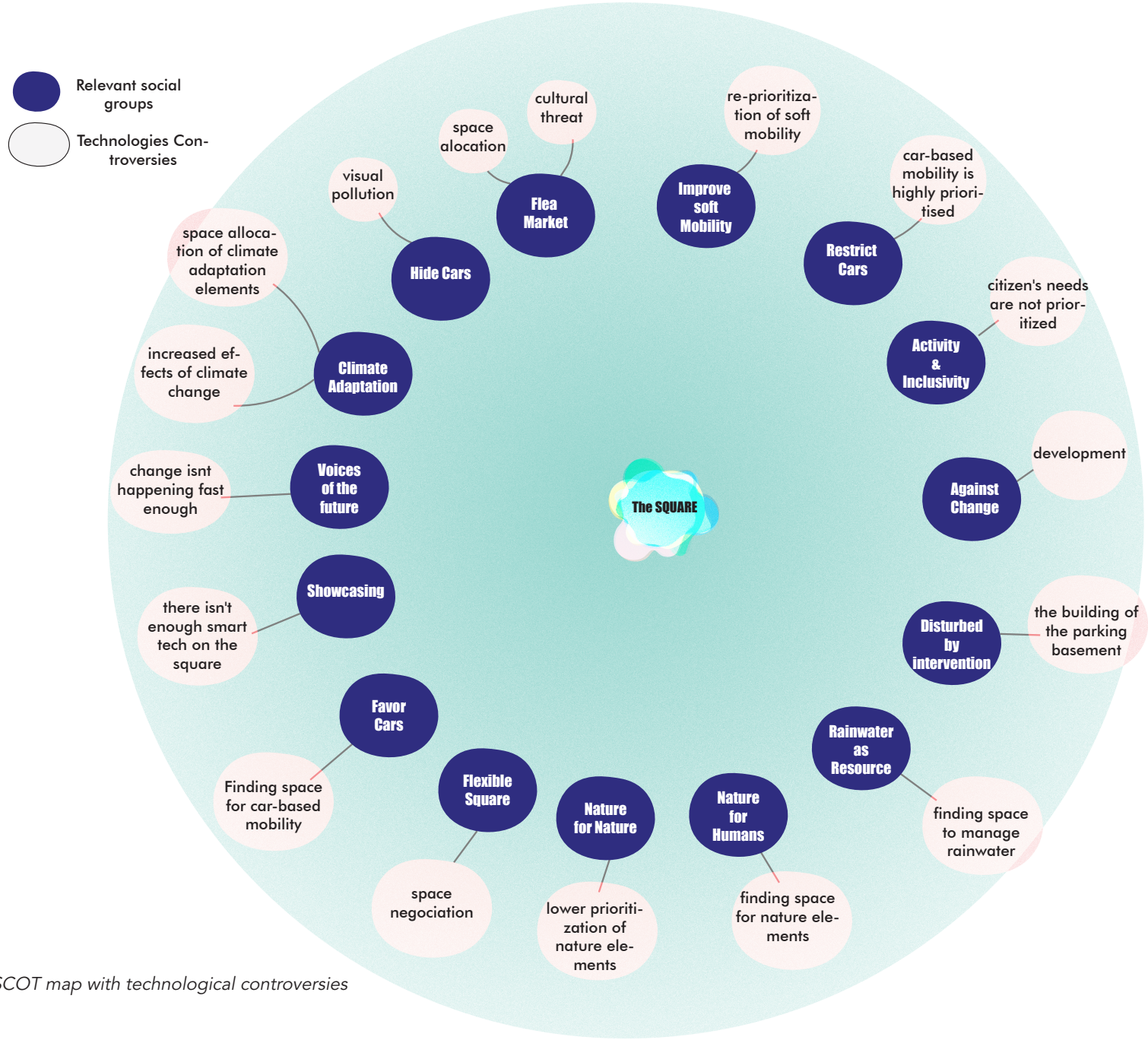


Figure 22. SCOT map with technological controversies

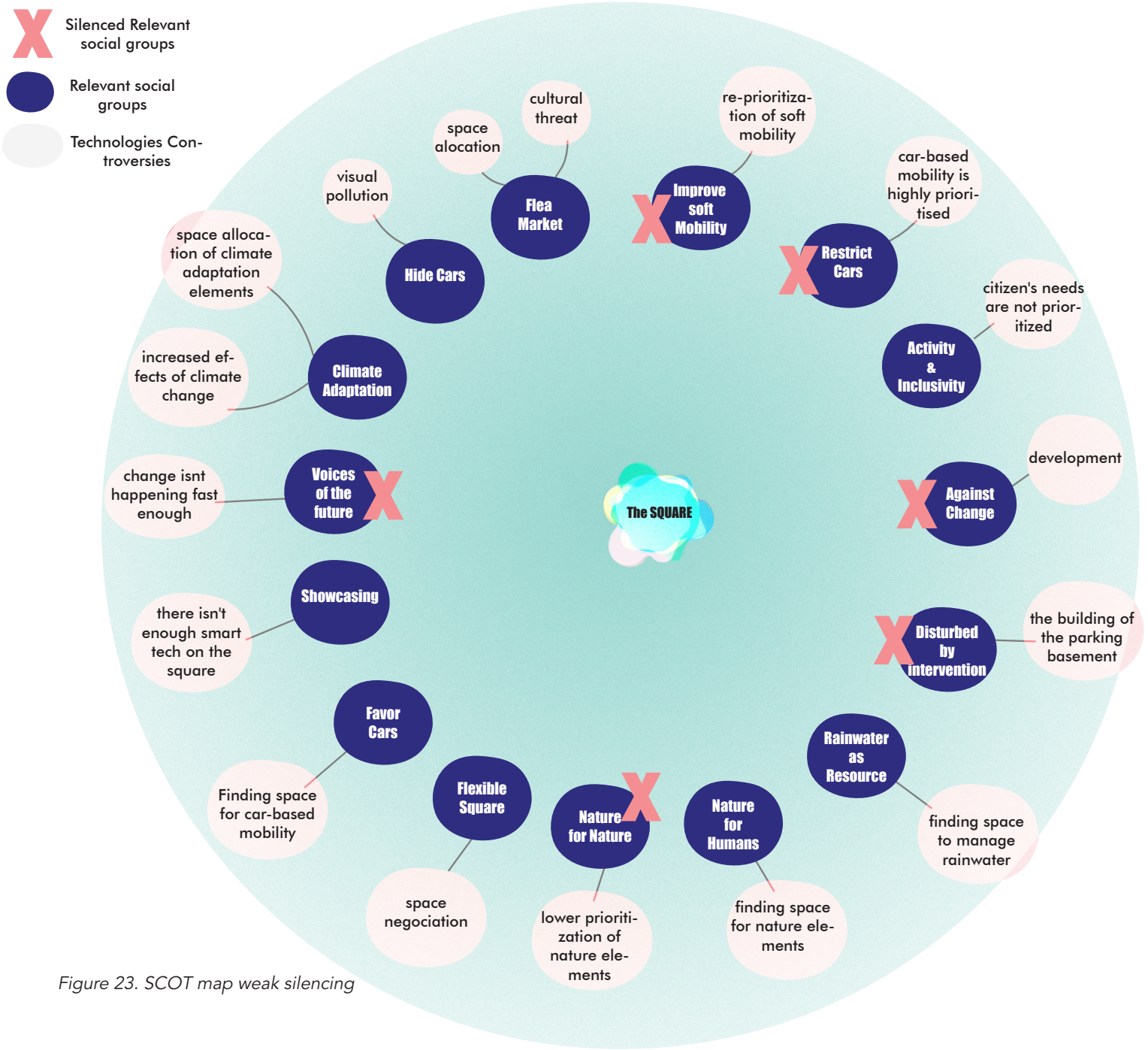


Figure 23. SCOT map weak silencing

SILENCING

The technological controversies are repeated in the two SCOT maps and are thus not changed. Where the maps differ are on which RSGs are allowed to contribute and speak their meaning attached to the artefact in the map. The RSG that are not allowed to speak are excluded in the map. We call this process "Silencing" as we purposely don't allow some RSG to contribute to the development. Mouffe (2007) argues that there is not just one, but several futures in play during planning processes and that the final outcome will depend on the inclusion or exclusion of possibilities. Thus, we silenced RSGs in order to mimic this political nature of planning processes, where some voices are heard while other voices are silenced or overheard. The silencing was done according to the weak and strong guidelines. The weak sustainability guidelines were used to bring forward the RSGs who believe that the weak sustainable guidelines describe the good sustainable city and silence the others, thus producing the weak sustainable SCOT map, which is illustrated in figure 23.

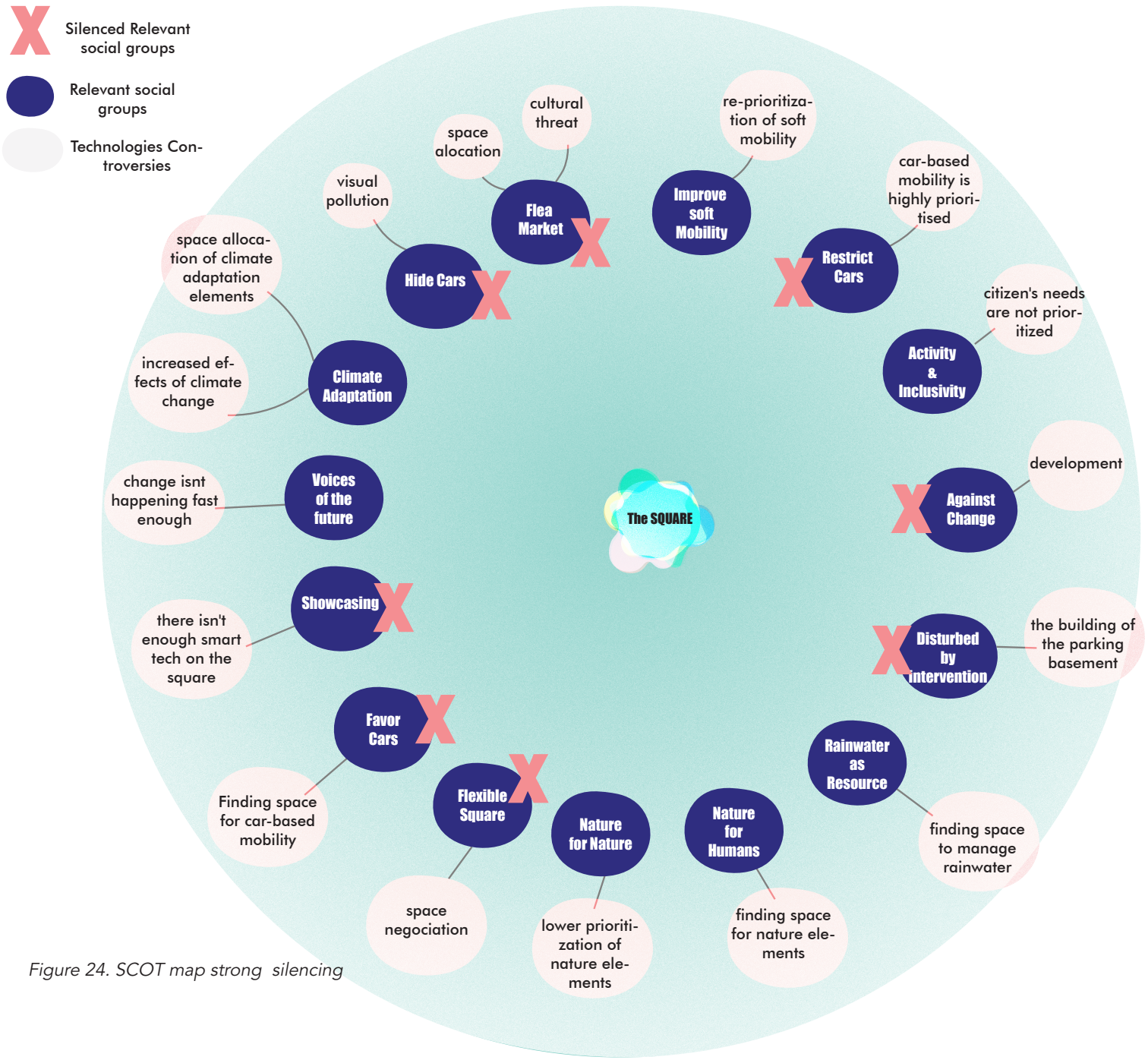


Figure 24. SCOT map strong silencing

On the other hand, the strong sustainability guidelines were used to bring forward the RSGs who believe that the strong sustainable guidelines describe the good sustainable city and silence the others, thus producing the strong sustainable SCOT map which is illustrated in figure 24.

From both figures some similarities are evident. For example, a RSG like 'Activity+Inclusivity' is present in both maps since it can align with both the weak and strong sustainable guidelines. Also a RSG like 'Against Development' is silenced in both maps since this RSG is against any sort of development of the square. The purpose is to show how the RSGs, that are allowed to be heard, will alter the square differently and produce different versions of the future. The characteristics that distinguish each are explained below.

THE WEAK SUSTAINABLE SCOT MAP

The weak sustainable guideline argues that environmental sustainability can be substituted for economic and social sustainability. Thus, it puts emphasis on the technological and human needs for the square. In the following we will argue for why different RSGs are either included or silenced in the SCOT map that builds on the guideline for weak sustainability.

- The flea market takes up a lot of space and requires a paved surface. It puts a restraint on the more environmental elements that could be on the square. It can be seen as nature is being substituted for social elements. Thus, 'Flea Market' belongs within the weak sustainable SCOT map.
- The guidelines for weak sustainability focuses on car-based mobility and thus 'Improve Soft Mobility' is under prioritized and silenced.
- The same is the case with 'Restric Cars' which is silenced due to the guideline's strong focus on car-based mobility.
- 'Activity+Inclusivity' is included because it focuses on the social and human needs of the citizens who are to use the square for recreational purposes.
- 'Against Change' is silenced because they oppose any development of the square.
- 'Disturbed by the Intervention' is also silenced because the guidelines allow for building of the parking basement. Thus, this group is suppressed.
- The RSG 'Rainwater as a Resource' is included since technology can allow for rainwater to be treated as a resource through storage in basins and smart technology.
- The RSG 'Nature for Humans' follows the weak sustainable guideline of using nature for aesthetic and recreational purposes and is thus included in the map.
- 'Nature for Nature' refers to how flora and fauna interpret the square and this RSG is excluded in this map since the guideline for weak sustainability focuses on what humans needs from nature.
- 'Flexible Square' aims for the square to include a wide range of social and technological needs and fulfill these efficiently. This is in line with the weak sustainability guideline.
- The weak sustainability guideline describes how development is path dependent and accepts car-based mobility and thus 'Favor Cars' is included.
- 'Showcasing' interprets the square as a place to showcase technological solutions for climate adaptation and smart technology. This focus on technology makes 'Showcasing' fit within the weak sustainable SCOT map.
- The way 'Voices of the Future' interprets the square does not go well in hand with the guidelines for weak sustainability and thus this group is left out.
- The RSG of 'Climate Adaptation' interprets the square as part of a response to climate change and not a solution that should aid in preventing climate change. The proactive measures that can be taken to support environmental sustainability are substituted for actions that can increase resilience and protect the status quo of the city.
- The RSG 'Hide Cars advocate for a parking basement and sees it as a technological solution to problems created by path dependent processes. Thus it is also in line with the guideline for weak sustainability.

THE STRONG SUSTAINABLE SCOT MAP

- The flea market requires a large amount of paved surfaces which is not inline with the guideline for Strong sustainable development since the environmental impact of paved surfaces is high. Thus, the RSG 'Flea Market' is not heard in this map.
- The RSG Improve Soft Mobility is included in the map because the development guideline for strong sustainability prioritizes soft mobility.
- Even though the RSG 'Restrict Cars' is critical towards cars, they still don't oppose the presence of cars and car-based mobility and thus they are silenced.
- The RSG 'Activity+Inclusivity' interprets the square as a space that should accommodate all relevant social needs and this is in line with the human centeredness of the strong sustainable guideline.
- The strong sustainable guideline presupposes some sort of development of the square and thus 'Against Development' is silenced.
- 'Disturbed by the Intervention' is silenced because the guideline argues against the parking basement. Thus, we don't see this RSG as capable of contributing with any valid points to use in the further development.
- Treating rainwater as a resource can also be done through methods that have a positive impact on the environment such as the sponge concept. Therefore, 'Rainwater as a Resource' is considered in this map.
- Even though the RSG 'Nature for Humans' interprets the square as a space where nature can serve the recreational needs of humans, we will argue that nature can act to serve the recreational needs through the approach to nature which the strong sustainable guideline proposes.
- The RSG 'Nature for Nature' is very much in line with the strong sustainable guideline's emphasis on environmental sustainability and is thus included in the map.
- The RSG 'Flexible Square' is silenced since it puts technical and social needs in an urban environment before environmental needs.
- The strong sustainable guideline does not accept car-based mobility and thus the RSG 'Favor Cars' is silenced.
- The RSG 'Showcasing' focuses on using technology to solve problems which contradicts with the strong sustainable guideline's emphasis on ecosystem services and materials with a low environmental impact.
- The RSG 'Voices of the Future' interpretation of the square is very much in line with the guidelines for strong sustainable development.
- The strong sustainable guideline describes how climate adaptation should at least be handled through nature based solutions and ecosystem services. This approach is acceptable for the RSG 'Climate Adaptation' and thus they are included in the map.
- The RSG 'Hide Cars' interprets the square as a place to build a parking basement which contradicts with the strong sustainable guidelines' aim to not accept car-based mobility.

ALLIANCES

Our intention with the two SCOT maps (see figure 25 & 26) is to simulate two different development processes. The result of these two processes will be two different visions. In order to create the visions and find the solutions that should constitute them, we must first locate potential for development and find a probable path for closure within the simulated discussion we created. This potential for development is where the RSGs, who are allowed to have their voice heard, agree on the development for the square. That is what we have mapped as alliances on the SCOT maps. Each alliance connects two or more RSGs. The alliances are based on the Interest and Conflict diagram and the RSGs' technological frames. The alliances can create a way to decrease interpretive flexibility and show how technological controversies can be solved.

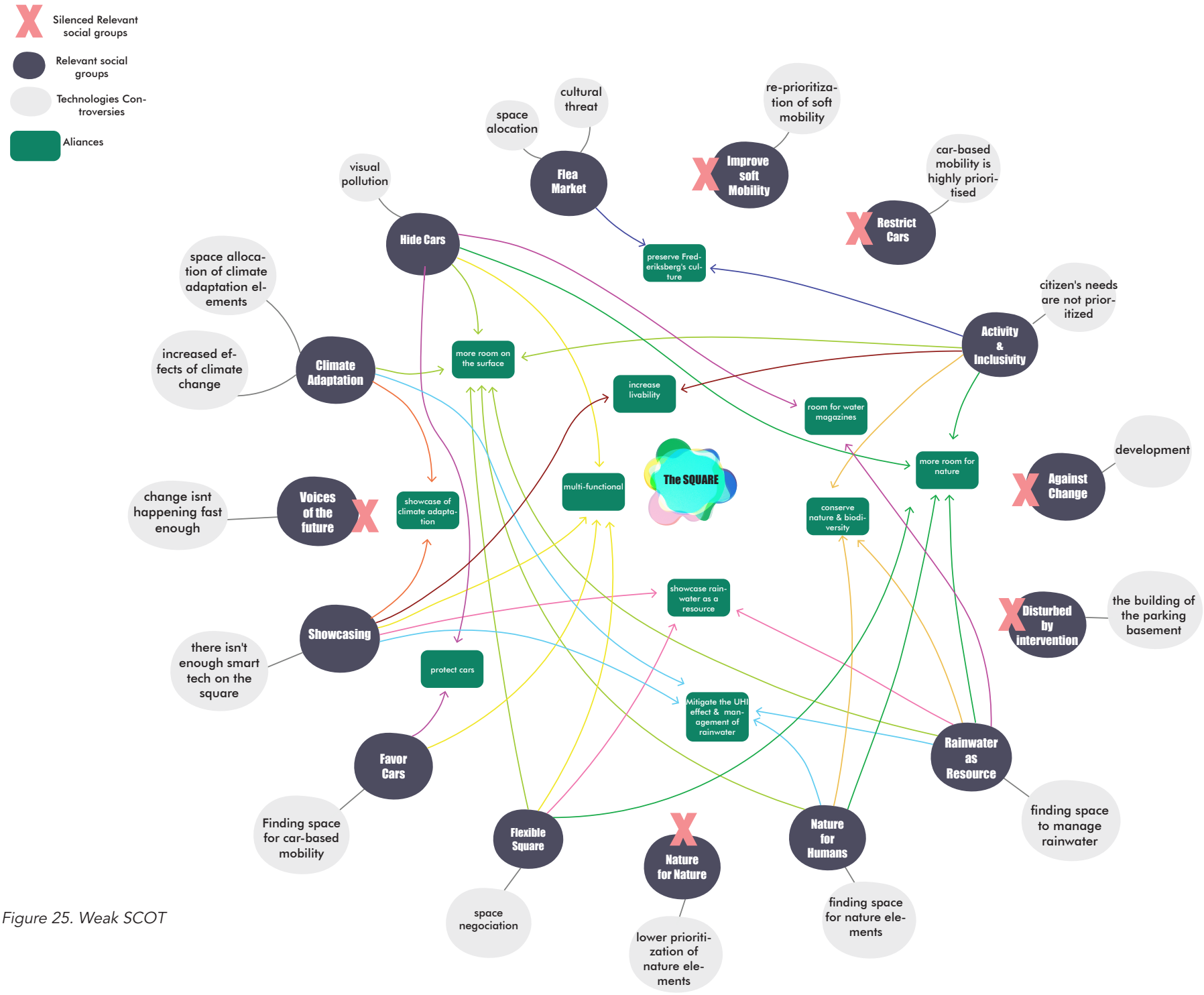


Figure 25. Weak SCOT

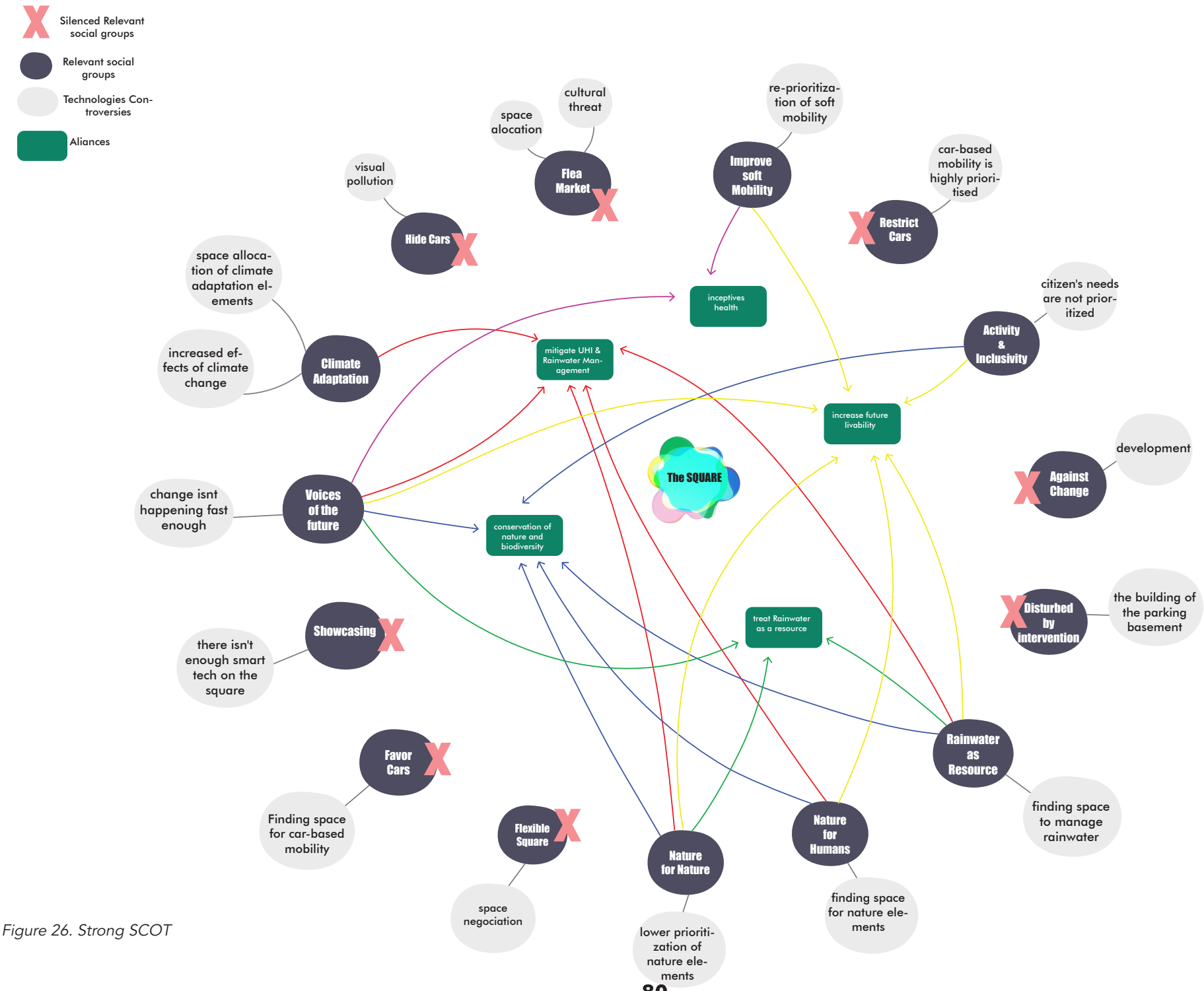


Figure 26. Strong SCOT

6.3.6. DEVELOPING THE VISIONS

For each SCOT map we developed a morphology chart. Each chart shows the present alliances together with the related technological controversies. The alliances from the SCOT map are used as features for what the subsolutions should achieve and the technological controversies are used to reference problems that the subsolutions should solve or at least not intensify. We created the different sub-solutions through a brainstorming process and chose the sub-solutions that were most in line with either the weak or strong sustainable development guidelines (Appendix 10, Morphology chart). Together the sub-solutions constitute two visions that represent a possible closure process. In the following section we will describe the vision that builds on the weak sustainable guideline and the vision that builds on the strong sustainable guideline.

6.3.6.1 THE WEAK SUSTAINABLE VISION

The public space in this vision is transformed from a parking lot to a recreational area with a strong focus on human needs and activities. In this vision the paradigm of Frederiksberg Municipality prevails as the cars are stored away underground to make room for leisure activities and climate adaptation. The description of this vision follows.

ACCESSIBILITY AND MOBILITY

Citizens who need to access the square will be either car owners who need to park their car in the parking basement or citizens who want to visit the urban space above the parking basement. The visitors who live close by will mainly arrive by public transport, foot or bike. The cars that go to the parking basement will arrive by either Frederiksberg Bredgade or Smallegade, enabling cars to easily access one of the parking spaces in the parking basement. Smart tech will show car drivers which parking spaces are empty so they don't have to drive around and look for one. Car drivers will still need access to the town hall or the surrounding shops during construction of the parking basement and so Frederiksberg Municipality will attempt to find as many extra parking spaces in the area. An example could be turning the bus lane between the town hall and Smallegade into parking spaces. This could also be combined with making Hospitalsvej into a one-directional street creating more room for parking.

CLIMATE ADAPTATION AND LOCAL MANAGEMENT OF RAINWATER

Beneath the parking basement there will be built-in rainwater magazines for storing rainwater during cloudbursts and this will enable the square to manage rainwater without being connected to the sewer. This disconnection from the sewer is also known as local management of rainwater and it enables Frederiksberg Municipality to use rainwater as a resource. Rainwater collected in the magazines will be used for the following purposes:

- Cooling of the square and EV chargers.
- In sprinklers that will help cool down the pavement during the summertime.
- A kids pool, which will also function as a fountain. It has to be pointed out that rainwater will be cleaned before it goes in the pool.
- Renew the water in the duckpond.
- Rainwater circulation in pipes under the pavement of the square which can cool the square during the summer and heat it up during the winter.
- Watering of greenery during dry periods.

The duck pond will be redesigned so that it can overflow into a limited area during a cloudburst and create a temporary wetland. This will give an extra buffer for the underground rainwater magazines and be a safety precaution to any unpredicted cloudbursts.

NATURE

The main focus in this vision is human needs. Thus the greenery will be visually interesting and dynamic but it will leave plenty of space for the citizen's activities. A way to find space for greenery is to utilize the vertical space and let the hedge between the square and Smallegade grow larger in height. This will create a green wall, which can both cool down the surroundings and reduce noise pollution. Moveable flowerbeds with endemic flowers will be situated on the square so that they can be moved to accommodate the flea market or an event. New and existing trees will make up a tree canopy structure that will create shade for adults and an interesting forest for kids to play in. As many of the existing trees as possible will remain but some will be cut down due to the construction of the parking basement. There will also be a bug hotel in the tree canopy and near the pond which will take care of biodiversity and act as a spokesperson for the small creatures that are everywhere around the citizens. Overall the green aesthetics will resemble Frederiksberg Have except for a few bioswales and stormwater tree pits which will make the square dynamic and interesting depending on the weather.

INTERACTION AND FUNCTIONALITY

The design of the square needs to accommodate many different needs. One of these needs is being an outdoor space protected from the weather. A pavilion will create shade and protect against rain. There will be a green roof on the pavilion with solar panels which will fuel a defibrillator, a panic button and smart lighting on the square. It must also be easy for citizens to get around on the square and thus, most of it will be covered by permeable, white surfaces. This will allow for rainwater to percolate to the ground while also keeping the surface relatively cool during the summer. There is a designated area for sports activities which will combine a multipurpose sports area, exercise area and a running lane. In another area there will be a playground for kids. On the open areas of the square there will be moveable garden beds and furniture, for example a moveable group sitting area and ergonomic benches. This will enable an interesting urban space during the week days and an open urban room during the weekends which can be used for events such as the flea market. The square will also be made dynamic and visually interesting by including sculptures and a mural with changing art installations. The Frederiksberg green color will be used to create a visual connection between all these different functions and to create a connection to the culture of Frederiksberg.



6.3.6.2. THE STRONG SUSTAINABLE VISION

RADICAL TRANSITION OF THE SQUARE

The public space in this vision is a transcendence of future possibilities and presents a paradigm shift in how to design and implement urban nature in Frederiksberg Municipality. The purpose of the square is to place nature and its benefits above technological needs and solutions. The description of this vision follows.

ACCESSIBILITY AND MOBILITY

In this vision motorised mobility is replaced with green mobility with the aim to reduce the number of fossil fuel vehicles and make the area CO2 neutral. One of the targets of this vision is for the area to become CO2 neutral, everything that runs on fossil fuel is now replaced or made scarce, meaning that there is no room for cars in relation to the square. Instead, Frederiksberg Municipality has initiated a green transport package funded by the 110 million kr that were to be spent on the parking basement. The package contains: an option for Residents of the area to use free public transport for a year if they give up their car; free e-bike charging stations and free rental of e-cargo bikes that can facilitate easy transportation of goods in the area. To encourage connectivity around the square and support the local economy a walkable neighborhood strategy has been planned and a super walkable path is being implemented between Smallegade and the Metro. Furthermore, the public transport in Frederiksberg has been reinforced. Citizens are also encouraged to take part in the mobility behaviour change with a rewards system that promotes a healthy lifestyle and environment.

NATURE, CLIMATE ADAPTATION AND LOCAL MANAGEMENT OF RAINWATER

Having nature as the core of the design approach, means that its aesthetics will deviate from the typical public space, where nature is very domesticated. Instead, in this public space ecosystem services are prioritized. In this vision, the future square is a green oasis, where people can escape the anthropic environment.

Vegetation will have different functions, for example a green wall will act as a barrier against noise and visual pollution from Smallegade. Small pockets of vegetation, that citizens cannot access, will increase the biodiversity level of the square. An important function of the vegetation will be to act as nature based climate adaptation since climate change is a threat to urban areas. In this vision, the climate adaptation on square will have a transformative approach and an ambitious goal in successfully managing local water. This means that no rainwater will be led to the sewer. Climate adaptation elements on the square will emulate the natural world and borrow its functionality by implementing concepts like bioswales, rainwater gardens and a pocket forest. Here the rainwater can be retained and absorbed by either the plants or the soil. Nature based rainwater management will double as the natural aesthetic elements of the square. A moat will surround the square, physically separating the urban environment from the nature that is on the square. The moat will also be connected to the duck pond which will be naturalized and expanded. Both the duck pond and the moat can additionally be used as retention ponds. Beside protecting the square and the neighbourhood from climate risks, the square functions as a green circular system that reuses its resources. The rainwater collected is reused for maintaining the green areas, as well as maintenance of the square. Therefore rainwater will also be stored in tanks close to the surface, from which water can be used to water plants during dry seasons or cool down the surfaces of the square. Collected

water will also be used for the toilets and the showers in the nearby dorm and for the public toilets on the square.

INTERACTION AND FUNCTIONALITY

A canopy with a green roof will cover a part of the square. Underneath it there will be a green, lowered, shaded area allowing the space to act as a retention pond during heavy rainfall and as a sheltered area in the winter. The green roof will also act as an interactive installation for citizens as it will be possible to access the roof and get an overview of the area. There will also be multiple walking paths over the bioswales and drainage basins so citizens and users of the square can watch nature from a distance.

Trees will be planted in strategic spots where there will be a need for shade in the summer and shelter in the winter. Lights will be installed in the trees providing an interesting experience for the users of the square during nighttime. The rest of the lights in the square will be on lamp posts that will be covered in ivy.

An area of the square will be designated for social gatherings and human recreational activities. There will be a natural playground and an aromatic garden for adults and kids to explore. The area will also have group sitting spaces and planting boxes with vegetation, which will mainly consist of endemic species. The planting boxes will allow for the vegetation to be moved to the side of the area during larger events or social gatherings.

The visual expression of the square will be an extension of the more wild part of Frederiksberg Have, which is just on the other side of the dorm. Any weeds will be allowed to grow and there will be no use of pesticides.



7 Design solution

CHAPTER INTRODUCTION

This chapter will present the formation of a design game as our design proposal and how it developed from three previous prototypes. The chapter will first describe the purpose of the design game and then go on to describe how it evolved through three iterations. Every prototype was tested and each subsection will present the lessons we learned from each test. The last sections will focus on describing our latest prototype and how it aims at incorporating reflections on sustainability into the planning process. Finally we will reflect on the limitations of the design game and how we aim to implement it.

Our design solution for this master thesis project is a design game, based on the strong sustainability SCOT map presented in section 6.3.5. The game is meant to be used as a tool for planners in Frederiksberg Municipality to use in future urban development projects. This section will present how we developed the design game, the different iterations the game went through and how the reflection is based on both our analysis and our perspective as sustainable designers.

7.1. CREATING THE DESIGN GAME

A study based on an international workshop called the 'Ideal Future City' made by researchers from University College of London proved that the most important element that cities should focus on in their urban developments is people (Ortegon-Sanchez & Tyler, 2016). Based on this and our empirical analysis we argue that social interaction with citizens should have a bigger influence in the urban development of Frederiksberg. The alternative interpretation of the triple bottom line (see section 3.2) tells us that the social spectrum cannot stand alone. As sustainable designers we will argue that the social spectrum needs to be supported by the environmental spectrum and thus we will also develop the game to promote environmental sustainability. Similar to the research mentioned above, our intention is to support and guide decision makers to work on future developments that address current challenges and understand the needs of society while considering the planet.

We chose to communicate our knowledge as sustainable designers and generate new insights for the planners of the Frederiksberg Municipality through a design game. We have observed that planning in the city administration often relies heavily on reports, documents from politicians and loose brainstorms. Thus we expect that the design game will provide a valuable new input to the planners of the city administration through sparking creativity and new inputs. The intention with the design game is to allow for the participants to play the role of potential users and then experiment with concepts and design proposals. In future projects we hope that this tool can make the planners prioritize differently when developing an urban space and move away from their focus on car-based mobility. We want to use the design game to create a space where planners can reflect and make mistakes, but most importantly we want to use the game as a space for learning.

The foundation of the game is made by following the guidelines from the strong sustainable theory (see section 6.3.4) and our strong sustainable SCOT map (see section 6.3.5). The vision from the strong sustainable SCOT map will be used in the game as a guiding image of what a strong sustainable conceptualization of the square will look like (see section 6.3.6). Our motivation for not just delivering the vision to the planners is for them to learn how to develop a strong sustainable scenario instead of just borrowing features from our strong sustainable vision. Moreover, we want to utilize the knowledge from our analysis and replicate essential steps from the strong sustainable SCOT map in our game. For example, the design game will build on and use the RSGs that we found to be in line with strong sustainable development.

With the design game we want to create a higher order learning experience where the participants, in this case the planners of Frederiksberg Municipality, will be taught how to include perspectives of the citizens and other stakeholders in the city. The design game is intended to act as a supplement to the urban development processes, both for the Square behind the Town Hall but also for future development projects. Moreover, the design game will constitute a co-creation process where the planners together can bring their professional knowledge into action while playing the game.

The game has so far been through four prototypes. Each iteration that the game went through entailed the production of prototypes and testing with participants. At the end of each iteration we reflected on the results and incorporated them into the game. As sustainable designers we continuously aim to find ways

to innovate for sustainability, hence we wanted our design game development to achieve a certain level of innovation and reflect our scope of this project. All the prototypes follow a similar structure. The space that is developed is presented to the players and they have to work together to achieve different tasks, producing an outcome that should help them understand what's needed in the design of a strong sustainable development project.

To create a clear framework we created a list of features that our design game contains. We did this by using the features of a design game proposed by Brandt et al. (2008).

Typologies of features	**Brandt et al (2008) design game features**	**Our design game features**
Setup of the game	A diverse group of players are gathered around a collaborative activity guided by simple and explicit rules, assigned roles and supported by pre-defined gaming materials.	The game can be played by a diverse group of 2 to 6 people. They gather around a collaborative activity that can take place virtually or physically. The game should have a clear set of rules and each player should be aware of their role Some cards in the game are predefined and some are flexible meaning that players will be able to write on them
The context of using the game	the game materials typically point to either or both existing practices and future possibilities	The game is designed with the square behind the town hall in mind but it should be able to be played for any future development of a public space.
Time-limit	The games are played within a confined and shared temporal and spatial setting often removed from the everyday context of the players.	The game can take between one and three hours to play and should be played as a co-creation process between the planners of Frederiksberg Municipality. The game will constitute a new element in the player's normal planning process.
Goal of the game	The purpose of the game is to establish and explore novel configurations of the game materials and the present and future practices to which these materials point.	The purpose of the game is for the players to identify the needs of relevant actors that are connected to the space investigated and co-create concepts that will be considered in a sustainable urban development
End of the game	At the end of the game, the players will have produced representations of one or more possible design options.	At the end of the game the players will have produced a set of design concepts to be used in the planning of the sustainable urban space.

Table 2. Design Game features

7.1.1 THE FIRST PROTOTYPE

The first prototype of our design game had a pre-set board, a set of rules and three types of cards, which we call sticky notes, that the player could fill out during the game. The RSGs from the strong sustainable SCOT map which align with the strong sustainable guideline for development were made into five groups (see figure 27). We reduced the seven RSGs to five groups in order to reduce complexity and make the names of the five groups less abstract. The result of this merging was: Climate Adaptation & Treating water as a resource (Climate adaptation and Rainwater as Resource), Sustainable Future (Future Voices of Sustainability), Nature (that represented both Nature for Nature and Nature for Numans), Recreation (that represented Activity+Inclusivity) and Soft Mobility (Improve Soft Mobility). The purpose of the game was to make the participants brainstorm on the actors related to the groups, their needs and then design concepts that would solve those needs. The actors, needs and design concepts were written down on what we will call sticky notes. This can be seen on figure 27.

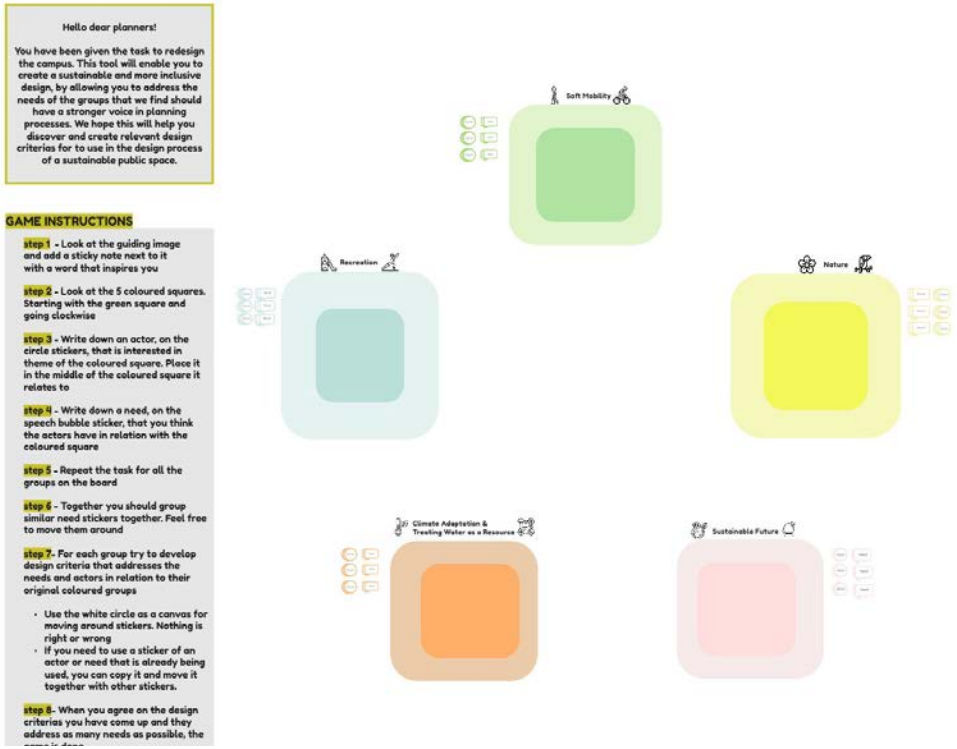


Figure 27. Design Game Prototype One

The game begins with the facilitator presenting the vision we previously described as the strong sustainable vision (see section 6.3.6.2). The first step is to ask the player to consider each group at a time (the colored boxes on the board) e.g.: Soft Mobility. For each group they have to write down three actors they identify as part of the group. In the case of soft mobility the actors can be bicyclists, pedestrians and roller skaters. The second step involves each player filling out 3 sets of needs related to the actor that they identified in the first step. The purpose of making the players write down the needs of the actors is to make the players empathize with the actors and adopt their perspective. These two steps are repeated for every group. The next step involves the players, discussing what similar actors and needs can be grouped together in a bundle and then individually developing the design concepts. In the end of the game they will be collaborating on what design concepts to consider in the design of the square.

TESTING

The test was performed using the online platform Miro. The audience for this test was made up by five of our colleagues from sustainable design of which two had experience with urban design. Even though the game board was online we did the test in person. Every participant had their own computer and we, the facilitators, were in the same room with them. The problems we identified during the test and the possible solutions we proposed are presented in table 3.

Problems identified	How can it be addressed?
The players were confused about how they should fill out the sticky notes (is an actor a mother or a mother with a baby stroller?)	Better facilitation of the game. Provide clear rules in the game.
It's confusing to name the actors for all the groups and then name the needs. The participants instinct was to write the actors and then the need, because they thought about the needs directly in relation with the actor	The game should have a clear sequence of tasks that is more user friendly
The number limitation of the actor, need and concept sticky notes didn't work, players would add more than 3 sticky notes on the board	Make the game more challenging so they won't produce so many concept or create pre-set cards to steer the brainstorming process
It didn't work to force players to concentrate only on one group (e.g. soft mobility). Players would have ideas about other actors or needs that were relevant for the other groups	The order of the boards should be more clear. Create a more user friendly environment that the players can follow. Create better structure of the game
The criterias that the players came up with were to generic	Develop a challenging game that would help the players do better brainstorming
We couldn't track the player's sticky notes and the players didn't respected the space dedicated for placing the sticky notes	Each player receives their own board and the board should have a clear space where the player should place her/his card.
The players were confused when to collaborate and when to brainstorm by themselves	Create a design that allows for collaboration
The players didn't feel like the game had an ending	Create an ending where the players can sum up their findings
The players did not understand the group Sustainable Future and it was too abstract	Make Sustainable future less abstract by adding an actor to represent it.
The players did not understand how to make the connection between the actor and the group on the board that should represent the RSGs.	Use the RSGs in a different way and give them another role in the game.

Table 3. Reflection of prototype one

Throughout the testing of the first game, we identified a series of drawbacks that were linked to the game (see table 3). Of all the problems and solutions identified in table 3 the following are the ones we considered the most relevant in the further development of our prototype:

- Explain how to use the sticky notes on the board. The purpose of the sticky notes should be more clear to the player while playing the game.
- The game should have a clear structure for when the player needs to consider a card; when it is time for the next move; where the sticky notes should be placed and how many sticky notes the player should use.
- We noticed that it's hard for the players to name actors and they ended up not respecting the rules or forgetting to relate their task to the rules of the game.
- It was hard for the players to name actors that are part of the Sustainable future group
- The game should focus on making the players create the design concepts together while also being aware of the actors' needs.

7.1.2 THE SECOND PROTOTYPE

With our second prototype we redesigned the game completely. The purpose was not to address all the problems identified in the test of the first prototype but to test a new structure for the game. The second prototype was a game where the cards and the game board were made of paper. The analog prototyping and low fidelity approach helped us make fast decisions and generate new ideas and improvements for the design game. We chose this approach to rapidly test a new setup of the game, before transforming it into a digital version of higher fidelity.

By redeveloping the game, the second iteration is focused on making the players listen to the RSGs that are associated with strong sustainability. During the test of the first prototype we found that the players had a hard time finding appropriate actors for each group. Furthermore, we found that using the actors from the seven relevant social groups by themselves is not enough as they can also reflect interests of the silenced RSGs in the strong sustainable SCOT map, for example a dog owner can be a member of the RSGs Pro Parking & Cars and Activity & Inclusivity. Thus we chose to make predefined actor cards as a way to solve that issue where we wrote down all the actors we could think of from the seven RSGs from the strong sustainable SCOT Map (see figures 28-31). We also included non-human living actors in the actor cards even though SCOT doesn't acknowledge non-human living actors. We did this because non-human living actors are important in the framework of environmental sustainability.

Another way we changed the game was that instead of the five groups we wanted to try a game where we moved closer to our original strong sustainable SCOT map and used all the seven RSGs in the game. To avoid imposing SCOT terminology on the player, we represent the RSGs as context cards; they will refer to the context that the actor operates in. Hence, we use actor cards, that were described earlier, to create an image of the actor and the RSGs to create context for these actors. In order to make the participants focus and reflect on sustainability issues we created 'if' cards. These cards are based on strong sustainability and our strong sustainable guidelines (see section 6.3.4). Most of the 'if' cards focus on environmental sustainability since we interpret environmental sustainability as the core concept of strong sustainability, however social aspects are also included. Below we will describe the setup of the game.

The game consists of three pre-set deck of cards: Actor Cards (see figure 31), Context Cards (see figure 30) and What if Cards (see figure 29); a set

of blank cards and a main board that consists of a guiding question(see figure 28). The players are situated around the game board. Similarly to the first prototype, the game starts when the facilitator introduces the players to the strong sustainable vision of the space the players will work with. For each round the players take turns taking cards. Player One takes a random card from each category: An actor card, a context card and an 'if' card. Player One places them on the designated spaces on the Main Board and reads the sentence out loud (see figure 28). The players have to discuss how the actors' needs can be fulfilled and then come up with a concept that would be able to fulfill the need identified. Player One writes the proposed concepts as full sentences, being as specific as possible. If there is a discussion involving the concepts Player One makes the decision on which to include. When a maximum of three concepts have been written down, the three cards on the board plus the written ones are placed together on Player One's board. The next player repeats the same steps as Player One. When all players are through, the players take turns reading out loud their actor, context and 'if' cards along with the proposed concepts. Together all the proposed concepts form a scenario for the space that is being developed. The players can write it as a story, make a drawing or turn the concepts into design criterias. A possible second round can be played with the provided actor cards or the players can write their own if they identify more actors, but the context and the 'if' cards can not be changed. The same steps are repeated for this second round of the game.

The results will be different every time the game is played because some cards from each category (actor, context and 'if') will not be included in every round. This will result in different design concepts. Players can choose to go through multiple rounds to pursue a greater variety of combinations or they can play just one round. This will not affect the overall purpose of the game, since the purpose is to make the players aware of different perspectives and to move away from their dependency on car-based mobility. We find that the game can still fulfill this purpose even though all possible combinations are not explored in every round.

TESTING

The test using the paper version of the game was performed in person with one participant who has experience with urban design. In the second round two members of our group participated in the game while the last member of our group facilitated the game. After completing the test we were able to identify some problems, these are presented below in table 4.

Problems Identified	**How can it be addressed**
The player chooses to replace the cards, instead of working with the ones that they draw from the deck	Improve the correlation between the cards
Some cards are still too broad for the player to relate to (e.g. What is accessibility?)	Rephrase the cards into more clear sentences
The final concepts were too generic	Introduce more challenges for the players
It is hard to remember the combination of the actor, context and if cards that the player formed	Develop a framework where the players can clearly see all the cards.
The actors for Voices of the Future were difficult to understand. It didn't influence the concept development	Develop a creative way to include Voices of the Future in the game that can be understood by the participants and can have an effect on the outcome of the games.

Table 4. Reflection of prototype two

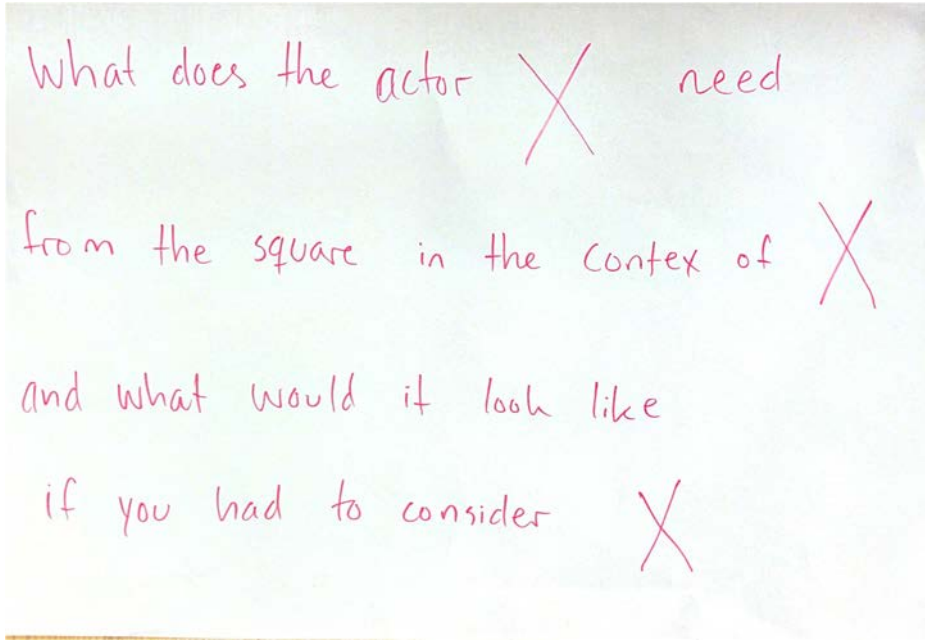


Figure 28. The guiding question

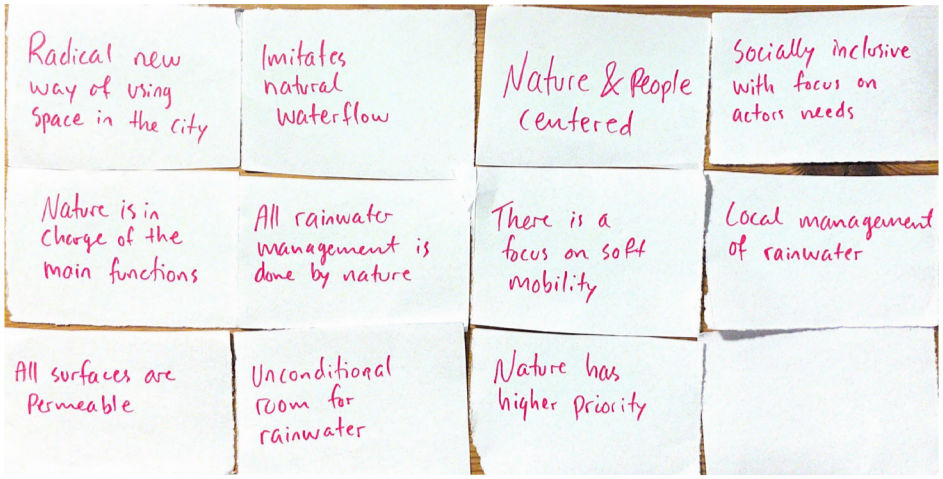


Figure 29. The What if cards

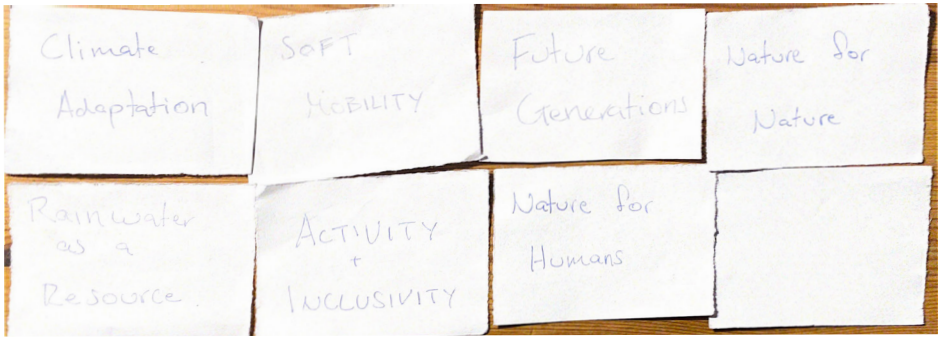


Figure 30. The Context cards

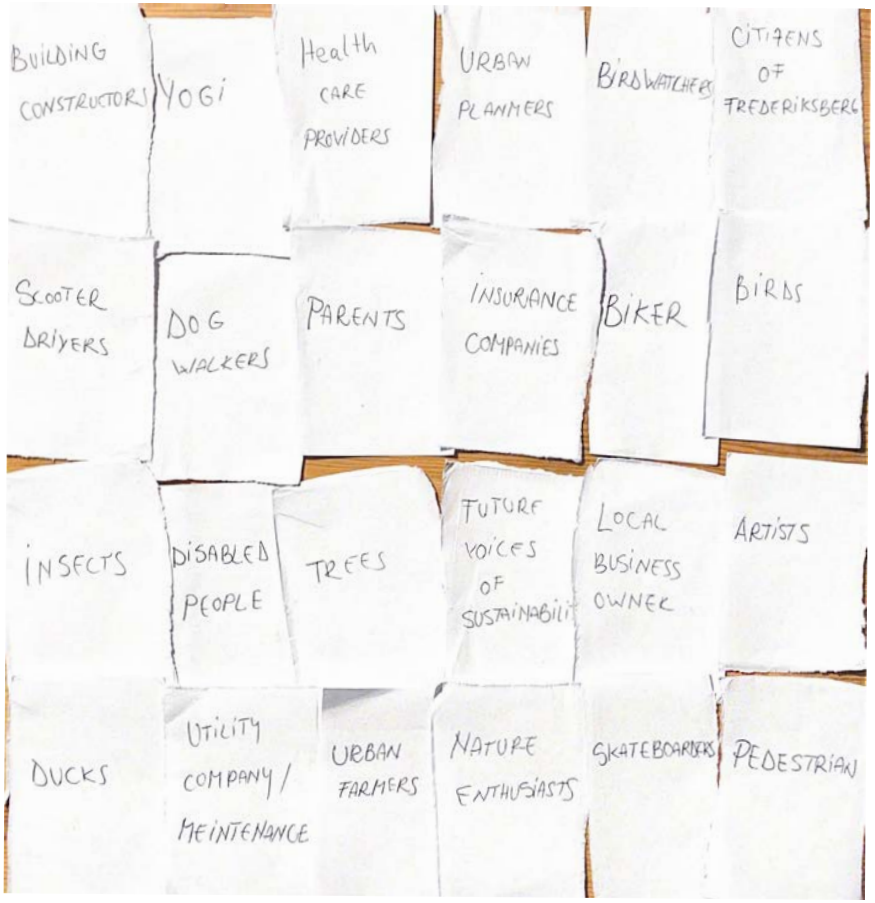


Figure 31. The Actor cards

Even though the second prototype didn't have that much negative feedback from the players (see table 4), we feel like the game still needs to be developed further before it can fulfill its purpose. The most relevant finding from this prototype test session were:

- To be careful how we describe the cards and mainly to be clear about the content of each card.
- Work on creating a setup for the game, so the final vision that the players develop won't end up being too generic.
- Be structured about how and where the cards should be placed on the board
- It's helpful to have a guiding question in front of each player, so they can relate to it during the game.
- Having the flexibility of changing the cards during the game helps the player but does not contribute to the purpose of the game.
- The ending of the game still needs to be improved.

7.1.3. THE THIRD PROTOTYPE

The third prototype is more complex compared to the previous pro totypes. By learning from the last two prototypes, we ended up developing a digital design game that was in line with all our requirements (see table 2). The focus of the game is the same, however, we want to experiment with the time frame used in the game. Instead of using Voices of the Future to develop actor and context cards, we added another deck of cards that makes the player consider the future, by stating a change in time, for example in 20 years.

Looking at our previous attempts for the setup of the game, we created two boards where the game takes place, an instruction section and an index that explains the meaning of each card used in the game. The game has three decks of cards (same as prototype 2) that are placed on the main board (see figure 32), together with the main guiding question. Each player has its own working board, which only they can manipulate. The deck containing the time frame cards are placed on the board with the other decks but it's to be used one time per round allowing the players to challenge the concepts they create.

Differently from the other prototypes this time the game starts by presenting the space the players are working with. Then Player One has to pick a random card from each pile and place it in the designated space within the guiding question. The player has to read out loud the question for the rest to hear. The players then discuss between them the circumstances given by the combination of the cards and propose concepts that target all the cards in question. Player One has to fill out all three empty concept cards in their working board before another player can start playing. All the players repeat the same task. The players can choose to stop after all the players have completed their board or they can continue the game by adding more concept cards to the board. In the end, the players are asked to create a common scenario from the concept cards they have created.

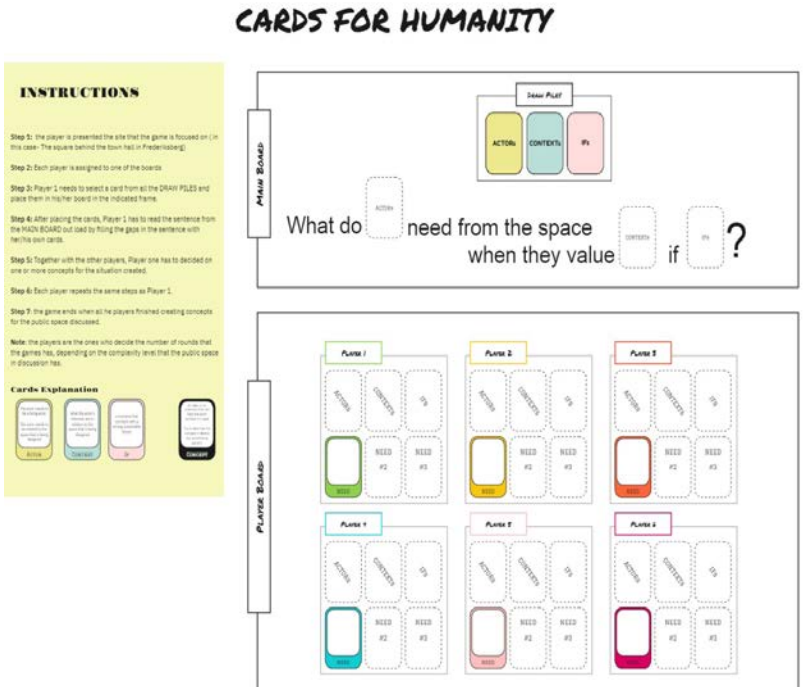


Figure 32. Design Game Prototype Three

TESTING

For this session, a group of four people tested our prototype. Similar to the first prototype, the design game was tested using Miro but with the participants being in the same room. One of the participants had experience with design and creative processes. After completing the test we were able to identify some problems, these are presented below in table 5.

Problem Identified	How can it be addressed
The guiding question is too complex throughout the game	The game should be split into stages and the question should be gradually filled in
The players don't focus on the timeframe and it was too abstract.	The players should first focus on the present state of the project, followed by a separate step where the time frame is added to the game. We will make the timeframe more concrete by introducing future scenarios.
The players don't identify with the actors and had a hard time coming up with the needs	Transform the actor cards into general persona cards so that the player can identify with the actors throughout the game.
The players forgot about focusing on the specific space they were working with, while considering the needs of the actors .	We need to include a map in the game that will help the players relate to the space and draw the players' attention to the space which they should always consider during the game.
The game doesn't have a clear start	The facilitators should introduce the game and the first round of an easy combination of cards as an example. Then the facilitator should give way for the players to start.
The game doesn't have a clear ending	Work on a task that would help the players construct the scenarios from their concepts. Ask them to place that scenario on a sustainability barometer. Example: Imagine the square with your concepts implemented. Where is it on the barometer from weak sustainability to strong sustainability. What is missing in order for it to become more sustainable? This will make the planners discuss their perceived sustainability of the square. Further ask: What could increase sustainability even more?
The setup of the game goes in different directions and it's hard to focus on the outcome	Split the task of the game so the players can have an undisturbed focus on the task. Create a sequence of steps the players can follow within their turn
The players got stuck in the game and could not come up with more ideas when they had to fill out all the empty spaces	Make a time limit for each round of 10 minutes.
The players had a hard time identifying the connection between the actor and the context	Bicyclists can only be drawn with the context card: Improve Soft Mobility and Nature for Humans. We should identify which actors cannot be played with specific contexts and mark them so to indicate to the players the cards cannot be played in combination.

Table 5. Reflection of prototype three

The third prototype of the game was the closest to the final design game that we are going to play and deliver to Frederiksberg Municipality. Throughout this iteration we managed to test all the improvements made based on the testing of the previous prototypes and the highlights were the following:

- It's really important to create a setup of the game for the player and make it user friendly so everyone can understand.
- Clearly present the purpose of the game, the space that is to be developed and the rules of the game.
- The game should add tasks gradually and not present all the tasks at once
- The cards should be supported with visuals or clear descriptions
- There should be a time limit imposed on the player when they fill in the empty cards on the board. Another limit is that the player can fill out up to three cards.
- Work on a framework that makes the players consider different time frames through future scenarios.
- Develop a clear ending for the game in which the player can further reflect on the outcome of the game

7.2. FUTURE SUSTAINABLE PLANNING TOOL

Reflecting on the trials and errors we entercoured during our three iterations, we want to highlight a few key points that took us closer to our final design of the game (see figure 33). The most important aspects we will use in the development of the game are: to create a structured setup of the game; to make the player understand the meaning of each step; and to create a challenging game that will support co-creation and proactive brainstorming sessions that will promote sustainability in urban planning.

In order to create a structured setup of the game, it was broken into two stages: concept generation and scenario reflection. In the first stage the players develop a set of concepts. These concepts are created through the first four steps, where the player brainstorms on the actor's problems and needs while relating the concept to the If cards. In the fifth step the players have to discuss how the concept performs in a proposed future scenario. In the second stage the players first imagine a scenario where all their concepts are included in the space they are developing. Then they should discuss the perceived sustainability of their visions and agree on where to place it on the sustainability barometer.

The game starts by introducing the purpose of the game, the rules and the space the players are working with. Different from the prototypes tested earlier, we added the map of the urban space on the board of the game and the players are reminded that they need to consider the map while playing the game.

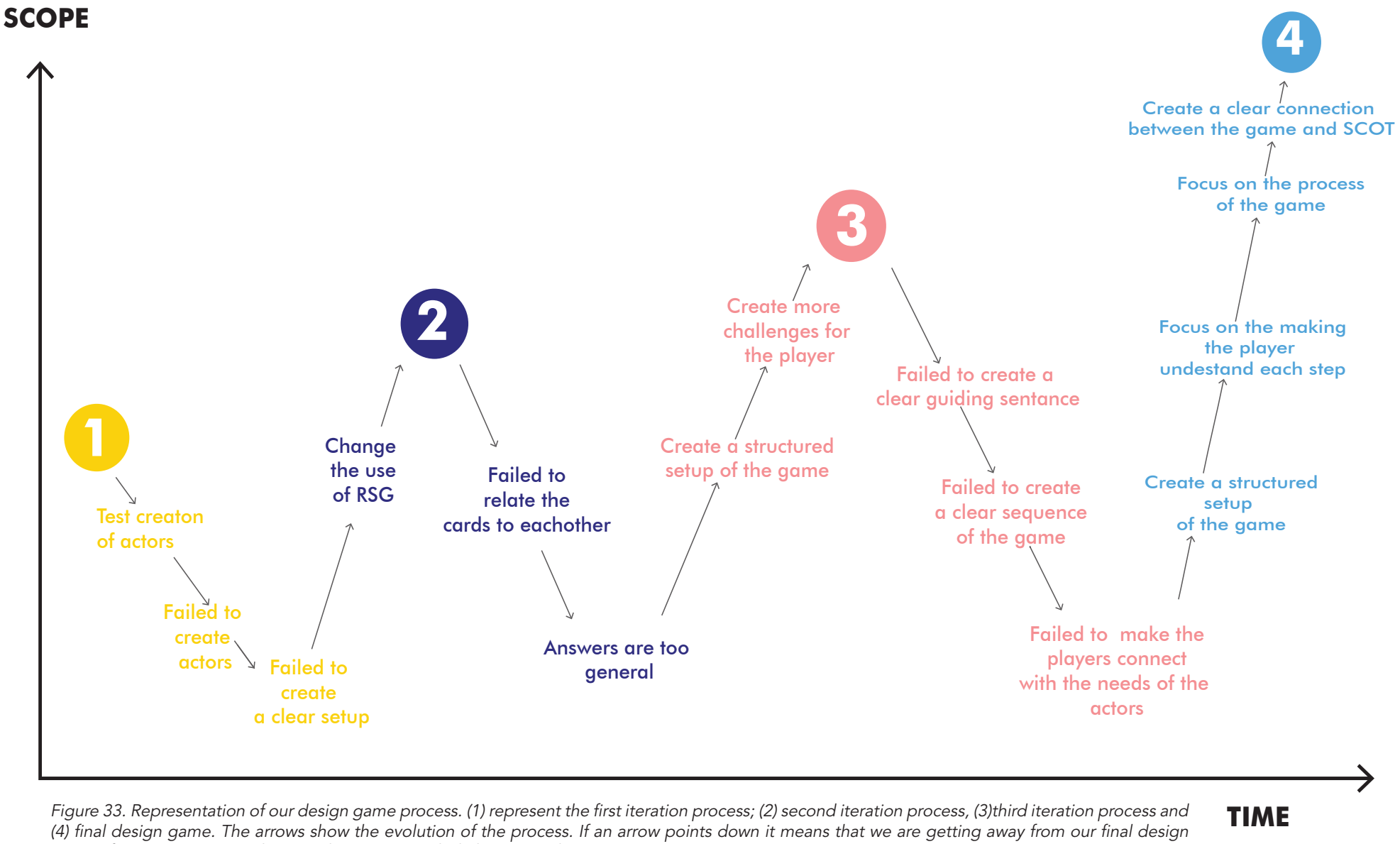


Figure 33. Representation of our design game process. (1) represent the first iteration process; (2) second iteration process, (3)third iteration process and (4) final design game. The arrows show the evolution of the process. If an arrow points down it means that we are getting away from our final design game. If an arrow goes up the contributions we include brings us closer to our purpose.

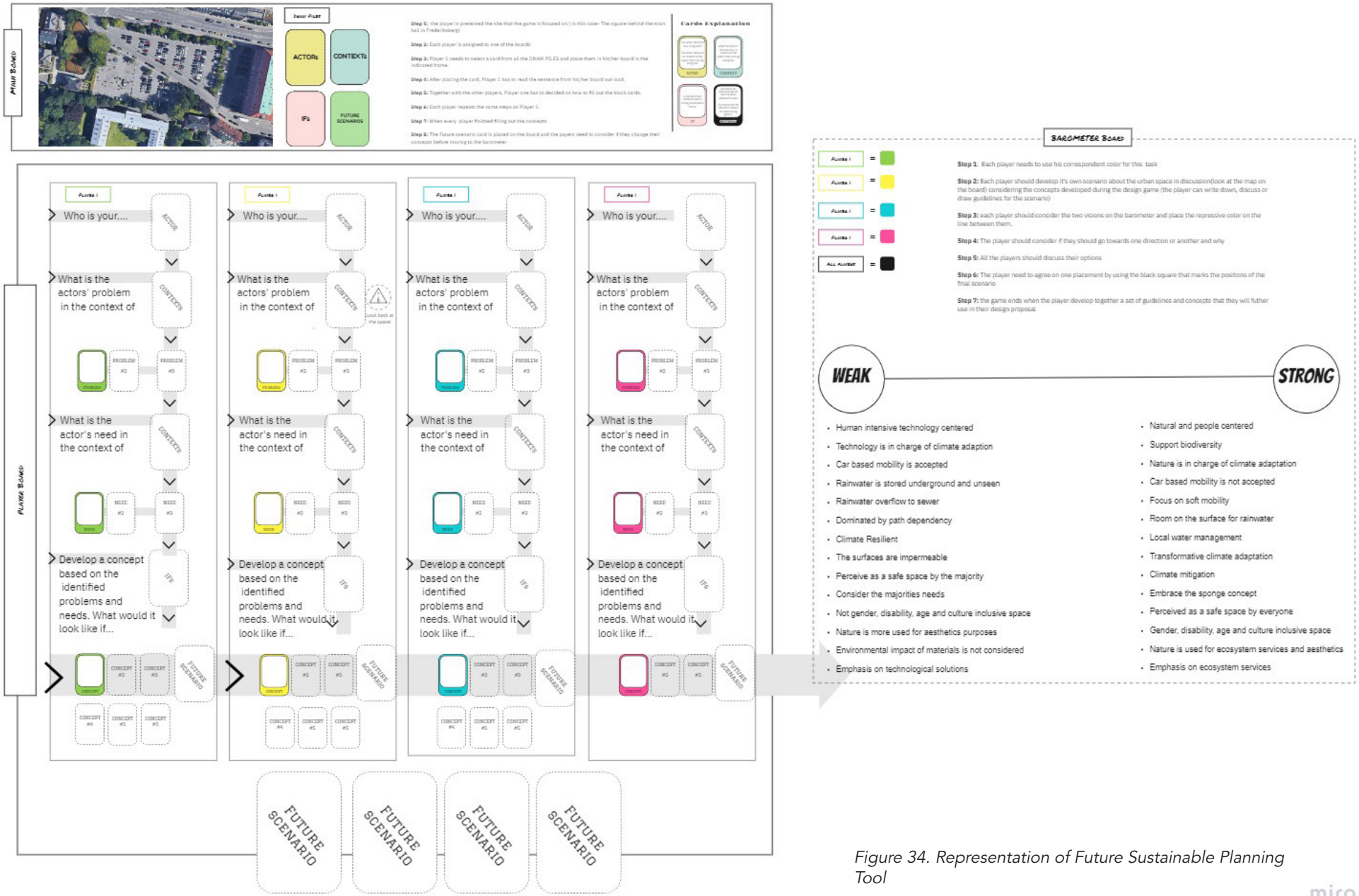
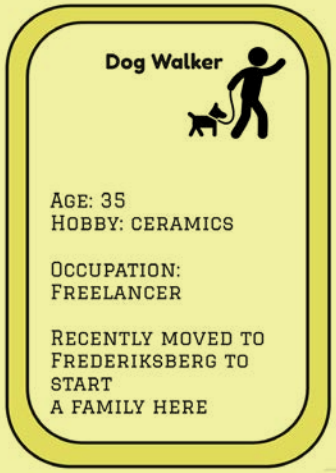
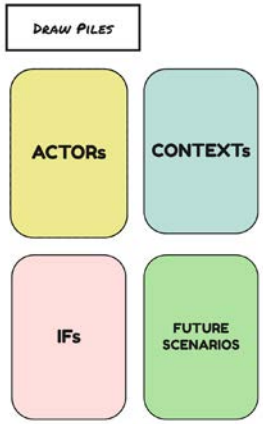


Figure 34. Representation of Future Sustainable Planning Tool

Figure 36. Persona Card







(Climate adaptation)
- Urban Planners
- Healthcare providers
- Styrelsen for patient sikkerhed
- Insurance companies
- Building Constructors

(Nature for humans)
- Artists
- Kids
- Birdwatchers
- Urban farmers
- Yogi
- Nature enthusiasts
- People who gather herbs
- Dog walkers

(Nature for nature)
- Birds
- Ducks
- Bees
- Insects
- Trees
- Flora
- Fauna

(Activity and inclusivity)
- Parent
- Local Business Owner
- Runners
- Senior citizen
- Musician
- Dorm student
- Neighbours to the future designed space
- Pregnant women
- Tourists
- Disabled people
- Street janitors

(Improve soft mobility)
- Biker
- Pedestrian
- Parent with baby stroller
- Disabled People
- Skateboarders
- Roller Skates
- Scooter riders

(Rainwater as a resource)
- Citizens of Frederiksberg
- Utility Company

(Future generations)
- Adults in 2050 (If the time frame does not work)
- Kids in 2050 (if the time frame does not work)
- Represented by the time frame cards: 20 years from now so that every player is forced to take future generations into account

Figure 35. Presenting the list of actors

The players work with two board games, a board that is to be used in the first stage where every player has an assigned individual board and a common board, the barometer, which is to be used in the second stage. In our third prototype we tested a similar set-up, which focused on a two board system. It provided a structure on which the players could depend and work on.

Player One draws a card from the Actor Card Deck (see figure 35). The actor card contains a general description of the actor, approximating a persona. We adapted the actor card from the previous iterations as we realised that the players didn't acknowledge the purpose of the actor card and often would forget about using it during the game. We decided to reinforce the actor card by giving it a description so that the player can understand how different voices represent the square, before asking them to consider working with the context card.

Player One draws a card from the Context Card Deck (see Figure 37). This version of the game is different from the other prototypes since all the actor cards relate to the context cards, this relation between the cards is indicated by the use of symbols on the cards. The context cards are inspired by the RSGs that we outlined in our analysis (see section 6.3.1.).



Figure 37. The Context card

Player One places the actor card and the context cards on their board and considers both cards to start brainstorming together with the rest of the participants. This Brainstorming looks to answer what kind of problems the actor presented on the card has in relation to the context, for example, what problems do pedestrians have with the square in the context of Improve Soft Mobility? Furthermore, the players have to identify up to three problems that they find most relevant from the discussion and write them down in the space assigned on the board.

Next, Player One brainstorms with the rest of the players on the needs that the actor card has in relation with the context card and the problems identified. In both steps, the players are asked to use the map on the board for reflection, discussion and support to create relevant needs and problems. By asking the players to reflect on the problems and needs we are pushing for them to follow our steps and identify that an artefact has interpretative flexibility.

The next step of the game introduces the strong sustainability aspect through the 'If' cards which are based on the strong sustainable guidelines (see figure 38). Player One adds to their working board the 'If' card that they draw from the deck. At this point, the player has to consider all the cards on their working board. Player One brainstorms with the rest of the players on solutions that address the space being discussed while considering the cards that they have on their board. The player selects up to three concepts from the brainstorming session and places them on their board, this should take no more than 10 minutes. After this the steps are repeated for the rest of the players. We propose this approach in order to guide the players into a more structured path of generating concepts for the urban space in discussion.



Figure 38. The If card

The last step in the first stage is to make the players reflect on how their concepts will perform in the future. In order to do so we make them draw a scenario card. The players should then collectively decide if they need to change their concepts based on the information from the scenario card.

The game is to be played as a structured brainstorm to create arguments for what the future design needs to encompass in order to be environmentally and socially sustainable. The same tasks are repeated for all the players that participate in the game. After all the players have gone through the process then the players draw a final card from the Future Scenarios Deck (see figure 39). This card represents a provocation for the players to consider. The future scenarios are based on how the RSG Voices of the Future interprets the square. In order to provoke the players even more, we have made half of the scenario cards unsustainable or opposite of the other half. The purpose of the scenario card is to make the players reflect on how their concepts will perform in the future and to challenge the players in reflecting on their own interpretation of how the square should be developed. The players have now the chance to reconsider the concepts that they proposed and add new concepts to their boards. Further on, the players consider all the concepts from all the players' boards and develop an individual scenario that addresses the space in discussion.



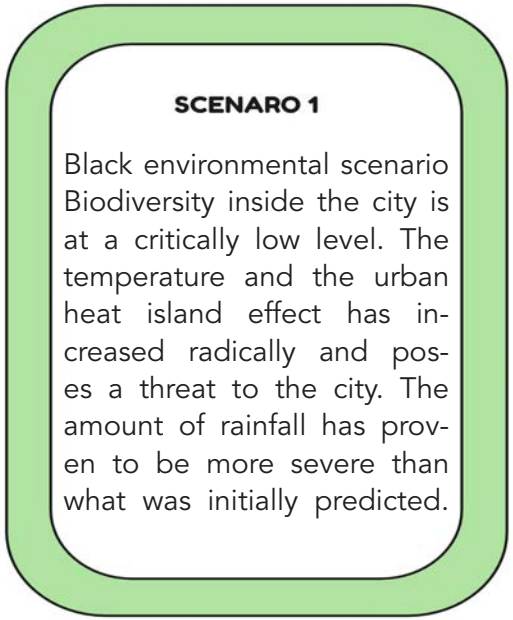


Figure 39. Example of Scenario Cards

For the final task, each player is asked to imagine all their concepts implemented in the urban space that they are developing and place this scenario on the sustainability barometer in the common board with the designated 'symbols'. These scenarios are not to be confused with the future scenario cards. Different from the other versions of the prototypes, we chose to use the visions in the end as a means to support the player's learning process. We will argue that having the visions in the beginning could bias the player to just redo the vision. The purpose of using the barometer is to allow the participants to bring some level of closure to the interpretation of the space while giving a reflective overview over the decision-making and how each player's influence on the public space can bring the development to one extreme or another (either closer to a weak sustainability approach or a strong sustainability approach).

7.2.1.SUSTAINABILITY ASSESSMENT

An important tool that is going to be used in the design game is the sustainability barometer. In the beginning of our design process we acknowledged that our end product will be intended to guide Frederiksberg Municipality in taking sustainable decisions that consider future urban development. By including the barometer step in the design game, we intend to provoke the participants and create a reflective discussion on the sustainability assessment of the scenario developed by the participants in the game.

The barometer has two ends (see figure 40) and a fluctuation line that is free of any measurement indication. The two ends are represented by the visions: weak sustainability vision and strong sustainability vision (see section 6.3.6.). The two visions are supported by a list of guidelines that are meant to help the player understand the context of each vision.

As a last step in the design game each player is asked to imagine a scenario where the concepts developed through the game are implemented on the square. Each player is asked to place a point on the fluctuation line that represents the scenario they imagine at the end of the design game. After everyone completes this task, the discussions are initiated. Why did each player place their point on the barometer on that specific point? Why is it closer to the strong or weak vision? The game ends when the players negotiate and decide on a collective scenario that can be placed on the barometer. The purpose of the barometer is to create an overall learning process that will hopefully contribute to a change of attitude in Frederiksberg Municipalitys' administration.



Figure 40. Barometer

Through this last stage of the game, we want to express the necessity of understanding the steps the players need to take to reach a desired state of sustainability. The players need to consider the users of the urban spaces, their needs, the sustainability context and the impact of the decisions on the future and acknowledge the impact on the future societies. Moreover, the importance of using the last stage allows the players to understand the desired state, discuss, negotiate and agree on paths to get closer to the desired state and consider actions and effects on reaching the desired state.

7.3. LIMITATIONS OF THE DESIGN GAME

After developing this tool we were able to identify some limitations that might have an effect on the purpose we intended for it. These limitations can restrict how the participants will use the game as a planning tool and as a space for learning.

- All the actors won't be considered if the game is only played once and this will create an exclusion of some actors.
- There is a risk that the planners will be stuck in their professional structure and have a hard time seeing the development of an urban space from a different perspective.
- We have multiple agendas with the game: Making the planners see urban development from a new perspective and make them reflect about sustainability. This has created a complicated game with many steps that the players have to navigate.
- Even though we constructed the visions by analysing the weak and strong sustainability theory guidelines, there are still some empirical elements that are filtered by our sustainable design perception. There is a risk that the participants using the design game don't accept the terms which the barometer and 'if' cards are based upon.
- The game is based on the Square behind the Town Hall and how different actors interpret that square. This is a possible limit to playing the game on other development projects but we will argue that the seven RSGs that the game is based upon are also relevant in other development projects.

Despite these limitations we still expect the game to fulfill its purpose:The game will enable the planners to see that if they widen their perspective, there are many more paths in which an urban space can develop. This opens a space in which they can explore the possibilities of how the development of an urban space can be redefined and reached through a strong sustainable approach.

7.4. IMPLEMENTATION OF THE DESIGN GAME

WHY USE THE GAME

The game will allow the planners in the municipality to consider the needs of the users during the design process of an urban space. In Frederiksberg Municipality's situation, the game will allow for a calibration of the decision making on how the design of the square should look, while adapting to the current circumstances which is the construction of the parking basement.

Even though the parking basement is already planned, we believe that it is still important for the planners to play the game now since they don't know what the square would look like and they should use the game to create viable solutions for social and environmental sustainability. If used right, the game will allow them to be aware of how urban spaces can be sustainably transformed in the future.

HOW TO USE THE DESIGN GAME

The game will be played with different employees of the municipality that have a direct contribution to designing the Square behind the Town Hall. Our intention is to present the design game as a product that will be used in their design process of the Square behind the Town Hall and enroll into adapting and further using the game for other urban spaces. We plan for the game to be used during the initial design phase of a new development project (see figure 42). However it can also be used during the development process but it should not be used as an afterthought. If it is played as an afterthought we cannot be sure that the game will impact the planners prioritization of car-based mobility. The game can be played both online and physically. The map can be changed so that the game can be used for other development projects.

WHO SHOULD USE THE DESIGN GAME

We advise that the game is played among planners and designers from different departments since it includes a wide range of features such as climate adaptation and recreation. Playing the game across professional borders will enable the players to see the development process from different perspectives. This will also ensure the synergy which Frederiksberg Municipality values.

Using a design game is not a practice that the planners of Frederiksberg Municipality have at the moment. However, we believe that using a design game won't be so big of a change since the planners are used to collaborating and brainstorming with colleagues. Since we have observed that the planners of Frederiksberg Municipality don't have any practices that support engagement with citizens, we believe that playing this game with colleagues is the next best thing to include voices that were previously silenced in the planning process.

Sustainability is a difficult subject for many professionals and we believe that there are other municipalities in big cities who need a framework that can ensure sustainability in their development processes. If the test with Frederiksberg Municipality goes well and if we manage to improve the game further, we believe that other municipalities like Copenhagen or Aarhus can make use of the game.

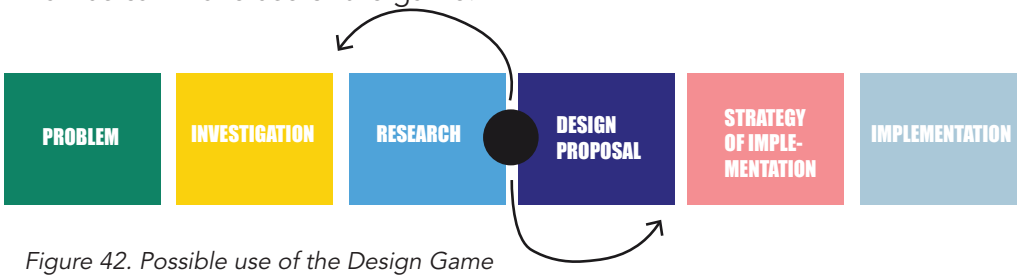


Figure 42. Possible use of the Design Game

8 Reflection

This report approached the Square behind the Town Hall as a study case with the intent to design a tool that can be used for other similar development projects in Frederiksberg and possibly other urban municipalities. Using a study case with the purpose of developing a general tool is one vulnerability of the design game. Since it is based on an analysis of the RSGs' interpretation of this particular square; it is a possibility it might not be representative for other urban development projects of public spaces. However, we will argue that the RSGs 'Nature for Nature' and 'Voices of the Future' are not only connected to the Square behind the Town Hall but also to development projects in the city in general. The five remaining RSGs might have to be confirmed or modified through other study cases before the game can be considered a general tool.

The design game is intended for planners in the Municipality as a means to empathise with different perspectives and interpretations of the spaces they are developing. However, the game does not require them to truly engage with citizens, which we believe would have been the best thing to do. We have designed the game in this manner because we estimated the lack of citizen engagement practices within the municipality to be too big of an obstacle. Therefore to increase the chances for our game to be introduced into their planning process we chose to make this trade off. We could have made a tool or a guide that could teach and support planners in citizen engagement, but we estimated that this approach would take us too far away from our intention to impose more sustainable development in Frederiksberg Municipality. However, such a tool is an interesting subject for further research.

The game is intended to be played at the beginning of a design project, before the planners become too attached to the design solutions for car-based mobility. However, our design game will be tested in the middle of the project planning phase when construction for car-based mobility solutions have already started. This could have an effect on our test with the planners and make it hard to say if the game works as intended. However, the design of the surface of the square has not been decided on yet and our game might be able to push the design in a more sustainable and future oriented direction.

One of the limitations we encountered in the application of SCOT is the number of actors we as researchers were actually able to identify when mapping the context surrounding the artefact being studied. We proceeded to do fieldwork and research different perspectives as an attempt to minimise this drawback but there is a chance that some actors and their interpretation are not mapped. Furthermore the development of the artefact, in this case the Square behind the Town Hall, is highly dependent on our interpretations of the RSGs and what we perceive as opportunities for them to form alliances around the development of the square. Thus, our work should not be read as an accurate representation of reality but as our approximation of it.

Throughout the project we have been in touch with the employees and politicians of the municipality. However, our critical standpoint towards car-based mobility has put restraints on the collaboration in regards to the interests of planners and politicians of Frederiksberg Municipality. Looking back at the development of the project we think we could have communicated more with our collaborators, however we are aware that this would probably have pushed our project in another direction, and produced different results.

9 Future considerations

9.1 FUTURE WORK

Before the 'Future Sustainable Planning Tool' can be used by planners, specifically Frederiksberg Municipality's, our next step would be to produce a high fidelity prototype and test it with the future clients. Doing this will allow us to identify where we have to make minor changes and tailor the final product for Frederiksberg Municipality. The test will be performed with 2-5 planners or project managers. The test will have to be conducted online since employees of Frederiksberg Administration are still working from home due to COVID-19. We would like to produce a physical product and deliver it to the planners at Frederiksberg Municipality, so they can use it in their future actions of shaping their city.

An additional test can be made with passersby of the square. This test can be made in order to see if the game can be used directly between planners and citizens. If the game is able to be used in this way it would overcome the drawback of planners guessing the different problems and needs of the actors that are impacted by their urban development.

9.2 FUTURE RESEARCH OPPORTUNITIES

During this master thesis we have become aware of additional research opportunities related to our subject and the product we have developed.

The first opportunity we have identified concerns the adaptability of the tool to different developments. This can be done by applying the tool to different development projects of different municipalities.

The second opportunity we have identified concerns the development of the relevant social groups utilised within the tool. We think that for the tool to be utilised in different development projects the relevant social groups have to be defined based on these other development projects. The tools' way of promoting the sustainable agenda is based on strong sustainability. However, there are multiple other sustainability concepts and it could be interesting to see how the tool will transform if it is based on other concepts such as Planetary Boundaries or the UN Sustainable Development Goals.

10 Conclusion

At the beginning of the report we introduced the research question that guided our project into analysing how our partner's design of public spaces, how they undertook the concept of sustainability and how we aimed to change their approach to the design of public spaces. The research question is presented again below:

HOW CAN WE PROMOTE A STRONG SUSTAINABLE AGENDA FOR THE DESIGN OF PUBLIC SPACES IN FREDERIKSBERG MUNICIPALITY USING THE SQUARE BEHIND THE TOWN HALL AS A CASE STUDY?

How can the proactive use of SCOT be developed into a tool that will represent different actors and their relevant social groups in the design of future urban spaces?

Through the development of the report we were able to identify various instances in which Frederiksberg Municipality failed at not only driving forward a more sustainable agenda by using different methods which will eventually sustain the carbon lock-in described by Seto et al. (2016). We conducted multiple interviews with politicians, administrative employees, citizens and experts; field trips to different squares and the site itself; and desk research. All these interactions in the context of the case study allowed us to analyse how Frederiksberg Municipality prioritizes some of the elements that make up the city. We took a close look at how Frederiksberg Municipality applied and used the results of their citizen dialogue concerning the Square behind the Town Hall. By doing this we were able to identify how the participation of the citizens of Frederiksberg in the design process is used mainly to validate the ideas proposed within the Municipality. Furthermore we identified how future citizens, flora and fauna are left out of the design process. With the object of challenging Frederiksberg Municipality's planning process we based our work on SCOT, as it allows to include a sociotechnical aspect into the development of the Square behind the Town Hall.

In order to challenge Frederiksberg Municipality into opening up the planning process and include a more sustainable oriented perspective we used SCOT proactively. Using SCOT this way allowed us to introduce different relevant social groups in relation to the Square behind the Town Hall and the ones we included supported a strong sustainable agenda. Consequently we proceeded to silence some relevant social groups depending on whether they supported a weak or a strong sustainable agenda. To reach a possible closure amid the unsilenced groups we explored possible shared alliances between them and built solutions from that. By doing this we were able to generate two visions, one supporting weak sustainability and the other supporting strong sustainability. However we did not want our contribution as Sustainable Design Engineers to end with the delivery of a set of visions.

We produced a tool that the planners at Frederiksberg Municipality could introduce into their future planning processes concerning public space developments. This tool took the form of a design game to be played by the planners in order to provoke them to consider the inclusion of different relevant social groups into their process. After testing the design of the game multiple times we came to a structure that allows the planners to take on the role of members of the relevant social groups. The relevant social groups included would allow planners to pursue a strong sustainable agenda and start challenging the lock-ins experienced by Frederiksberg Municipality. We intentionally did not include relevant social groups that would support car-based mobility as we identified this to be a contrary to our intention of pushing the agenda of strong sustainability in the planning process. We also found that the inclusion of relevant social

groups that support car-based mobility would push Frederiksberg closer to a Tragedy of the Commons regarding distribution of space.

The design game we produced is based on the proactive use of SCOT. To do this we identified the technological controversies of the relevant social groups around the Square behind the Town Hall and continued to determine the alliances between the one that supported a strong sustainable agenda. The game provides descriptions of actors that are more aligned with a strong sustainable agenda, giving the planners the task of providing different solutions to the problems and needs presented by the actors in relation to the project being developed. After this the planners would discuss the solutions proposed and open up a negotiation space where alliances can happen.

We developed a tool for the planners in Frederiksberg Municipality that allows them to empathise with different actors who are impacted by the development of the public spaces. Another purpose of the game is to have planners to adopt a sustainable agenda and include strong sustainability in their planning process. Additionally we were successful at utilizing SCOT proactively to generate different possible visions for the Square Behind the Town Hall based on Strong and Weak Sustainability.

Cities will always face many challenges, both today and in the future. In order for cities to face these challenges in an inclusive way, it is important that all Citizens, be them future or present, human or non-human, are considered a key part of cities today and that they play a role in developing the parts that will make up future cities. This report has presented our take on how this can be achieved by impacting planners directly through a creative tool.

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