Aalborg University - Sustianable Design 4th. Semester - June 2nd. 2016
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Sustainable Mobility in Copenhagen

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Theme: A Sustianable Transition in the Copenhagen Mobility Sector

Period: January 15th 2016 - 22nd of June 2016

Supervisors: Andrés Valderrama & Christian Clausen

No. of Pages: 110

Appendix: Eksternal drive

Hand in: 2nd of June 2016

Master of Sustianable Design
Institute of Design, Innovation
and Sustainable trasitions
Aalborg University - CPH

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Abstract

This report investigates the effects of user-involvement towards creating a sustainable transition of the Copenhagen mobility. While the municipality of Copenhagen aims for a CO2 neutral city by 2025, the mobility is getting behind in achieving this vision. Many investments have been done in altering or improving infrastructure, but an element of user-involvement is missing. This report will attempt to look further into this problem and provide a solution. An investigation of the mobility of Copenhagen and its users have been developed, which will give an analysis consisting of the user oriented Practice theory and the systematic Multi-level perspective as to succeed in creating the best solution possible for a successful transition. Through a workshop with the users, a co-design process was initiated, which ended up giving new perspectives for further work. A concept has been developed centering around creating awareness and direct the citizens of Copenhagen towards a more sustainable mobility behavior. This is done by getting the users to see and relate to the issues at hand and creating a better understanding, while providing options for how they can continue in their process towards a more sustainable behaviour.

Acknowledgements

Introduction

Over the last century the demand for mobility in Copenhagen have been on a high increase. Because of the population of Copenhagen have increased and the surrounding suburbs have expanded in size, have the mobility behaviour of citizens increased in length. This was a result of the industrialization of Copenhagen, and together with the industrialization came new innovative mobility technologies to fulfill the new needs of the users. The following effect of the industrialization can now be seen on the current mobility situation in Copenhagen, it has lead to an unsustainable relation to the way "we think" mobility in Copenhagen. Fossil fuel driven vehicles have become of a part of the Copenhagen City picture; in form of cars, vans, busses and trucks, all which have a negative effect on the 3 pillars of sustainability; the environmental, the social and the economical. Yet on an international scale Copenhagen is one of the highest ranking urban cities within sustainable mobility, and this is because of the deeply implanted biking culture the citizen of the Copenhagen have, which is a very sustainable form of mobility seen from the perspective of all 3 pillars.

The idea of a sustainable mobility sector have been a growing trend, and therefore Copenhagen decided in 2009 to become a CO2 neutral city by 2025 [(Copenhagen Municipality, 2009), which includes creating a more sustainable mobility sector, by converting more citizens to use either biking or public transport, while converting the remaining car-parks and busses to electrically driven vehicles .

While the engagement of the municipality for converting towards more sustainable mobility of Copenhagen is of high interest and currently undergoing, does their method of encouraging the transition lack a certain important element of user involvement. The municipalities strategy is based on investing in the infrastructure that promotes sustainable methods of transport, which mostly affect the current unsustainable methods. E.g. the urban space reserved to cars, like car lanes and car parking, is being remodeled to bike lanes, bus lanes and reserved e-car parking. While this is an efficient method for the transition, it can be seen as a way of forcing the citizens to alternative mobility methods. But this can resolve in unsatisfied citizens who lacks an understanding of the situation and feels a limited in their freedom of choice.

This report will attempt to understand the users, focussing on their mobility habits and needs. This will be done through researching the users by applying basic ethnographic fieldwork methods such as, interviews and shadowing,

while also digging into the historical changes of the users. These methods will create a better understanding of how and why the users have had a change in the mobility practice previously. The main approach to analyse the user's mobility culture, will be the method of Practice theory. Practice theory will identify opportunities for change in the user's' mobility practice by comparing patterns of consumption, related to the associations surrounding their mobility, and the historical development within the practices.

To support Practice theory and bring in a strong historical perspective, the method of Multi-level perspective been drawn in as a way of providing an overall view of the mobility in Copenhagen. By acquiring this perspective it will provide a foundation to evaluate on the outcome of practice theory on the three differnt levels; micro, macro and meso level, which means a more integrated solutions with a higher degree of success for effecting the transition.

The report will end up with a concept focusing on providing knowledge, education, inspiration and motivation to the citizens. By doing so it is expected that the users willingly will convert to an alternative way of mobility, without being forced through regulations or financial 'penalty' policies.

Problem-statement:
Discovering &
Defining problem within the Mobility sector of CPH

A sustainable urban mobility sector, which has no negative impact on the surrounding environment and is fast, cheap and comfortable whilst also healthy, is a vision that the Copenhagen city and probably many other major cities strive for. Copenhagen Municipality have a vision of becoming CO2 neutral by 2025, and this includes the mobility of Copenhagen. The municipalities plans for doing so is based on boosting the alternatives to the car; e.g. bicycles and public transport, while creating more efficient car traffic and yet limit it their dedicated space in the city. Electrical and hydrogen cars is also considered a part of the solution, so they are investing in a fueling infrastructure for both, while they are waiting for new possible mobility technologies to emerge and assist in the transition towards sustainability. (Copenhagen Municipality, 2009)

From a present day perspective, are the advancements towards a more sustainable mobility system developing too slowly and will not reach the goals of 2025 (Copenhagen Municipality, 2015). Copenhagen is known as a bicycle city, as the percentage of citizens who choose biking is relatively high in comparison with other cities. But the amount of cars in Copenhagen is still high with no notable decrease, so traffic congestion, noise, CO2 emission and air pollution is still a part of the everyday life in Copenhagen (Capital Region, 2014). All these factors which have a significant negative effect on the city environment and the public health. Yet despite these factors, it seems as though the general population lack the initiative to change their mobility habits. They have to be confronted with their habits and taken by the hand to get them started. (Gate 21, 2014)

The sector is mainly technology driven, as it is controlled by actors like the Movia, municipality, government and car manufacturers., while the citizens are waiting for the next convenient technology to emerge and alter their way of unsustainable mobility behaviour without having to compromise their current mobility culture, needs and method. So there is a lack of responsibility among the general public when it comes to their own mobility behavior, in spite of the current focus on sustainability, which has been growing for the last few decades. Yet the political landscape also has an influence and responsibility. The municipality of Copenhagen has shown the willingness to invest and develop in sustainable mobility (Press release by Copenhagen Municipality. 2015), despite the internal conflicts existing in the municipality. But a greater conflict can be seen between the municipality and the government as a change of government in 2015 went from a socialist to liberal party. This means that in the last year have many environmental policies been discontinued, including some that directly and indirectly have had an effect on the sustainable transition of the transport sector, like introducing fees on the electrical car, that resulted in a total halt in the e-car market. (Godske, B. 2016)

The mobility of Copenhagen is in the middle of a much needed transition towards a more sustainable alternative. The municipality have shown their vision and initiative towards sustainable change, but they have run into a conflict with the newly elected government, where the importance of environment has decreased in favor for a quick financial gain in the state treasury. On the other hand there are the users, who have taken a more passive role by waiting for directions and new technologies to alter their mobility behavior.

When looking into which initiatives have been made in order to change the user's mobility habits, most initiatives have been focused on restructuring the infrastructure, issue several regulations and introduce financial policies on certain mobility methods in order to 'force' the users towards change (Appendix 1) By doing so the municipality is risking dissatisfied citizens as their 'freedom' of choice have been limited, and not all situations of the citizens are the same, so the alternatives might not be possible for all, either technically or financially. With dissatisfied citizens is the danger of a political change in Copenhagen's municipality increased and therefore a risk for a new mobility policy. Yet there is a lack of confrontation and involvement of the users themselves in the transition process, except for a few bicycle oriented campaigns, which have shown some limited changes. By studying and involving the users in the transition process, it is possible for a more accepted if not efficient transition to take place, as the users keep their 'freedom' of choice, and will be enlightened and feel involved in the process.

This leads to our **Main Research Question** for the thesis:

How can user-involvement contribute to the development of a more sustainable oriented transition of the mobility in the city of Copenhagen?

To support the study **Two Sub Questions** have been included:

How do the approach of Practice Theory work as a design tool which supports the sustainable transition of the mobility in Copenhagen?

Can a user-oriented approach and holistic approach work in synergy towards developing a more successful transition?

This project attempts to initiate a sustainable transition of the Greater Copenhagen mobilty by using practice theory and multi level perspective, in order to achieve a realistic progress towards a more sustainable and flexible transport community with a greater individual responsibility.

To frame the area of interaction, it has been decided that mobility of Copenhagen municipality and Frederiksberg municipality is in focus as their situations are similar and connected. This means all mobility affecting these two areas will be of interest. Throughout this report several areas will be mentioned and described as the following; City of Copenhagen is the municipalities of Copenhagen and Frederiksberg, Greater Copenhagen is the city of Copenhagen and the surrounding suburbs, The Capital Region is going beyond Greater Copenhagen, as it includes The East and North-East of Sjælland, whom also have a limited political power in the area.

Methodology

Throughout the project will several different methods be made of use for gathering information, analysing and evaluate.

Ethnographic fieldwork has been an important method for gathering empirical data. This project has made use of 3 different forms:
Survey was used to gather quantitative data from the many users. Several multiple choice questions were made with focus on the user's relation to mo-

bility. While a surveys like this do not provide a deeper understanding of the user mobility, does it provide a tendency to which factors they see as important.

Interviews in form of semi structured interviews were conducted to gain a deeper knowledge of the user's commuting mobility. The interviewees were attempted to be found around train stations, parking lots and bicycle parking. The interviews were not recorded, as the interviews were done 'in the field' and a microphone might affect the interviewee. Therefore notes were taken during the interviews. Interviews were also done with some stakeholders and these were recorded, if we were given permission.

Observations were done in several forms. First method was going around Copenhagen and take pictures of the situations and conflicts that could be found. Some participatory observation was also done in form of trying the different forms of transportation methods. Shadowing was done in several persons, as to get an 'uninterrupt' insight into a user's mobility habits. The last observation done was car counting done on Åbouldevarden during rush hour. The point of this was counting how many persons could be seen in each car, as to get an idea of issue.

Two different theories has also been used, one in the form of Practice Theory and the other Multi-level perspective

Practice Theory is the main theory of the project. It is used to analyse user behaviour and understand their choices and how it can be changed towards a more sustainable mobility behaviour.

Multi-level Perspective (MLP) is a transition theory giving an overview of the mobility transition of Copenhagen. MLP respects that several factors have to take place in order to create a transition, and MLP can help finding these factors for the mobility of Copenhagen.

SWOT analysis is used to evaluate the value of the concepts generated by finding the strengths, weaknesses, risks and possibilities

A **Workshop** with a design game included was made. This was done for the purpose of creating a co-design process with the users and the users are driving factor behind the project. By involving the users in the process, should a more user accepted solution be developed, as the ones who understand the users the best is themselves.

research, observations and interviews. First a historical representation of the development of the Copenhagen mobility based on desk research, which helps build a foundation for the later presented MLP analysis (Multi Level Perspective) and support the practice theory and its arguments. Collecting data on historical trends and resource consumption of a target practice can be helpful for two main reasons, the first being because it provides knowledge of the long-term and previous trends which can help identify future trends, and the second being because it can describe the development in resource consumption and intensity in the past as described by Kuijer, S.C. (2014). This provides a level of reference which is required to later evaluate whether the solution will fit into the trend and possibly become a success.

"Project showed that going back at least a century is far more insightful than going back just a couple of years." - Kuijer, S.C. (2014, pp. 57)

According to Kuijer, S.C. (2014) gaining a process overview and an idea of the resource consumption in the targeted practice performance and how they are interlinked is important in order to understand the consumption patterns in the analysis. In this project the focus lies mostly on the emission rather than then consumption, as this is the key factor for a reason of change within the practice. In order to gain an overview of the links between the different processes and consumption patterns in the practice several different types of ethnographic research were done. A short survey about practitioners and how they connect themselves with their type of transport and who they see as responsible for their choices. Next, a semi structured interview was made in order to dig further into the understanding of their everyday transport experience.

Historical Development of Copenhagen Mobility

For several hundreds of years, after the origin of Copenhagen in the 11th century, the main method of transportation within the city was either by foot, horseback or horse-drawn carriages. Transportation over longer distances, e.g. to other countries, was mostly by ship. Back then the citizen needed to live near their workplace, in order to get to work, and therefore the labor market situation was vastly different than what we see today.

Years of 1847 to 1947

The first major impact on the Urban mobility in Copenhagen happened in 1847 where the first railroad was constructed, between Copenhagen and the city of Roskilde, a ground breaking technology, which later evolved into a more urban form of transport, but in 1847 the trains only went to Roskilde, and therefore had a limited impact on the urban mobility. Yet the innovation of the railway system had played an important role in the further development of mobility and the city itself while it also was among the first options for people to reconsider their mobility needs.

In the late 18th hundreds a new possibility emerged, one whose impact on the Copenhagen mobility was quite revolutionary, yet simple. This is where the economically viable 'safety' bicycle model emerged into the city picture. The bicycle gave the ordinary men and women a new option for mobility, and in that a much bigger radius of movement. This gave the general population the ability to move away from the inner city's cramped small apartments and move out to the nearby growing suburbs. The bicycle become a function of 'free' movement in the city as well, it is flexible and it could go around every corner and small street in Copenhagen. The local distribution of goods was also given a boost, with the danish made cargobike 'Longjohn'.

"The bike could go anywhere, from door to door, was independent of routes and travel times, should not be fed, was more effective than walking, and it proved to be faster than most other forms of transport." - Nørgaard Jensen, (1981, pp. 28)

The bicycle became a great tool in urban transportation, and it became such a big part of the mobility that Denmark called itself 'Land of the bicycles' in the interwar period. This came to be a benefit for Copenhagen during the Second World War, as gasoline and rubber were limited resources during the war,

though the rubber did become an issue even for the bicycle (Fruensgaard N.O., date unknown).

In the same period of the late 18th hundred, the horse-drawn carriage evolved into 'tram' system in Copenhagen. These 'trams' were generally a big carriage which ran on rails placed in the road, while pulled by horses. This horse-driven tram system was only for short distances within the inner city and only 3 different routes existed. It existed for only approximately 30 years, because in 1901 the electrical tram system came to Copenhagen which phased out the horse driven system during the years that followed.. The electrical tram system, became a big part of the Copenhagen mobility in the many following decades. It evolved into 22 different tram routes, it was cheap enough for the general population to use, and it became a dominating part of the Copenhagen city picture. Like the bike, the tram system provided a broader radius of mobility in Copenhagen. This meant that the mobility needs of the citizen changed. Now it was possible for the worker to acquire work outside of their own neighborhood or move out of a highly industrialized neighborhood and yet still get to work. With both the bicycle and tram system in the city, it was possible to divide the residential and industrial areas (Jeppesen, J. G. 2011).

Despite the gasoline car first being introduced in Denmark in the year 1888, it took some time before it really took hold on the market. The main reason for this was of course the big expense of purchase, so it was only a means of transport for the wealthy upper class population. But also a proper gasoline infrastructure needed to be created as well as certain elements of the car needing development, e.g. the drum brake in 1902 . The car situation didn't significantly change until after Henry Ford developed the method for mass pro-

Berlinske (2013)

duction assembly line for the Ford T model, and in 1919 Henry Ford opened an assembly line in Sydhavn in Copenhagen. A few years later the competitors General Motors and Mercedes Benz followed. As a result of cheap mass production and local production, the car prices were reduced dramatically and now a greater proportion of the general public could afford a car, so the car market escalated (Lund, M., 2013) By 1933 117.000 cars were used on the Danish roads, yet economic crises and the following Second World War brought the market to a halt. It wasn't until the 1960's that a car became common property for the general population (Den store Danske).

In the start of the nineteen hundreds the gasoline driven bus (called an omnibus) had started to appear in the Copenhagen transport system. The old horse-driven omnibus had almost disappeared due to the electric tram system having taken over, as it was faster and much more comfortable. But now the omnibus had slowly come back into the market, as it became faster, easier to implement and as the suspension technology evolved. Proliferation of the busses escalated rapidly during the interwar period, yet as the 2. World War reached Denmark, it came to a halt as a result of fuel and rubber restrictions (Den Store Danske).

In 1934 the first part of the S-Train system emerged. It was a project emerged from the idea of electrifying the local railroad system around Copenhagen, and the S-train became the first electrical rail system in Denmark. The first routes of the network were quite local to Copenhagen, as they mainly went between Copenhagen Central Station, to the nearby areas of Frederiksberg, Vanløse, Hellerup and a little further out to Klampenborg. A few years later, in 1936, a new route was acquired into northern greater Copenhagen, from Hellerup, to Holte through Lyngby. The s-train system had a basic timetable where all routes had departures of a 20-minute interval.

The Finger Plan from 1947

The effect of city planning

As a result of massive population growth in Greater Copenhagen, but no existing coordination, a municipal planning committee was established. In 1947 a plan was made for how greater Copenhagen should grow and develop in the time after the 2nd World War. The finger plan has received international acclaim and is now considered a part of the Danish cultural heritage and represents the Danish architectural values and quality. The main objectives of the plan were ensuring that the citizens of the suburban areas could get around greater Copenhagen easily, but also to control the urban growth and create order and beautiful physical surroundings, by having recreational areas called

'Green Wedges' between the fingers. The 'Green Wedges' were a central element in the plan to avoid the enclosed feeling often found in other metropolitan areas, by maintaining the nature between the 5 fingers, which give the citizen easy access to light, nature and fresh air (Mortensen, M. T., 2013). As a tool for realizing the finger plan, the s-train system was expanded and used for controlling the city growth, at this point the car was still for the wealthy part of the population. In each of the 5 'fingers' in the plan, the rail system was expanded for the s-train, along with stations for each suburban city, which resulted in great city growth around the s-train network, following the rails or 'fingers' out. This is known as Transit Oriented Development (TOD) (Knowles R.D., 2012).

From Bike to Car

Soon after the creation of the Finger Plan, an unexpected transition took place in the mobility of Copenhagen. In the end of the 1950's an economic upswing took place in Europe and Denmark, which meant that an increased interest in the car was shown among the general public. This was not foreseen in the Finger Plan, as it was built up around public transport. The finger plan worked as a element for distributing the citizens of Copenhagen out to the suburbs, by having dense city development emerge in a near proximity of the s-train stations. Yet a nation issued regulation supporting single family houses, was counteracting the dense city development and spreading out single-family houses across wide areas in the suburbs. Together with the upcoming market for cars, this meant that the market became even greater, as now the citizens of the suburbs had a more free option for longer distance transportation without living in proximity of a train station. This development was not included in the Finger Plan, which meant that the road infrastructure of Copenhagen was insufficient and therefore became the new focus of development in the Copenhagen area in the following two decades, which to some degree reduced the visioned effects of the Finger Plan (Pineda A. & Vogel, N. 2014).

More locally in the city of Copenhagen, has the electrical tram system expanded, to be an essential part of the citizens mobility. In the mid-end of the 1940's the tram system was at its peak with approximately 280 million passenger transits a year. Yet there was an inflicting factor to this, oil and rubber regulations from the war period, which meant that the existing busses were at a halt.

Picture: The tram system in Copenhagen in 1952
Source: Ojgaard, A. (2016)

A change in the political landscape took place few years later, as a new "tram-road mayor" came into the picture. He was firmly fixated upon changing the tram infrastructure to a bus infrastructure, as tram wagons were worn down and he saw the bus as rational and a modern form of transport. He did so by replacing the current director of the tram company with a new one who was formerly from a bus company. 2 years later, in 1965, a plan was presented called "Langtidsplanen" which was focused around replacing the tram system with bus routes in yearly steps, so by 1973 the last 3 tram routes were replaced and this marked the end of the electrical tram in Copenhagen (Ojgaard, A. 2016).

During the 1960's it became accepted that the car was the primary form of transport for the citizens. By 1973 a car oriented plan was developed, that involved moving future growth out of Copenhagen and constructing a highway network combining the areas of 'Sjælland', south and west of Copenhagen, and a connection to Sweden. In the meantime an oil crisis and halting economy put a stop to the plan, with pressure created by Jan Gehl (author of 'Livet mellem husene') and other city planners and organisations, who pushed for developing a better infrastructure for bikes and pedestrians. This lead to a revival of the bicycle in Copenhagen, despite the rest of Denmark experiencing a small increase in the car market. (Pineda, A. & Vogel, N. 2014)

A plan, inspired by the Finger Plan, was developed in 1992, which was centered around metro system in Copenhagen. The metro was used as a tool for city planning and development, as it connects the inner city with a new area, Ørestaden. The concept behind this was creating the infrastructure before the city part itself. This way will the ground plots in Ørestaden be interesting for investment firms and the income from the sales of the ground plots could be used to support the construction of the metro. (Mortensen, M. T. 2014) The

background for the plan was centering around connecting Copenhagen to the Swedish city Malmø, as response to create a European area of interest as for international investments. (Pineda, A. & Vogel, N. 2014)
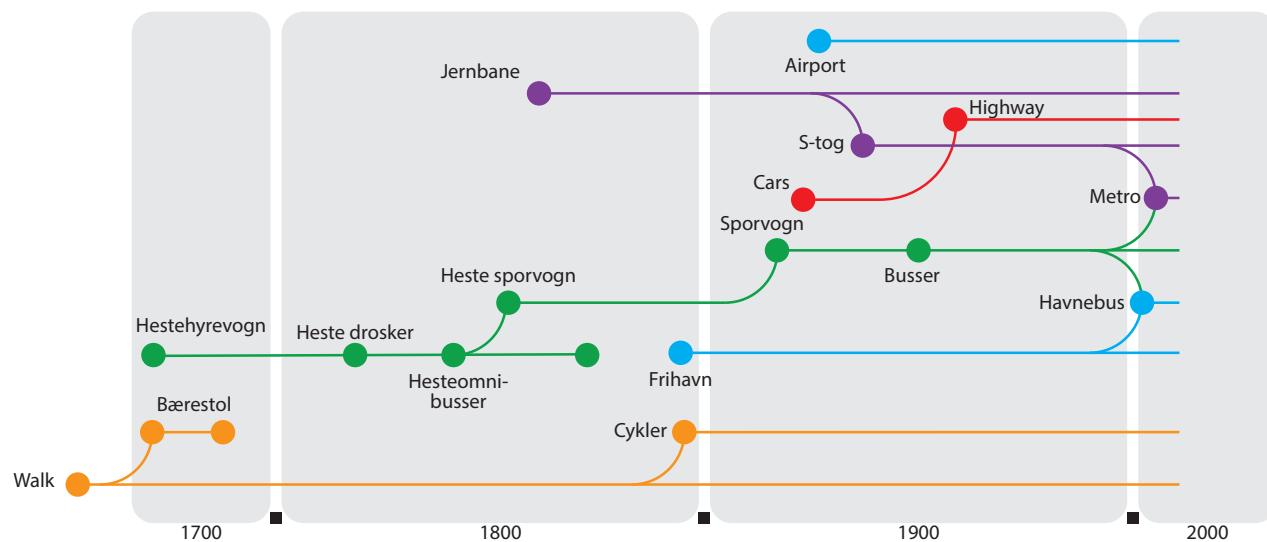
Table: Transport Technology Timeline for CPH
Source: Different Sources

The Current Mobility of Copenhagen

This chapter will map out how the current transport situation is in Copenhagen, based on desk research and ethnographic field work included. This information will give an information about the current technologies, infrastructure and policies which the system consist of, which will be used for analysis and evaluation on later in the project.

The area of greater Copenhagen consists of over 1.2 million inhabitants spread over 18 municipalities, and the municipality of Copenhagen plus Frederiksberg, which are known as the Center of Copenhagen, accounts for approximately 700.000 the inhabitants. Such a great area and amount of people creates the need for sustainable mobility solutions, as a big amount of people enters and exits Copenhagen each and every day.

The mobility of Copenhagen can roughly be divided into 3 main forms of transportation; Car, public transportation and cycling. Copenhagen is known to be a quite high ranking on an international when it comes to sustainable mobility. This is because of the high amout of biking seen in Copenhagen especially when commuting between work and home. This is shown in the illustration below.

FORDELING AF TURE 2014

Pie chart 1 — Ture til arbejde og uddannelse i Københavns Kommune: 45 %, 5 %, 23 %, 27 %

Pie chart 2 — Københavnernes ture til arbejde og uddannelse i Københavns Kommune: 63 %, 10 %, 10 %, 17 %

Pie chart 3 — Alle ture med start og/eller stop i Københavns Kommune: 30 %, 17 %, 33 %, 20 %

Pie chart 4 — Alle ture med start og/eller stop i Københavns Kommune, gang undtaget: 36 %, 40 %, 24 %

Legend: Cykel · Off. transport · Bil · Gang
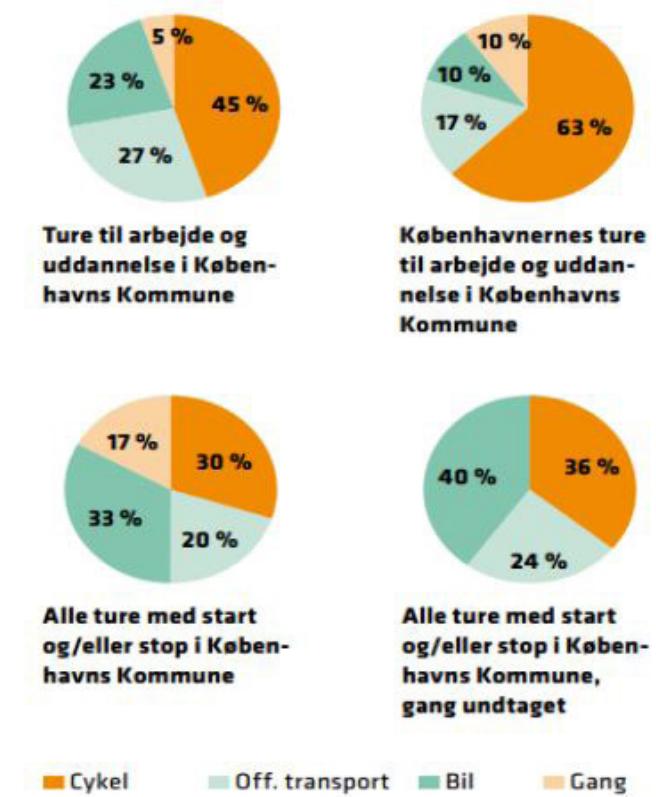
Picture: Division of Trips
Soruce: Copenhagen Municipality (2014)

Yet despite of such a high percentage of cycling, does Copenhagen stil stand before a quite unsustainable mobility in form of the car which is a result of the previous industrialization where the car took hold of the market. Yet the unawareness of the effects of the car have lead the to current issue that Copenhagen and world is now faced with.

The obvious and quite known issue with the transport sector in general is its high contribution to CO_2 it delivers to the atmosphere, that contributes to the global warming. The consequences of global warming which we are already seeing is the average global temperature has risen and the polar ice is melting faster than it can regenerate, and therefore the sea level is rising, courses floods at the low placed areas of the globe.

A more central issue for an area like Copenhagen is the air pollution as a response to being a high density area. Especially during the rush hour traffic in the morning and afternoon, can the high pollution be a health problem for

the citizens. It is described by Brandt, J. et al (2013) from DCE - The National center of environment and energy in Aarhus, that the air pollution in Copenhagen was responsible for an estimated 540 premature deaths in 2010, and is the cause of some people's suffering from breathing issues. According to Jensen, S.S. et al (2013) 80% of the vehicles on 99 roads in Copenhagen were personal cars, making private cars responsible for most of the NOx and CO2 pollution in Copenhagen.

In the graph below shows the difference in CO2 emissions in relations to how filled the vehicle is eg. 20% means 1 person in a car.
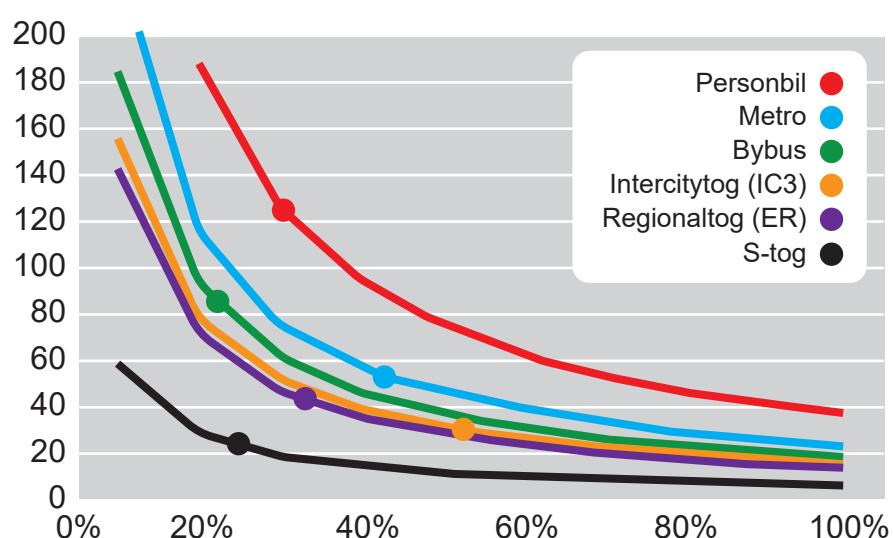
Table: CO_2 Emissions Compared to Coating
Source: Transportministeriet (2010)

This shows another issue with the current car commuting in Copenhagen. While car has usually 5 seats, is the average amount of person per car extremely low. From a car counting observation made during rush hour on Åboulevarden, is seen that the average amount of persons per car was 1,12 persons.. This means a lot of extra unnecessary traffic in Copenhagen.

The graph is calculated for the whole of Denmark, so in the case of Copenhagen, there are some considerations to be made as there are a more of queuing in Copenhagen, so therefore the car and buss emission will be higher, but also do busses have a lot more of stops in Copenhagen compared to the rest of the country and therefore a lot more acceleration and breaking, means an even higher emission for busses, whereas the trains, S-trains and metro will stay the same, especially the metro and S-train as it only exist in Copenhagen.

In the following will the different main elements of the mobility be described.

	NO_x	PM_{10}	$PM_{2.5}$
PASSENGER CARS	43%	62%	57%
BUSSES	15%	7%	7%
TRUCKS & VANS	42%	31%	36%
OVERALL	100%	100%	100%

Table: Average Pollution Distribution
Source: Jensen, S.S. et al (2013)

The Car

Currently the car situation is that almost all cars run on either gasoline cars or diesel, despite that electric cars, hybrid cars and hydrogen cars, have existed for several years. As gasoline and diesel are fossil fuels they have a high emission rate, and therefore contribute to the global warming and air pollution in the world, and even more so, the pollution in the city of Copenhagen. Despite Copenhagen being known as a bicycle city, does Copenhagen still have a high amount of car traffic, actually it has increased over the last years because of Copenhagen's population growth. This leads to a lot of traffic congestion throughout Copenhagen, especially during rush hour traffic. It is estimated that during rush hour the average transit time by car is prolonged by over 15 minutes. When cars are caught in the traffic queues, it becomes the peak time of most emission and pollution per kilometer. Though in recent years the smaller and long mileage per liter 'microcars' and in general a focus on longer mileage technology, have been coming rushing into the sector, which of course have reduced the emission per kilometer. But this reduction focus does not change the problem in reality, as the 'micro-cars' cheap economy has enabled more people to afford a car and more families to acquire a second car. (Københavns Kommune, 2015)

Despite this the popularity of alternative cars are currently on the rise. The electric car has steadily begun getting into the Danish market, as the infrastructure of charging station have started expanding, and the mindset of people has begun to change. 2015 has been an especially great year for e-cars, the market tripled compared to 2014. This can be seen in the graph below:
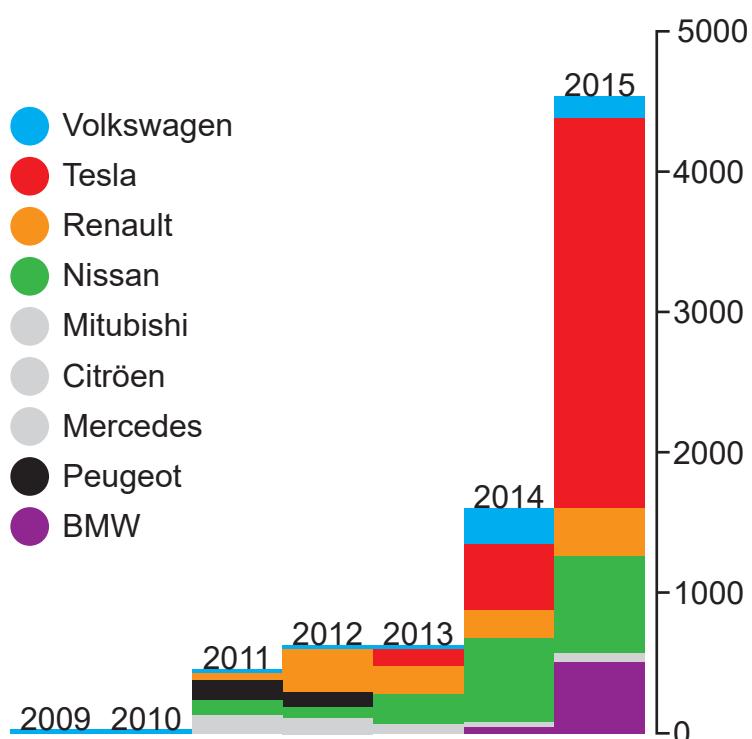
Table: New Registrated El-Cars in DK
Source: Dansk El-Bil Alliance

Here it can be seen that the Tesla sales have grown enormously, compared to the competitor e-car brands. Tesla is the luxury e-car brand on the market, the sales price is much higher than the competitors, but they also have a bigger battery package enabling longer distances between charges and therefore more flexibility which have made Tesla more attractive.

Recently the government made a change to the electrical car regulations, so now usual car fees will increasingly be applied to e-cars over the next 4 years, starting with 2016. This fee could also have been an influence on the 2015 sales, especially on Tesla as it would affect them the most.

Despite the electric car being seen as the sustainable solution, everything is not so 'green' in the end. First of all the electricity production is an issue, as this can lead to a CO_2 emission close to the emission of a regular car, if no green energy is supplied to the energy system. Fortunately, Denmark has great conditions for e-cars with over 40% of wind energy in the system.(Hansen, T. H., 2013) The second problem with e-cars is the production, as they pollute over twice the amount of CO_2 compared to a regular car. One reason for this is the mining of Lithium for the battery production. Therefore, an e-car has to drive over 100.000 km to be a more sustainable choice compared to the regular car. (Lomborg, B., 2013)

This leads to another alternative of the hydrogen car, which is basically an electric car, where the battery is switched out with fuel cells that convert hydrogen into electricity and water. The hydrogen car has the advantage of being able to be instantaneously fueled like a regular car, yet the hydrogen infrastructure is still quite limited.

Two big advantages of electric and hydrogen cars, are first and foremost, that despite how the electricity and hydrogen is produced, the car does not emit any local pollution to where they are driven and therefore does not add to the issues of city pollution and public health in Copenhagen. The other advantage is the possibility of being a part of a bigger more sustainable energy sector, as electrical cars can be plugged into the electricity grid and here the batteries can be used as an electricity buffer for storing energy when the fluctuating wind power is exceeding the current electricity demand. Another possibility is using the extra wind power to convert saltwater into hydrogen, which can be used in hydrogen driven vehicles.

Public Transport

Copenhagen has several services available for public transport. Most organizations offering transport is owned by the municipalities or state.

The S-train system, which connect Copenhagen, with the surrounding suburbs around Copenhagen. As a result of the 5 finger plan, the S-train network has expanded to reach the towns of a 40 km radius of Copenhagen Central Station, so the towns like Hillerød, Køge and Høje Taastrup are included. It has departures every 20 minute on all lines, and every 10 minute doing rush hour.

There is the metro which partly connect inner city with the airport and the southern part of Copenhagen, known as Amager and Ørestaden. The current Copenhagen Metro opened partially in 2002 and more of it opened in stages towards 2007. It has two lines, M1 & M2, which goes from Vanløse to Copenhagen Airport, and the other from Vanløse to West Amager. In 2019 the metro network will expand, with two new lines that will be known as the CIty Ring. The City Ring will connect the inner city of Copenhagen more efficiently, and move many of the user of the S-train and busses to the metro, and hopefully also motorists. In the following years will the city areas of Nordhavn and Sydhavn also be included.

The organisation Movia, iis servicing the bus system that connect Copenhagen all over with different bus lines. Some bus lines are Express line going out of Copenhagen, others a connecting to the S-train stations across the s-network, and others have a focus on inner city transportation with departures

every 5 minutes.

As these services are owned by the municipalities and state, there is no competition between these services (Appendix 5) This gives some positives and negatives, as it means that a great cooperation between the services exists, especially when transiting between different services, as the payment platform for the different services are collected into one. But on the other hand it means there are no completion to hold down the prices, which is seen as quite expensive, and that is despite of governmental subsidy are quite high to the services.

The Bicycle

Copenhagen is known to be a 'Bicycle City'. In 2014 it could be seen that of all the everyday trips to work/education in Copenhagen municipality is 45% of them on bicycle.(Copenhagen Municipality, 2014) The bicycle is the cheapest option for transportation is Copenhagen; only a small investment in a bicycle is needed. The only emission existing is in the production of the bike, which is quite low and almost non existing in comparison. The municipality have a strong focus on increasing the amount of people choosing the bicycle, and therefore the municipality are expanding the current bike lane infrastructure, by making the bike lanes wider, creating "super bike-lanes" and develop green bike routes, while regulating the traffic light infrastructure in order to make the "green waves" for cyclists. The municipal motivation for doing so is less pollution, it is an inexpensive infrastructure to develop (Appendix 1) and it is shown to have a big health benefit which can be seen on government's health budget. Cargo-bikes have begun show up in Copenhagen City; recent data shows that 26% of Copenhagen families own a cargo bike. It has a greater storage capacity for transporting the kids to their institution and for grocery shopping, and therefore substitutes the need for cars in the city.(Copenhagen Municipality 2014) Electric bikes are also emerging on the market. They have a higher CO_2 emission than regular bikes, but it has the benefit of travelling longer distances and getting a hold of people who usually would choose another alternative.

Other alternatives

Other alternatives to these forms of transportation do exist in transport sector. In the recent years the concept of shared cars has emerged. Special car rental services such as Car2Go (now closed in Copenhagen) and DriveNow, give the users a new option and provide an alternative to buying a car. Most of the

time in Copenhagen a car is not needed for the regular transport needs, yet at special times the need for a car does exist, so these car services provide the citizens with a simple rental method of a car, which is placed all over the Copenhagen area (including nearby suburbs) and can be simply found by the help of a mobile app. Over the app it is possible to open the doors on the car and pay for the rental on a minute rate. DriveNow is currently the biggest actors on this market, whom have made all the cars electric and also give the option of using the public transport system's 'Rejsekortet' for payment of the car. A similar car service is also in play, which is known as GoMore. GoMore is a service platform for which car owners can rent out their car, for either a short or long time. Another option on the platform is carpooling, so a car owner can upload their area of departure and destination, for which people than reserve a seat for an exchange of a monetary contribution to the cost of gasoline.

A new service called Uber has found its way to Copenhagen. Uber is a kind of private taxi service with a mobile app belonging to it. The car owner has the option as working as a taxi driver, by applying to be a 'Uber driver' and through the app the customers can book a taxi, give reviews of the driver and pay over it as well. Yet currently there is a political debate about the concept, and whether it is illegal or not, so the future of Uber in Copenhagen is uncertain.

A more unique alternative is "hitchhiker pick-up points". It's an organization which have made some designated pick-up areas for hitchhikers to place themselves, and for willing drivers to pick them up.

An old invention that could work in create cooperation with the public transport is the skateboard, as it can diminish the need of changing between transports and make it slightly faster. Yet Skateboarding on public roads has been banned. While roller skates and scooters (løbehjul) are legal on the sidewalk, the sidewalk ground is not very wheel friendly, also roller skates are not very practical to combine with public transport and scooters have a negative reputation among people (Jensen P.B., 2012).

The Political Landscape

Copenhagen municipality wants to brand themselves as a green sustainable urban city. As a result of this they have set up the ambitious but somewhat realistic goal of becoming CO2 neutral by the year 2025 and this includes the Copenhagen mobility sector. For Copenhagen to achieve this vision, the municipality created a Climate Plan in 2009, where they describe which goals they need to fulfill the vision. Firstly they want people to use the alternatives to cars, so biking and public transport. They also want to reduce the car traffic by creating environmental zones, redirect the traffic and present a 'congestion ''. But the car is not to be completely phased out of Copenhagen. The municipality want a more efficient use of cars by implementing intelligent traffic systems and developing an infrastructure for electric and hydrogen cars. The

municipality wants to lead by example by investing in own electric and hydrogen vehicles for municipal use, and reducing the CO2 reduction on transport of garbage.(Copenhagen Municipality 2009) To achieve these goals set in 2009 have municipality invested and developed on both infrastructure and material. Today almost 7 years later, it is possible to see many of the projects already made, under development or planned. As previously described, has the bicycle infrastructure been improved, by creating, wider bike lanes, 'green bike lanes', 'super bike lanes' and 'green waves' through the light regulations, which will be considered a part of the 'PLUSnet' that is network of bike lanes that ensures high standards for safety, road crossings, maintenance, space and speed. More bike parking for both regular bikes and cargo bikes is also in focus, which will be developed in dialog with the local businesses. (Copenhagen Municipality 2011). A report made in 2014 by Copenhagen Municiplaity called Copenhagen city of bicycles, shows the effects of cycling on the national economy. When including time, health, maintenaince and accidents, it can be seen that for each kilometer a peron bikes, is 1,62 kr is gained on a socioeconomic scale as the health beneifits are so great that it exceeds the costs. To compare it can be seen that the use of car per kilometer costs 5,64 kr, as the negative effects it has on healthy, both privatly and socital, are a major expence on the socioeconomical scale. (Copenhagen Municipality, 2014)
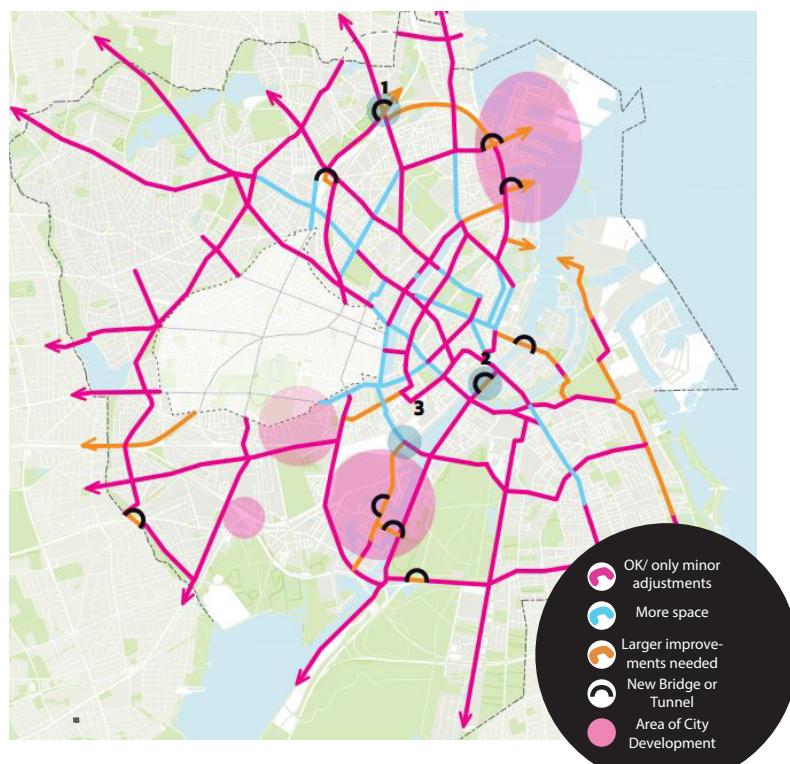

Illustration: Copenhagen City Bike Plan
Source: Københavns Kommune (2011)

A focus on the public transport system is also in progress. Dedicated bus lanes are created to make the bus system faster and more reliable. New particle filters are being installed on the buses, while testing on electric buses is undergoing on certain routes. In common for the improvements on both the biking and bus infrastructure is that takes up space from the cars. So parking spaces and regular car lanes are converted into bike lanes and bus lanes.
.
Another project being implemented have also previously mentions Intelligent Transport Systems (ITS). ITS traffic systems that can regulate conditions of the infrastructure to adapt the changing traffic needs. This is mainly done through traffic light regulating. This means less traffic congestions for both cars, buses and bikes. New project which will be incorporated into the ITS, is these LED roads, which can change the purpose of specific part of the road, so a part of the road can be converted into either a bike lane, a bus lane, or sidewalk after the timely needs. (Copenhagen Municipality 2011)
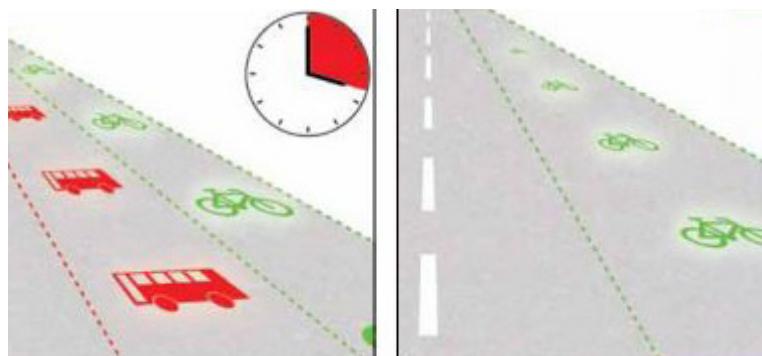
Illustration: LED Bike- & Bus Lanes
Source: Københavns Kommune 2011

Investments in the electric car infrastructure as also developed quite a lot in the recent years, so now it has several hundred of charged spread across Copenhagen (Dansk elbil allience, 2016). But the infrastructure for Hydrogen cars is quite small. Only 3 hydrogen stations exist in the Greater Copenhagen area (Brintbiller.dk, 2016).

Yet despite of all these initiatives and developments, is Copenhagen still behind on the reduction compared to the plan.

" Even though emissions are dropping, the City of Copenhagen is a little behind schedule on meeting its goal of carbon neutrality by 2025." - Copenhagen Municipality (2015 pp. 6)

The policy of 'commuting allowance' is government issued policy giving subsidies to people who have over a 24 km a day commute to and from work. For each kilometer traveled over the 24 kilometers, is a subsidy given. While 'commuting allowance' makes it financially attractive for the citizens to commute longer distances, does it also provide a negative impact on the mobility transition as gives the private car owners a better financial footing for driven even longer.(Bertelsen, T. N., 2008)

Due to elections in 2015 did Denmark have a replacement of government from a socialist to a liberal. This has meant a lot of changes in both the environment and transportation policies as a result of a more economical perspective. Several cost savings have been introduced to the supported green transition projects and universities research. (Hansen, J.L., 2015.)

A hard hitting policy change was seen on the electrical car. For the last many years have the electrical car been free of the 'car registration tax' on a 180%. This was done in order to make the electrical car more attractive economically as it is quite expensive compared to a regular car. Yet this as of start of 2016 has 20% of the tax been partly introduced, and it will increase yearly towards 2020 where it will be at max. (Kristensen, F.B., 2015.) This change of policy have halted the e-car market dramatically. (Ritzau., 2016.)

Recently the ministry of Transport leaked a evaluation report about the planned Light Railway system that is supposed to connect surrounding suburbs around Copenhagen more efficient. The light railway system is like a electric tram system, but with higher velocity and more isolated from the regular traffic. It is funded by the Region of Copenhagen, the involved municipality and the state. Yet the report from the ministry shows an analysis which claims a Bus Rapid Tranfer (BRT) system would be cheaper. Yet this is not electrified transport systems (Bredsdorff, M., 2016)

Survey on Transport Thinking in Copenhagen

Creativing a survey helps to gather opinions, visions, observations and experiences from informants, subjects and respondents to build up a knowledge on actors within the mobility of the Copenhagen municipality. The data on and in the later analysis of social practice theory, and be a part of the quantitative data types. The questionnaire also seeks to confirm our hypothesis of whether people identify themselves with their type of transport, and the reasons for choosing them. The questionnaire was shared through different social groups on facebook, and got 27 respondents (See Table: Questionnaire on the Copenhagen Transport, Appedix4).

"Investigators are primarily interested in discovering the cultural knowledge of the subject; they seek to confirm or disconfirm a specific hypothesis by studying the subject" - Spradley, J.P. (1979, pp. 29).

The questionnaire seeks to get quantitative data on these assumptions, and to look for coherency in the suggested hypothesis, in order to achieve enough data to see a similarity in opinions to ensure success in the further development of the project and the problem formulation.

The questionnaires' will primarily be based on the methods provided by James P. Spradley "The Ethnographic Interview" to ensure a structured usage of the ethnographic elements and a coherency in method, structure, data, data-coding and analysis.

"Theory of planned behavior as the basis for delineating between key constructs including attitudes, social norms, perceived behavioral control, behavioral intention, and behavior through the use of questionnaire surveys of publics. As Whitehead et al. (2011) highlight, such research aligns well with the implicit values held by policy makers, who have come to value research that utilizes large samples, measures constructs quantitatively and with reference to theory, and, in a quantifiable sense, research that can be replicated reliably." Barr, S. (2015, pp. 94)

Data

The results show that most people use bikes, and use public transport secondarily which contradicts the statements "36% of all persons working or studying in Copenhagen cycles. That comes to 1.27 million cycled kilometers every day of the year. The figure covers both locals and commuters." Copenhagen Municipality (2012) and" 52% of all Copenhageners cycle to work or study every day - even if it is outside the municipality." Copenhagen Municipality (2012), but we have to consider that most of the people in this survey were students or people in similar financial situations, as the survey were shared in facebook groups where students represent an estimated 75% of the users. The survey was shared on Aalborg University social group and on Workspace social groups, both on facebook.

The questionnaire showed a big tendency towards choosing types of transport based on their speed/time and convenience, and even though around 50% have access to a car, only around 15% use that option meaning that the car often isn't the fastest or most convenient. The survey also shows that people want faster and cheaper means of transport, and around 50% would change

their habits toward more environmental friendly solutions.

Questionnaire on Copenhagen Transport

How do you Transit to and from school/work etc. usually?

- CAR
- BIKE
- WALK
- TRAIN / METRO
- BUS
- OTHER
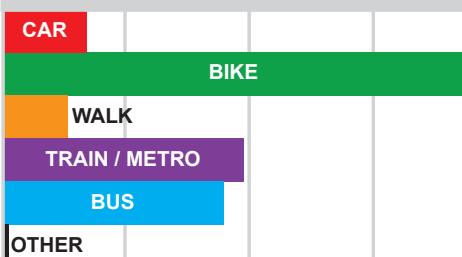
Who do you consider responsable for providing options in the transport sector

- COMMUNITY
- THE MUNICIPALITY
- THE GOVERMENT
- DSB, METRO & ARRIVA
- OTHER

Why do you use this type(s) of transport?

- ENVIRONMENTAL FRIENDLY
- HEALTHY
- IT'S FAST
- IT'S EASY
- IT'S FUN
- IT'S CHEAP
- OTHER

What would your resons be for making a mobility change

- ENVIRONMENTAL FRIENDLY
- HEALTHY
- FASTER
- EASIER
- MORE FUN
- CHEAPER
- OTHER

What options are available for you in you area?

- CAR
- BIKE
- WALK
- TRAIN / METRO
- BUS
- OTHER
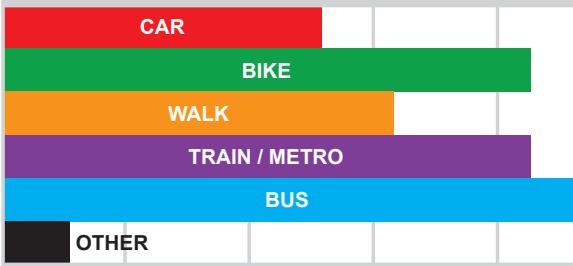
What type(s) of transport do you use for unregular trips (not work/school)?

- CAR
- TAXI
- UBER
- GOMORE
- OTHER CAR-SHARING PLATFORMS
- PUBLIC TRANSPORT
- BIKE
- OTHER
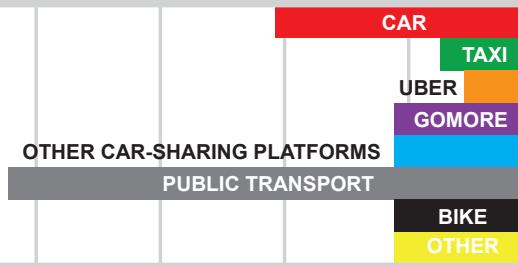
Do you identify yourself with the way you transport yourself?

- YES
- NO
- I DON'T KNOW

Do you feel that you are provided with opportunities to change your transport situation?

- YES
- NO
- I DON'T KNOW

Interviews With The User

In order to get a better understanding of user's view, several interviews were conducted, with people in different locations, mainly picked at s-train stations, car parking lots, and bicycle sheds.

The interviews were semi structured, in order to give a better and more relaxed conversation with the user, as it can give more reliable information about the user. For this same reason it was decided record the interviews, as the user can feel more evaluated when a microphone is held up in front of them. Therefore notes were discreetly written, but this could have lead to a loss of information due to not managing to note everything down properly and because written notes do not capture the tone in the voice or the body language during the interviews. Yet when aware of these issues, it should be possible to limit them. The interviews have shown:

- Some argument that it is cheaper to lease a small car when traveling a long way. (e.g. Hillerød)
- Tired of traffic congestion
- Like the cycling conditions, but still room for improvement
- Do not feel heard or do not know how.
- Some want an alternative to biking.
- More of the wider bike lanes and green lanes
- Choosing the bike because it is cheap and fast in CPH
- Transportation method can vary for some people depending on the local weather.
- Public transport too expensive,
- Minor interest in sustainability and health (to a lesser degree).
- Price and speed seems to be the most important factor for people when choosing transport.
- Need encouragement
- Happy about s-train system, as it is reliable and fast
- Unhappy about bus-system, unreliable, and slow during rush hour through inner city.
- Want cheaper public transport
- No tendency to contact DSB, Movia or the municipality with complaints or ideas.

These interviews gives an insight into the user's view of Copenhagen mobility, both by the facts they mention, but also on the facts they lack to mention. It is important to point out that the majority of interviews we managed to get a hold of were mainly in the age bracket of the 20's to early 30's and we only managed to get a few interviews with users over 40.

In the illustration above the main perspectives can be seen that were extracted from the interviews. Many of the younger people choose to bike as it is the cheapest and usually the fastest in Copenhagen. Most of the interviewees seems quite happy about the current infrastructure for biking in Copenhagen, yet with room for improvement. They seem quite happy about the new concepts being implemented, like 'green waves' and the 'green bike paths', but other areas still appeared to have trouble with crowding at certain bike lanes. When it comes to the public transport system, it seems to be more split. Some complain about it being unreliable and crowded. While others see it as easy and running with short intervals. When digging more deeply into this, there seems to be a satisfaction with the S-train system as it is fast, and mostly reliable, while the bus system is mostly seen as slow and unreliable, especially during rush hour. But all seem to agree on the pricing for public transport is too expensive. A feature there seems be popular is the possibility of bringing the bike with them in the S-train. Yet some complained that the accessibility of the bike is not so easy as in Copenhagen is the station platforms often elevated or underground, with only one small elevator and it is therefore annoying to carry the heavy bike up and down stairs. When it comes to cars, the car seems to be close to a necessity when living outside inner Copenhagen, especially when needing to go shopping or pick up the kids from the institution. But all agree that the massive amount of car traffic during rush hour is annoying and a waste of time. Some switch between using car or public transport, but mostly it depends the weather at the time. One of the interviewees mentioned that he almost felt guilty when using the car getting to work. The pricing of owning a car does also seem to be a issue to the users, yet users living in the outer municipality of the Capital Region, complain that using public transport from their municipality into the Copenhagen municipality is almost the same price a month as leasing a small car.

To go deeper into the user's culture and associations of the their mobility, is somewhat harder and it is mainly assumptions based on coding of the interviews, by' analysing' the text and the 'body language' of the interviewees during interviewing.
In general the idea of sustainable transport does not seem to be a issue filling much the user's mind, as no one mentions it during the interviews. Yet when asked about sustainable mobility, people in general support it and even some can feel a bit of shame about not having considered it. The idea of owning car when living in the suburbs surrounding Copenhagen, does seem to have special status among the users. It appears that they believe a life in the suburbs would not function properly without one, and it gives them the freedom

of mobility around their city at all times. Yet in Copenhagen the view on cars is the other way around, as it is mostly seen as being difficult and expensive, this can be because of high amount of traffic and lack of parking, which also are seen as an annoyance from a bike rider's perspective, who are mostly citizens are of Copenhagen. In Copenhagen bikes are seen as a "Copenhagen thing" and are pretty much a must have for being a 'real' Copenhagener.

Discussion on research

Throughout the research it can be seen from a historical perspective that 2 major factors; new technologies and the political landscape, have been the main drivers for transitions in the mobility of Copenhagen. It is seen that a political desire for dividing up residential and industrial areas, lead to commuting distance becoming longer, and the users adapted by changing their transport behavior, by using new mobility technologies as the bicycle or tram. Similar situation was seen later, when the municipality introduced the Finger Plan. The citizens moved to the suburban areas as the s-train network was developed. In these 2 cases are a political direction and a new mobility technology the carrier of change.

In the 1960's with the cars sudden uprise in popularity, it was against municipal wishes, as the finger plan was based on the s-train network. The agent of change for this transition was the economical upswing in the period providing the general public a freedom of choice to a higher degree concerning their own mobility. So here did a economic upswing work provide the citizens with a new choice, a technology which previously had been a representation of wealth and therefore a tempting choice for the citizens. In the 70's did a social movement and a oil crisis put an end to the government's proposal of creating a extensive car infrastructure, meanwhile the bicycle came back into the streets of Copenhagen, while the rest of Denmark continued in increasing the numbers of cars. So in these two cases it can be seen that global economics together with the citizens own priorities goes against the politics of the municipality or government. In the illustration below can the effects of technologies, political interference and economical situations be seen on the numbers of new registered cars per year and the general car population increase throughout the last 50 years in Denmark.
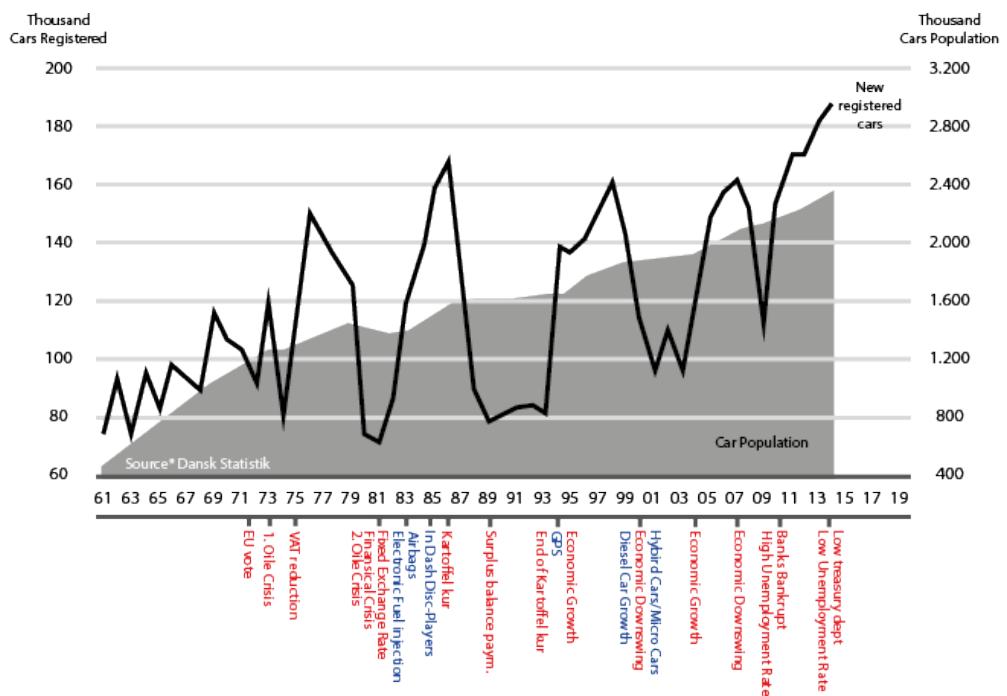
Table: Development of Car Registrations Over Time
Source: Different sources

So from a historical perspective can a tendency be seen, that the factors of politics, economy, technology and social pressure seems to have impact on creating a transition of the mobility in Copenhagen, but also that in order for the transition to take place, is two or more of these factors needed to have a proper impact.

The research shows a municipality of Copenhagen with big visions of having a CO2 neutral city by 2025. The municipality proclaim investing big in infrastructure for both cycling and public transport as a way of encouraging the citizens to use these two alternatives, instead of the car. Yet while this will encourage some citizens to switch, will it also be seen by other citizens that they are forced to do so, as the new infrastructures developed, takes the space from the current car infrastructure. The attempts to involve the citizens in the transition process seems to be very limited, through simple cycling campaigns have seen, but it has not been a focus of municipal politicians in general.(Appendix 1) It seems fair to make the assumption that by involving the users in the transition process, by enlightening of the issues and involve them in possible solutions, would a more successful transition take place. According to the Municipality Climate plan, is the reasons to convert to the sustainable alternatives it mainly to reduce the CO2 emissions and to meet the upcoming demands for mobility, as the Copenhagen keeps growing in population size. Yet while these of course are good reasons, does the focus on local pollution seem to be missing in their agenda. The negatives effects of the air pollution created by fossil driven vehicles are not mentioned and in general is to be a knowledge that the public lack, despite of the serious

health effects it has on the citizens themselves, their families and neighbors. The municipality of Copenhagen focus on expanding the cycling infrastructure as one of the main methods for the transition, does not seem correct when looking into how they are investing currently in the infrastructure. In the illustration below shows a couple of price examples of different infrastructure projects.

PRISEKSEMPLER PÅ INFRASTRUKTUR

CYKEL 16 MIO.	1 km cykelsti (begge sider) (kr.)	
CYKEL 900 MIO.	Net af cykelsuperstier (300 km) i hovedstadsområdet (kr.)	
BIL 1.800 MIO.	Nordhavnsvej (kr.)	
BIL 2.000 MIO.	Udvidelse af motorvejen Roskilde – Fløng (kr.)	
METRO 1.000 MIO.	1 km Metro Cityring (kr.)	
S-TOG 1.500 MIO.	Evt. overhalingsspor Holte-Bernstorffsvej (kr.)	
BUS 400 MIO.	Københavns Kommunes årlige tilskud til busdrift (kr.)	

Picture: Price eksample on infrastuctures
Source: Appendix 1

Here it can be seen that the expensive new road of 1.65 kilometers, called Nordhavnsvej, is twice as expensive as constructing 300 kilometers network of Super Bike lanes in the Copenhagen Area. This does not entirely fit into to Cycling focus the municipality claim to have. If such a big road investment was done in the cycling infrastructure instead could 300.000 people get a free electric bike (own calculation) or over 100 kilometers of new bike lanes be made. This can show that there are different political interests in the municipality, which are dividing mobility investments. (S. Astrup, 2016) Besides the internal conflicts in the municipalities political environment, is other conflicts seen with the governmental politics. The interest of these two political organisations, seems to be quite diverse, as the government promotes the unsustainable mobility, by applying the registration fee to the electric car, and also by paying a 'commuting allowance' to the people travelling longer distances. While the government sees the newly applied registration fee on electric cars as more 'fair' to the gasoline cars, who already have it, does it go directly against the sustainable transition to the electrical car, which something that the municipality of Copenhagen has a high interest. On the other hand does the 'commuting allowance' promote long distances of commuting. This means that finding a workplace close to home, is not as financially attractive for the citizens, and therefore longer commuting distances is encouraged. From a Copenhagen perspective would this work against the sustainable transition, especially towards cycling, as cyclists rarely ride over 24 kilometers a day when commuting between work and home. A option for change could be restructuring the 'commuting allowance' to only concern sustainable methods of transport, like electric cars, public transport and cycling, though the min. distance for cycling before acquiring the 'commuting allowance' should be smaller e.g. 12 km a day. Yet this option generate some ad-

ministrative problems of how to document which method a person is using, while it will also generate some dissatisfaction among some citizens. So here it can be seen that Copenhagen municipality and the government have a conflict of interests, and therefore therefore policies work against each other.

When it comes identify the users needs and behavior, is some elements up to discussion. In the quantitative questionnaire can it be seen that 50% of users are willing to change their mobility method in order to have a more environmentally friendly commute. Yet this tendency does not seem to be of interest when doing qualitative interviews with the users. A reason for this could be that in the questionnaire is the user confronted with the question of sustainability in their mobility, but with the interviews was a direct question on sustainability purposely avoided, until the very end where users was confronted with it. So this shows that the sustainability issue does not show to be given much though by the users, unless they are confronted with it. Yet both the questionnaire and interviews shows that economy and speed of their mobility is the 2 most primary concerns. A relevant fact to point out is the association the users have with the term sustainability, here they often mean environmental friendly, and not thinking of social or economic sustainability.

A weak point of the both the questionnaire and the interviews is that the main group of people who invested their time in answering, was mainly younger people in the twenties and start thirties, which means that a limited amount of elderly or families interests is reflected in the data. Yet over 40% of the population in Copenhagen is in this age group of 20-39, so the data does reflect a high part of the citizens (Nordhavnen.dk, 2012).

ANALYSIS:
Implementing MLP analysis into Practice Theory

The Chapter contains an analysis of social practices, which is used to describe practices/activities as an entity, to understand the general perception and cultural understanding of the practice. It collects users/actor's meanings/understandings of the activity and how they picture it, while identifying the skills needed to take part in the activity of the practice. It identifies the resource consumption connected to the activity.

Practice theory quantifies the selected practice's consumption indicators; it compares these indicators and patterns with other similar practices and the historical development of the practices, in order to identify possible opportunities for a desirable change. This project aims to change or transform these unsustainable practices towards more sustainable practices, and for this reason is practice theory is used.

To support the social practice theory, the project also use MLP (Multi Level Perspective), as a tool to evaluate on the outcomes of practice theory by providing the perspective of former mobility transitions and of how to break into the current regime. The MLP provides are deeper understanding of the transitions throughout time, and describes how the changes in the socio-technical regime managed to readjust, which can provide key insight on how to understand the development of the niches and on how to bring in new radical or incremental changes to the regime by using niche technology or social movements.

Practice Theory

Introduction

By using Practice theory to analyze the social practices, related to the problem statement of achieving more responsibility, can practice theory provide insights and understanding of the current practices and provide framing to the practice from a user perspective. This chapter will provide an overview of practices navigating within the transport sector of Copenhagen; it will identify consumptions and practice patterns to give meaning and understanding to the specific practices. The theory will draw on the historical and social-regime perspectives from the MLP to provide a historic overview of trends and meanings in order to reveal the development of new trends and practices, this will not be explained in this chapter, but that of the MLP. It will compare several similar practices which at times interlock and possibly provide ideas for radical and incremental practice changes in order to recraft the practices and/or provide substitute practices. These are the mechanisms that practice theory provide, as described by Spurling, N. and McMeekin, A. (2013). The methods are chosen as it functions as a tool to identify "destructive behavior" and configure this behavior into a more acceptable one, which fits the goals of the municipal policies while still maintaining the idea of individual freedom of choice.

"The notion of the citizen-consumer is one that has received considerable academic attention in the past ten years and into a particular form of policy making known as 'behavior change'. In this model, the philosophy and techniques of the market are used to create opportunities for shifting behaviors regarded as problematic to ones that meet prescribed policy goals."
Barr, S. (2015, pp. 93)
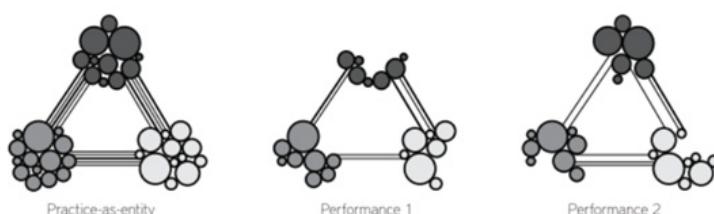
Figure: Social Practice Theory
Source: Kuijer, S.C., 2014, pp. 53

Theory:

The goal of practice theory is to create and gain an understanding of existing practices to find areas of possible development and change, that can create radical or incremental changes to the practises, and possibly find junctions and give them new meanings and values. "Methods for analysis aim to gain understanding of existing practices in order to inform and inspire design and find opportunities for change" Kuijer, S.C. (2014, pp. 49). The theory suggest that practices consist of groupings, element and multitudes of links which in the theory are described as Meaning (images), Skills (competences) and Stuff (material), which are linked together. Practice theory aims to map these elements and their groupings. It is important to understand the practice as an entity (a generalization of many specific performances) and as a performance (one specific performance) to see the difference between them and understand that there necessarily are not any chronological order to a social practice grouping and elements. The performance driven understanding describes the practices as a more specific goal of the certain practice, and the practice-as-entity describes a practice with several groupings (performances) that can provide an entity to describe the consumption of the practice (Spurling, N. and McMeekin, A., 2013). The theory presents an approach of how to understand and analyze social practices, which the auther decided to represent through six steps:

"Methods for analysis aim to gain understanding of existing practices in order to inform and inspire design and find opportunities for change. Methods for design aim to generate possible less resource intensive reconfigurations of practices." - Kuijer, S.C. (2014, pp. 49)

First step is to select a practice, Here it is important not frame it either to widely nor too narrowly, in order to quantify our analysis in a proper way, providing a good, specific and clear picture of meanings, images and skills.

Second step is analyzing process and consumption patterns in a practice, in order to later compare it with similar practices and compare it with the historical development of the practice.

Third step is to identify the historical development of practices and highlight trends and changes within the practice. Thereafter explorer and describe similar practices. The historic development is described in the Chapter "Research".

Fourth step is to map out the target practice, and connecting consumption patterns with flow, duration and frequency, depending on the activity. Followed by mapping out inertia, priorities and tensions in the practice.

Sixth step is about reconfiguration the practices by using co-design, and user involvement, to radically change the practice.

These steps helps providing pictures of the goals and possible opportunities for change within the practice. This method is based on Kuiljer, S.C. (2014) "Practice Theory" and Spurling, N. and McMeekin, A. (2015) "Intervention in Practices"

"Social practices are conceived as being routine-driven, everyday activities situated in time and space and shared by groups of people as part of their everyday life . . . Social practices form the historically shaped, concrete interaction points between, on the one hand actors, with their lifestyles and routines, and on the other hand, modes of provision with their infrastructures of rules and resources, including norms and values." Verbeek and Mommaas (2008, p. 634)

Framing the Practice

The practice that are being framed is commuting to and from work/institution in and around Copenhagen, and will further be divided into a category of commuting to and from work/institution by- car, bike and public transport. Each of the practices will be described as its own entity (seen on pp. 46-51), the "Carbon Footprint" numbers are used as a reference for environmental impact and is equivalent to traveling 10.000 kilometers in a year for one person using an average car, bus or train, Examples of specific performances will be provided to strengthen the statements by using these examples within the practices to display the general social practices.

The practice of commuting by car is the most central part of the analysis, and an obvious goal is to change it into a more sustainable practice, by provide change in either its meanings, skills or materials to reconstruct the resource intensity with the practice. The practice of commuting by bike and public transport are brought in as the two main sustainable alternatives to the practice of commuting by car, since it seen as sustainable compared to the gasoline car and it is the wish of the municipality of Copenhagen.

"The approach accommodates and re-conceptualises conventional intervention strategies, but also brings to greater prominence the pro-

spects for shifting patterns of demand for alternative modes of mobility and overall demand for mobility itself" - Spurling, N. and McMeekin, A. (2015, pp. 78)

The analysis will only contain meanings, skills and materials that the individual have to use, consider or think off, in order to be a part of the practice, and it will also only have the perspective of the practitioner, and not the conflicting or other interlinked practices, such as the practice of working as a bus operator. Therefore the analysis will not contain such informations as the infrastructures- resources, maintenance and policies, but only that of which the practitioner sees and identifies as being a part of their practice.

The Meaning assembles the general associations and cultural conventions that the general public has towards that the practice of commuting in Copenhagen. The meanings are based on ethnographic interviews done throughout the project (Appendix 2, 4, 7, 8)

The Skill assembles the abilities, knowledge and embodied skills that a user have to possess in order to be a part of or perform the practice. The abilities are can be physical skills but also the knowledge used within the practice which a practitioner would have to know or be able to use in order to function properly within the practice.

The Material cluster consists mostly of the physical materials like tools, objects, infrastructures and resources needed for the practice to function.
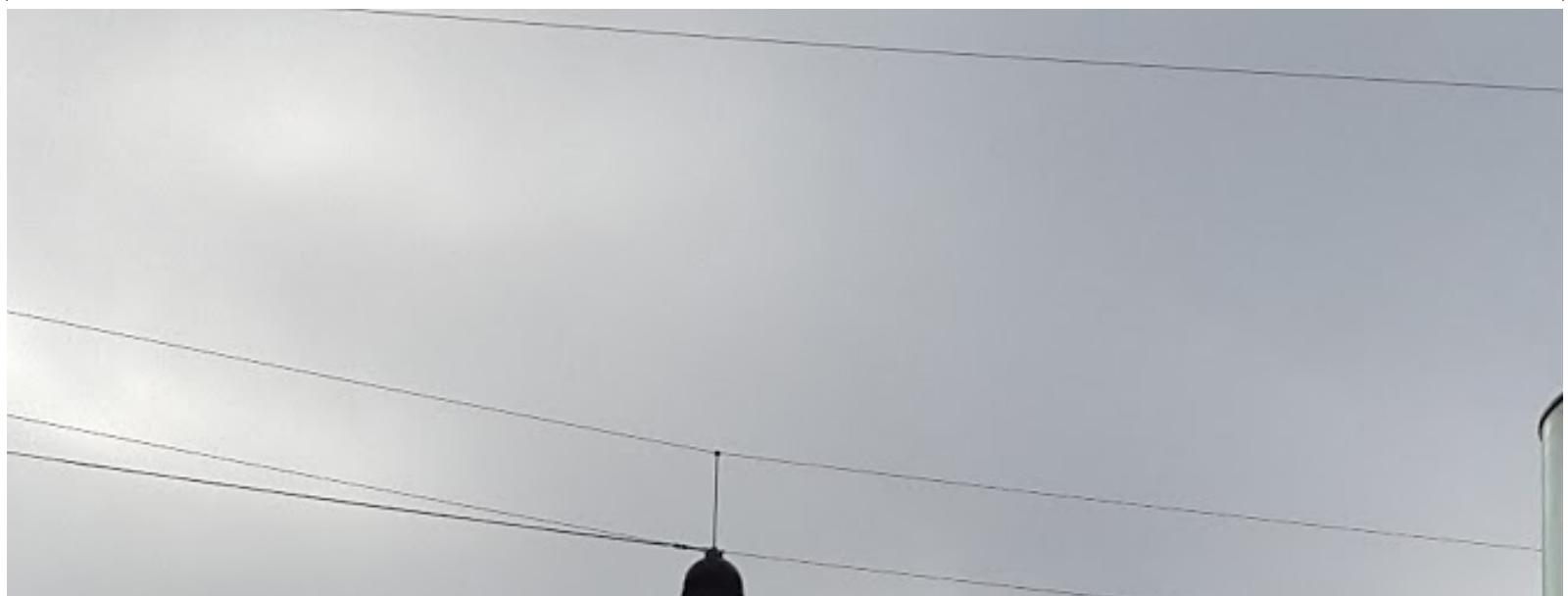
The Practice of Commuting

The practice represents the gather performances into a general idea of the social practices, meaning it collects individual "stories" and generalizes them into a practice. It is based on the information gathered from interviews, questionnaires and observations from around the city of Copenhagen, which together should give a picture of the general social practice of commuting within Copenhagen. The practice of commuting in Copenhagen is different depending on what type of mobility methods the individual uses, therefore a division in methods have been made, as the meanings, materials and skills are mostly based on the technology and the infrastructure provided, rather than wishes and preferences.

Private Foto

The Practice of Commuting by Car

The Meanings are grouped as

Inconvenient is where most of the negative meanings are grouped as one category; here the inconvenience of parking in Copenhagen city, of paying to car loans and insurance, fueling the car every other day or week, acquiring a driver's permission/licence and not being a option for children, handicapped or very elderly persons.

Convenient, where the notion of being comfortable in bad weather. The convenience to transporting big objects, and convenient when shopping on the way home.It provides an easy accessible transportation method and a freedom of own 'time table'.

Unsustainable consists of the fact that cars pollutes and can be dangerous for its surroundings, not only in the environmental impact notion but also the direct consequences of e.g. crashing a car, and the fear it gives to other practitioner groups in the environment the car operates and functions.

Expensive presents the costs and idea that a car are almost always a major expense to have in various ways, and not only in a monetary way, but also in a health related way, as it is more likely for a person to take the car for small trips instead of walking or biking and less exercise for the person.

CO_2 Footprint

2.5

The Skills are grouped as

Driving Skills are the skills to "feel the car" knowing how the car reacts and its limits.

Sense of Direction contain skills such as navigation while traveling and being able to use navigational systems such as maps, signs and GPS systems.

Reflexes are a physical skills difficult to learn unless you already possess it.

Regulation Knowledge consists of the needed knowledge to be legally allowed to drive a car. Knowledge about rules and regulations, the meanings of signs and where to drive and park.

Mechanics are the understanding of how the car and it component works and how to maintain and operate them.

The Material groups as

Parking are the physically spaces available and needed for the vehicle.

Car represents the car, but also spare parts, components, mechanics and the workshop to fix the car when needed.

Fuels & Money are goods like gasoline, and maintenance products needed to keep the car functioning, such as coolant, engine oil and windscreen washer fluid, and money needed to buy and maintain it.

Lessons are the educational lessons and the driving school needed to get the skill of regulation knowledge that are acquired for a driver's permission.

The Meanings are grouped as

Inconvenient contains such things are maintenance issues, e.g. troubles like the chain falling off or flat tire, but also the bad weather and becoming sweaty after the trip.

Convenient, represents the freedom of going wherever you want and it's relatively fast through inner Copenhagen. Not having to worry about time schedules or money for tickets or gas

Sustainable are the environmental friendliness that biking brings to mind when people talk about biking, but also the health and happiness, physical and psychological welfare.

Cheapest represent the idea that cycling are the cheapest form of mobility, in an urban environment compared to what it can do, and how far you can go. It has cheap maintenance, cheap parts, no fuel consumption.

The Material groups as

Parking are reserved bike parking spots, which are required in some space.

Bicycle contains the bicycle itself and its components and spare parts and tools needed too quick fix the bike.

Lessons are the education you need in order to navigate freely in the traffic in Copenhagen.

Cloth can be important for a person riding the bike, especially in Copenhagen, as the weather can change from sunny to rainy fast, and proper clothes will make the experience more comfortable way better. It also includes safety gear such as a helmet.

48

The Practice of Commuting by Bike

The Skills are grouped as

Riding Skills represents the abilities needed to ride such a thing as a bike. You need e.g. physical control over your body part in order, functioning strong legs and balance.

Sense of Direction contain skills such as navigation while traveling and being able to use navigational systems such as maps and basically knowing where you are.

Reflexes are the ability to react to your surroundings and adapt to the changes that might happen with a second.

Regulation knowledge are the ability of knowing the meaning of signs and signal, but also how to interact in the traffic.

Mechanics are the skill of knowing about the different mechanics of the bike and how the fix broken parts.

CO_2 Footprint

0

The Practice of Commuting by Public Transport

The Meanings are grouped as

Inconvenient represents the boundary of having to follow a time schedule decided by a company, and trains or busses. It can be filled up, and the lack available seats. An inconvenience could also be having to change between vehicles and having to walk to the nearest bus stop or station.

Convenient are such things as having no responsibility towards maintenance or controlling the vehicle and being able to go almost everywhere in the Copenhagen area.

Sustainable are the idea that sharing at larger system between a lot of people pollute less than the car, and that it runs on electricity which in Denmark means it runs on a lot of wind power, thereby being environmental friendly.

Expensive represents the notion of public transport being quite expensive and the price keeps escalating.

CO_2 Footprint

0.5

The Skills are grouped as

Social Norms are the knowledge of how to behavior when traveling with other people, and being around people in public places.

Read are understood as basic reading skills, in order to understand timetable, warnings and so on.

Payment represent the knowhow of paying for the transportation through, rejsekort, ticket offices or mobile apps.

Planning are the ability to plan a route and schedules for the departures and arrivals of the busses and trains.

The Material groups as

Money are the main factor in public transport for the user so possess in order to buy tickets and hence use the service

Tickets functions as a validation for service use. It can be a regular paper ticket, but also digital mobile phone ticket and "Rejsekort".

Phone is often used for keeping digital youth travel cards, ticket, time schedules and to get general information about trip.

The Practice as a Performance

Diving further into the practice and investigating the practice as a single per-formance will help understand an individual's daily practice of commuting to and from work/institution. This section will aim to specify meanings, skills and material in this situation, in order to find a more detailed pattern, and clearer meanings and understandings of the practice. By doing so it can help under-stand the practice and help provide them with precise solutions or alternatives to the specific type of practice. This section will illustrate three examples from some of the participants, from the interviews, shadowing and workshops.

Private Foto

Going to work by Car

This specific practice is based on a student commuting by car to a university, the picture below the text illustrates the route he drives to and from the institution.

Commuting by car first requires to have a car. To obtain a car the student has to have used a relative large amount of money; not only on the car but also on insurance, fuel and a place to park it. These materials are (as seen on Figure below) connected to the meaning inconvenient, as these are often connected as being frustrating factors by the practitioners.

When this is sorted out, the practitioner (the student) can continue his journey to the destination, where he will need the knowledge of how to fasten himself and of how to start the car. These skills are closely connected to the ability to drive a car, but the skill called Driving do represent that of being able to use the pedals and turning the wheel, and that of having an ability to check mirrors and be aware of blind spots; in general skills that can be gained through proper lessons, education and experience.

The Copenhagen rush traffic are relatively steep and slow where the student passes through, and by depending on a numerous amount of factors, it can some time to reach the destination. But it is in general considered a bit faster than the other alternatives described in this analysis according to the subject.

The Convenient really describes the notion of taking the car as being the easiest and fast way of getting from A to B, as one doesn't rely on public transport schedules and that of the cold windy bike that drives slowly up of hills, and requires a physical effort.

The trip around 8,5 km long and takes around 25 min

Going to work by Bike

The practice of going to work by bike will provide the practitioner, in this specific case a foreign worker from the UK, with a convenient, easy and most important cheap tool to get to and from work. The requires some skills of riding, and reflexes, in order to ride the bike and be able to react to the surrounding traffic. Also knowledge about the traffic signs and signals are important in order to interact with the traffic in the correct way, especially as a non-dane.

The inconvenient is connected to the maintenance of the bike, which are often fast and cheap, but a challenge for the inexperienced practitioner. Another inconvenience are that of the lack of proper bike parking areas, and it can give frustrations when a proper spot for the bike can't be found, but it doesn't occur often on the trip to and from work, unless some shopping are done on the way. An inconvenient factor are also the many other cyclist, the pedestrians and motorist that at times obstructs the trip, dragging it length out.

A lot of the material are connected to the bike and tools for the bike in case of emergency and breakdown of the bike. Also proper cloth is relevant for most bikers because of the Danish weather in Copenhagen. A breakdown of the bike usually means this practitioner either uses the public transport if at home, or borrows a company car.

The bike ride is about 7.5 km long and takes around 25 min.

Picture: Trip to Work by Car
Source: Google Maps
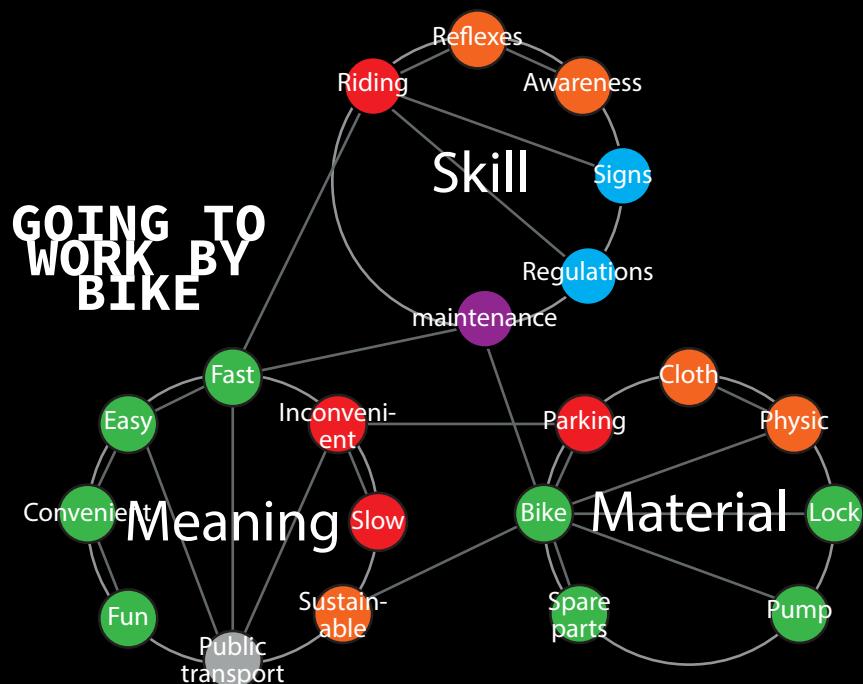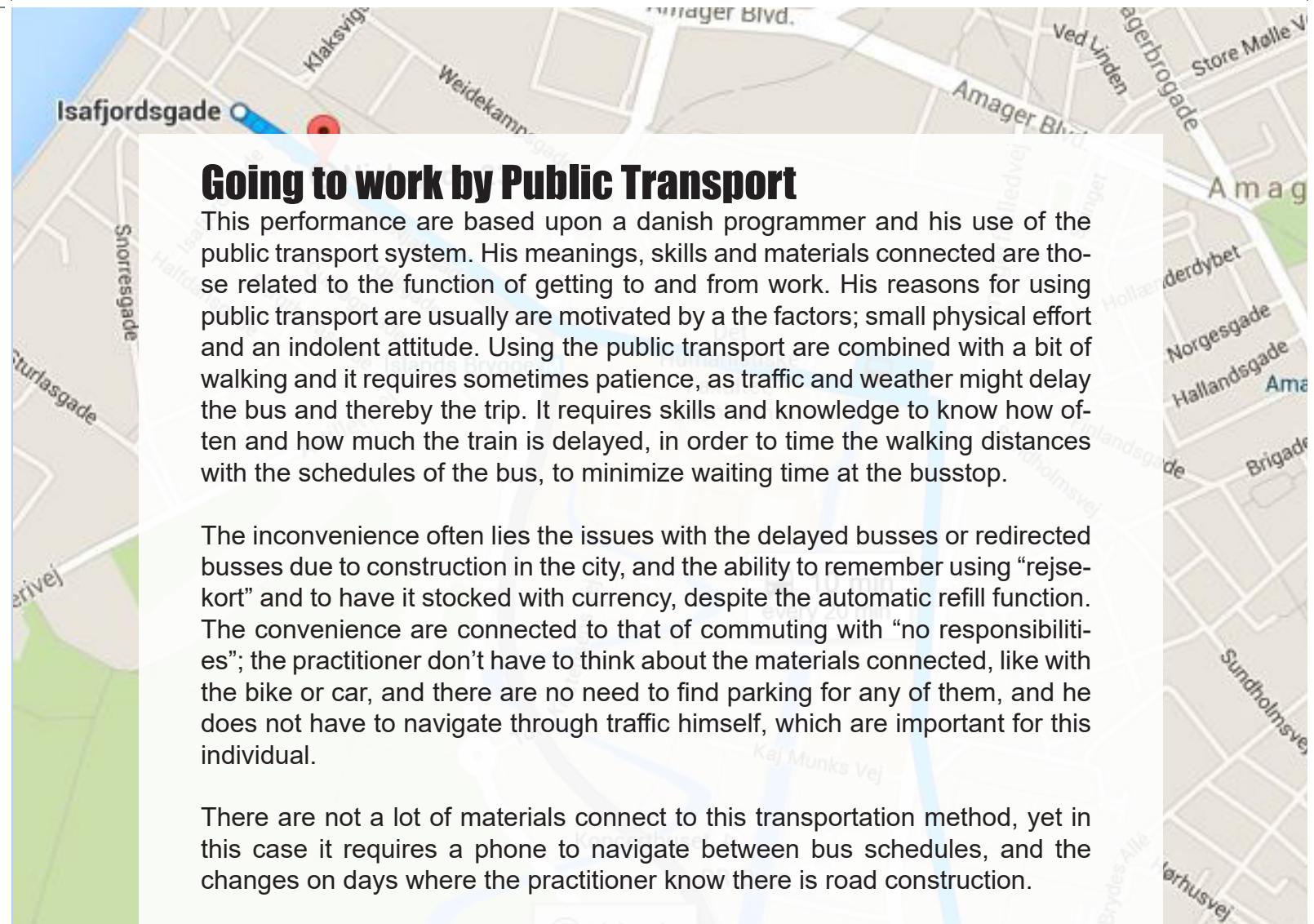
Going to work by Public Transport

This performance are based upon a danish programmer and his use of the public transport system. His meanings, skills and materials connected are those related to the function of getting to and from work. His reasons for using public transport are usually are motivated by a the factors; small physical effort and an indolent attitude. Using the public transport are combined with a bit of walking and it requires sometimes patience, as traffic and weather might delay the bus and thereby the trip. It requires skills and knowledge to know how often and how much the train is delayed, in order to time the walking distances with the schedules of the bus, to minimize waiting time at the busstop.

The inconvenience often lies the issues with the delayed busses or redirected busses due to construction in the city, and the ability to remember using "rejse-kort" and to have it stocked with currency, despite the automatic refill function. The convenience are connected to that of commuting with "no responsibilities"; the practitioner don't have to think about the materials connected, like with the bike or car, and there are no need to find parking for any of them, and he does not have to navigate through traffic himself, which are important for this individual.

There are not a lot of materials connect to this transportation method, yet in this case it requires a phone to navigate between bus schedules, and the changes on days where the practitioner know there is road construction.

The trip is around 3 km long and takes around 15 min plus the waiting times.
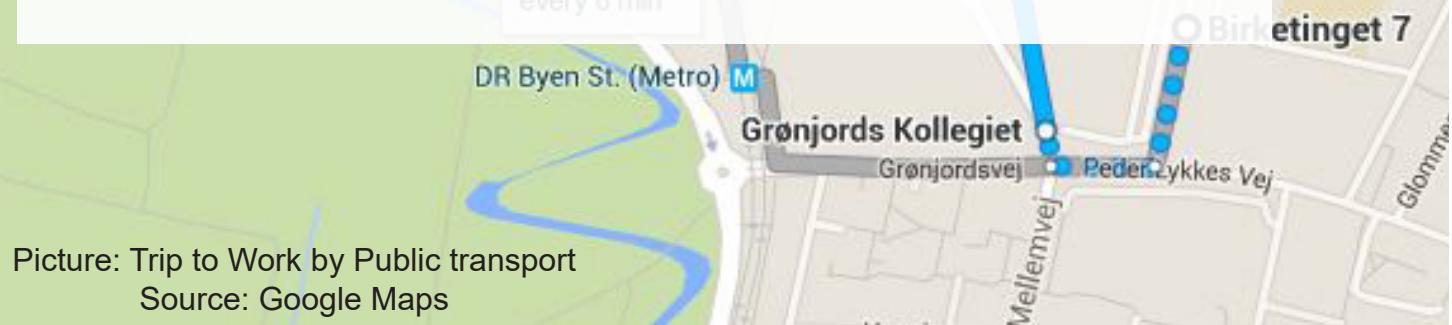
Picture: Trip to Work by Public transport
Source: Google Maps
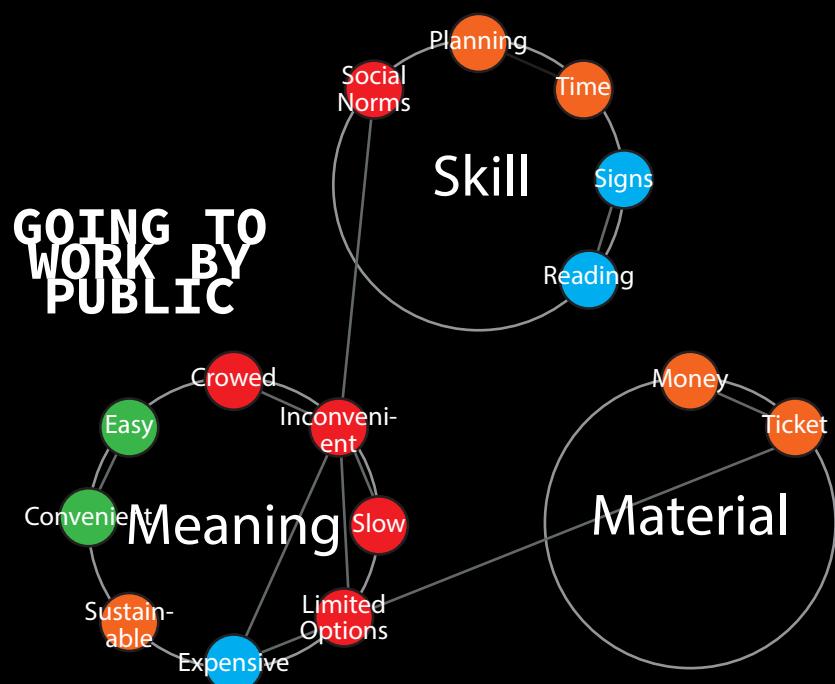
Discussion

The social practice approach initially provides tools to make changes in the behavior of individuals. The approach to the method were to develop a solution by using social practice theory, and not to create a political policies. In some of the articles mentioned (eg. Barr, S., 2015) in this report and experienced during the project, the approach is suited to develop communications-based messages and behavioral change strategies, which focuses on climate changes knowledge sharing and alternative choices.

Practice theory describes that in order for a practice to change to a new one, does the new practice have to live up to the same skills, meanings and materials as the old practice, unless it is a change of a more radical nature, like the bicycle and car was when they emerged . Through this analysis is the skills, meanings and materials found for 3 different practices. The practice of commuting by car, is the practice which are needed of changing for a more sustainable practice, and therefore are the skills, meanings and materials relevant to have as a method of finding relevant demands for a new practice and as a method of evaluating if a new practice will have success of changing from the old one. Whereas the findings in the practices of commuting by public transport or bicycle, are used for comparing the other practices. E.g. comparing which skills, meanings and materials that the car commuting and bicycle has in common or differ from, and then figure out which elements of the practice are important to look into.

An example could be to compare to relatively similar practices; the practice of commuting by car and the practice of commuting by electrical car. The practices are almost the similar; the needed skills for using a regular car and electrical car are the same. The few places where the practices differ is mainly in the meanings. The meaning of unsustainable has becomes sustainable, and in the convenience of fast fueling, becomes an inconvenience as the fueling method is quite slow in the electrical car. The meaning of expensive also differ by a small amount, as an electrical car is more costly in general purchase, but is cheaper in fueling costs per kilometer. A difference in materials is also seens as the fueling infrastructure for electrical cars are not as extensive as for gasoline, although in inner Copenhagen it has grown quite big.
So from this example can the comparison show which factors are blocking the way for a change of practice to electrical car commuting, which in this case is slow fueling, lack of fueling infrastructure and a higher purchase price. And this is despite of the of the new meanings of more sustainable and cheaper mileage.

By diving further into the practice as an a performance, the image of a user and daily conflicts start to develop, as some tensions grow and some disappear. For the amount of participants in each of the surveys and interviews, making

a performance based analysis made sense, as each of the "painted" conflicts become much more clearer when diving into specific situations. instead of looking for generalization based on few people meanings that connected to specific hidden ideas, these specific situations painted a stronger and clearer pictures of the situation of each participant, and meanings, skills and materials they used. In this phase it wasn't about which type of transport they used, but more how the did it. then afterwards three selected performances were chosen as these described a general pictures that of each individual product type (car, bike, public transport). In the performance based analysis we see:

Going to work by car
- It requires a lot of skills, which need to be obtained for an enjoyable trip
- Most of inconvenience are connected to that of expenses, and less so than originally envisioned environmental sustainability.

Going to work by bike
- The bike is pictured as the most convenient and most accessible choice, even though car is an option.
- Maintenance isn't the biggest issue.
- Parking and getting your bike stolen is something people think about.
- Weather is the biggest inconvenience.

Going to work by Public transport
- Is described as an easy alternative, in the described case as alternative to that of the bike, which always were in conflict with maintenance or weather.
- The inconvenience are mostly consider other people taking up space in the metro or on the bus.
- It is considered expensive to the user.

The approach when starting this project was to make something that would make the citizens take responsibility in their daily lives and drive it towards a sustainable development in Copenhagen. The approach provided an understanding of social, economic and physical structures and the relationship between theses structures and the practice of mobility, and to some degree the historical development. The method do not provide tools of how to identify the changes related to the meanings, skills and materials, and it is not found in the material illustrate any way of how to do so.

Barr, S. (2015) described how quantitative data often is the prefered data type for social practice theory, as you can develop good strong information, create statistisk which work well as source material, yet we found using performances to describe the practice have helped to understand some implicit meanings, of which we wouldn't have understood by analyzing quantitative data. The co-de-

signing process of which we got a big deal of our performance information is described in the later chapter: Co-designing.

"the practice-oriented approach proposed in this thesis views performances as the place where 'designing' happens. It thus acknowledges that an intervention in daily life requires redesign of the existing practice and web of practice it is part of." Kuijer, S.C. (2014, pp.96)

Spurling, N. and McMeekin, A. (2015) describes how social practice theory facilitates an analysis of socio-technical which describes how social changes and practices are dependent on technologies. which for the mobility sector could provide "Greater prominence for shifting patterns of the demand for alternative modes of mobility" and McMeekin, A. (2015, pp. 78), contradicting Barr, S. (2015) which describes the methods as tools for small incremental changes and being hindered by policies and city development contradicting the pressure for more sustainable transport means. In an interview with Bækgaard, M. (Appendix 1), whom illustrated for us the great difference between the size of investments in the non-sustainable transport infrastructures compared to the investments in cylcling iinfrastructure, are much greater, even though sustainability policies are among the most marketed, *"One of the key components of behavioral economics and the politics of nudge is the emphasis placed on the role of choice architectures. It is argued that the goals of behavioral change can be achieved in part if the surroundings in which people operate are conducive to the behavior being promoted"* (Barr, S., 2015, pp.100). This does not seem to fit, atleast not in a viablemanor. (Appendix 1).

In the follwing will the method of Multi-level perspective be described, as it will used to support practice theory for evaluating in the effects on the transition at hand.

Multi Level Perspective:
The Socio-Technical Regime of Copenhagens Transport sector

Multi.Level Perspective (MLP) is a known method used for analysis of systems transitions. MLP looks into the socio-technical systems and it respects that when a transition takes place, it is the effect of several factors in the system, and not just a new technology for substitution. MLP divides the system up into 3 categories:

The Landscape: The factors which are deemed uncontrollable and have an effect on the market/regime

The Regime: The factors which control and stabilizes the market, like laws/regulations, powerful actors, firmly implemented technologies, infrastructure and cultures or mindsets of the users.

The Niches: These are the technologies or concepts that are not implemented in the market, but have the ability to change it when the opportunity appears.

In this report is MLP drawn in as a method for supporting the practice theory. The idea is that while practice theory focuses on user's practice changes, does it not account for the systemic changes for creating a transition. Therefore is MLP used to evaluate on the outcome of practice theory, which will give an indication about its effects of the regime or what else it needs to work in cooperation with to have an effect.

This section will look into the historical transitions of the mobility in Copenhagen. This will based the former historical research on Copenhagen and the mobility in general. From this will certain elements show from the MLP analysis, elements which previously have shown to have part in the transitions. Following will an extensive MLP analysis be made on the current system, which will give an overview of the mobility in Copenhagen as it is now. This overview shows which actors, technologies and forces are deemed important and give an idea of where to push in order to have an effect towards a sustainable transition

Theory

The theory behind Multi-level perspective is based on understanding changes in socio-technical systems. The sociotechnical approach combines the technology and science with societal needs. By doing this, will the transition be considered from several aspects, and therefore respect that for a transition to take place is more than just a technological substitution needed, but also the markets, regulations, user practices and etc.

MLP divides between three level: Niche, Socio-technical Regime and Socio-technical Landscape.

The Socio-technical regime forms the meso-level. This level stands for the stability of the socio-technical system which are more or less controllable. This level would typically be things as law and regulations, infrastructure, networks, firmly rooted technologies in the market, but also user practices, lifestyles, powerful industries and actors who try to suppress newer innovation through market control or lobbying in order to protect their investment. Because of the stability in the regime, it is difficult radical innovation within the system. This is where the niches become relevant.

The Niche is the micro-level of MLP. The niches functions as a space for the needed radical innovations. This is possible because of the niches are protected from the 'outside world' or more accurate the harsh market. And therefore allow and nurture the early development of a technology or a small social network.

"The niche level is the micro level, where actors, companies, firms, and new initiatives operate, proposing new and alternative socio technical systems for the regime." - Pineda, A. & Vogel, N. (2014 pp. 6)

Some niches might have a small market, but these market niches are not considered as a part of the market, as they consist of such a small specific customer base and an extremely small part of the market.

"Niches are important, because they provide space for learning processes on several dimensions, e.g. technology, user preferences, regulations, infrastructure and symbolic meaning." - Geels, F.W. (2006 pp. 451)

So niches are a possibility to learn and reflect in order to make it ready for the

market.

The Socio-technical Landscape, which is the macro-level in MLP. This level refers to the aspects that are more uncontrollable and have an effect on the usually stable regime, so it is beyond direct influence of actors and therefore cannot be changed by the actors. Typically, this could be global warming, wars, epidemics and so on.

"...described as the "wider exogenous environment," is the macro level where entities with a high level of aggregation can become forces that exert pressure on the regime level. This level is understood as being "beyond the direct influence of actors and cannot be changed at will."" - Pineda, A. & Vogel, N. (2014, pp. 6)

When the three levels interplay it creates the conditions for a transition according to MLP. This can be seen in the figure below.
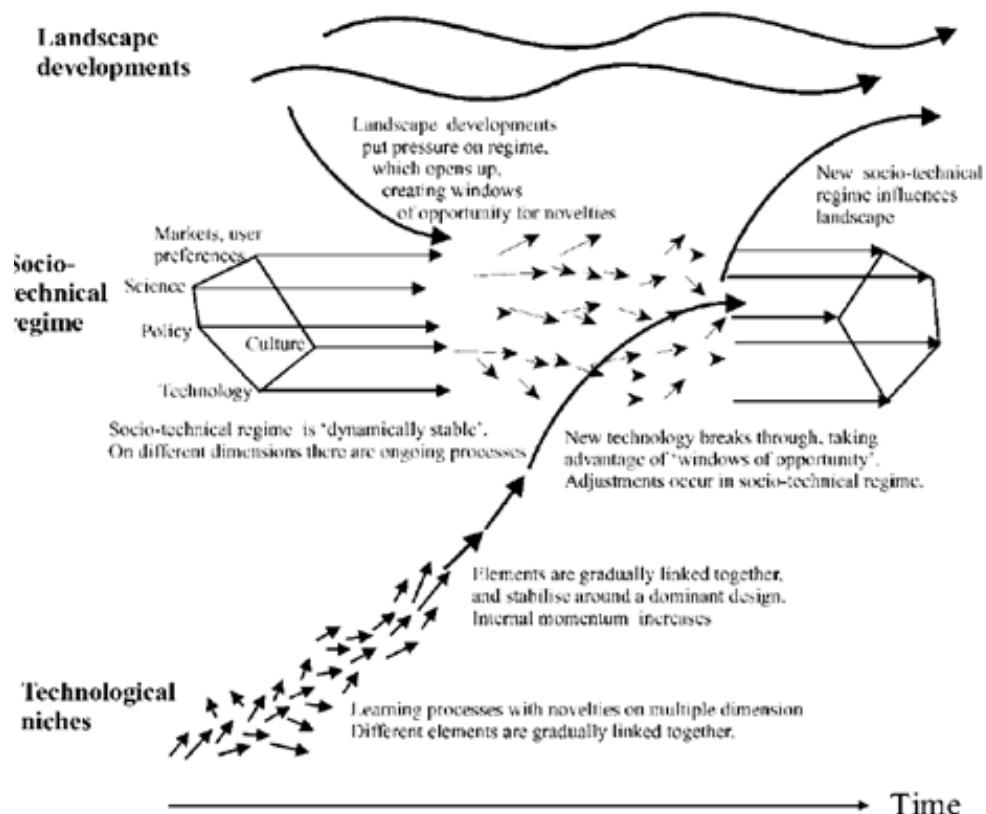

Figure: Multi Level Perspective
Source: Geels, F.W. (2006 pp. 451)

This figure shows the importance of the interplay between the levels, as new technologies or concepts cannot be implemented in the regime without desta-bilizing the regime first. So for a new radical innovation which have emerged on the niche level, it needs to break into the market, it needs first and foremost a window of opportunity to jump into the market. These windows of opportuni-ties are developed when tensions are occurring in the existing regime. These tension are usually a result of pressure from the landscape level that forces the regime to change, but this can also be a tension from internal problems in the regime where incremental improvements are not enough. Yet these windows of opportunities do not occur often, so a radical technology can be stuck in the niche level for many years, as it only will stand small chance of getting into a stabilized market, where regulations, user-experiences and pow-erful companies and organizations rules. Besides a window of opportunity, can a powerful actors support also be important, both financially and politically to stimulate development and overcome barriers.

To supply this understanding of multi-level perspective, is the idea of Pineda, A. & Vogel, N. (2014) added to the theory. This is done because that MLP is need of some modification in order to help account the complexities which is found in a subject such as mobility (Pineda, A. & Vogel, N., 2014).

"why not consider the social movements of the 1970s also as niches, and the intelligent systems landscape influences? "
- Pineda, A. & Vogel, N. (2014 pp. 7)

They put in the element of social movements into the MLP levels, as MLP in general have been more technologically driven.

"Despite the many improvements, MLP has remained tightly connected to a sector view of society, and it persists in having technology as the definitional core of niche and regime levels."
Pineda, A. & Vogel, N. (2014 pp. 6)

Multi-Level Perspective on the Mobility of Copenhagen.

By looking into the historical transition of Copenhagen mobility transitions, can some tendencies been seen of what is encouraging and pushing a transition. The tendencies seen can be used to understand and perhaps be involved in a future transition process. The following transitions analysis is based on the

information collected in the Historical development of Copenhagen mobility chapter.

A early transition of mobility in Copenhagen was seen in the late eighteenth hundreds to the start nineteenth hundreds. The regime of mobility was mainly consisting of walking and to a small minor horse-carriages for the wealthy. The industrialization of europe came in as a landscape pressure, which influenced the regime, meaning that Copenhagen had to follow, and therefore a political commitment to restructure the city that ended up with areas became more designated, meaning that areas, like the harbour areas, became industriali-zed zones, while other areas become residential zones. This meant longer commuting distances between home and work, and this opened a window of opportunity, where new niche technologies like the bicycle and tram system became of interest. This meant bicycle, tram and walking established new mobility regime in Copenhagen.

Several decades later in the mid nineteenth hundred was a new transition at hand. The regime of bicycle and trams, became influenced by the landscape pressure on Copenhagen, in the form of rapid population and uncontrolled expansion of the city. This pressure lead to the development a political sup-ported city development strategy. The niche technology, known now as the s-system, used the window of opportunity created in the form of the strategy, as the s-train system became a key element in the chosen strategy known as the finger plan.
This meant a new regime where bicycles and trams were still a big part of inner Copenhagen, and the s-train connected inner city with the surrounding suburbs, also became a big part of the regime, as the distances for commuting had become even longer as a result of the finger plan and city growth.

In the 60's was the finger plan still flourishing as a big part of the regime. But an economical upswing together with the mindset or culture of the citizens created a landscape pressure on the regime. This meant that the expensive niche technology known as the car, made its way into the a new regime. As the general public became wealthier and they had the mindset of wanting this pre-stigious technology as it was associated with wealth, it meant that car popu-lation grew rapidly and become quite dominating in the new regime. This was an unwanted transition by the municipality, as their finger plan was focused around the s-train and the car meant that the control of the city development was diminished.

In the 70's did the economy come to a halt and a oil crisis emerged. These 2 factors worked as a landscape pressure of the current regime, meaning that car industry suffered and destabilised the regime. From the niche level came in a new social movement in Copenhagen, a social movement about reclai-ming the urban space in Copenhagen. As the this nice exploited the window of opportunity, it managed to create a political change in the regime, and bicycle

and public transport came on a rise again, creating a more 'balanced' regime with both cars, bike and public transport in the form of s-train and busses. (The trams were being replaced by busses in this decade).

The current mobility in Copenhagen is vast, as many different technologies, actors and cultures are in play and therefore difficult to get a proper overview of the sector. For this can MLP be helpful, in order to sort the different aspects into their type of influence and give an idea of how a transition is needs to take place. In the illustration below is an MLP developed with the most primary aspects of the mobility in Copenhagen, and it is based on the research from earlier.

The Socio-Technical Landscape

Environmental Focus

Globale Warming

Lack of Oil Resourses

The Socio-Technical Regime

Landscape Pressure - Window of Opportunity

Political Focus

User-Habits

Car Manufactures

Car-Culture

Road Network

Bike Lanes

Gasoline Infrastructure

Public Transport-Network

Metro

Municipality Climate Transition Plans

EL-Car infrastructures

Smart Light Regulation

New Regime

Hybrid Cars

Bike Lane Focus

Eco-Cars

Governmental Environmental Plans

Technological Niches

S-Train Carriges for Bikes

Taking Advantage of the Window of Opportunity

Super Bike-Lanes

Electric Bikes

Smart Light Regulations

Hydrogen Cars

Electric Cars, Busses Trains

Illustration: MLP analysis of The Mobility situation in CPH

Currently is the mobility of Copenhagen in middle of a transition. The focus on environment and oil resources has begun spreading to the sector, and is calling for a need for change. The old mobility regime was ruled by oil resources, and the gasoline infrastructure is extremely deeply rooted in the regime, as many powerful actors, as both organizations and politicians have been fighting against a change in the regime as a result of wanting to keep their market sta-

bilized and protecting their investment. It is seen before that more sustainable niche technologies trying to get out on the market to early have resulted in either a quick acquisition of the technology by powerful organizations or the niche being outmatched on the market, because of the competitor's monopoly, power and infrastructure in the market.

But the despite earlier failed attempts have these niche begun finding their way into the market, because of the landscape pressure keeps increasing while it is being 'ignored' and therefore new or improved technologies have emerged, the support from both government and other actors have increased and the mindset of the people are becoming more aware of the unsustainable issues. So this is the so called window of opportunity, which is where the transition status is currently.

Currently we see that the electric car is becoming more popular, the infrastructure of chargers is increasing, and the sales from 2014 to 2015 have tripled. Until 2015 the government had given the e-car royalties as the car fee of a 180% was dropped on e-cars, yet this how changed in 2016 as a result of a new government with other priorities, which is believed to have a big negative impact, especially on the luxury e-car brand Tesla which is the most selling brand in Denmark (Dansk Elbils Alliance, 2016). E-cars are still quite expensive, even when the registration fee was removed, was e-cars still more expensive than the gasoline counterpart. Sales need to increase in order to decrease the price through mass-production and more investments is need for developing better production technology and new battery technologies. The hybrid car has also come into the market, where it works like a transitioning technology, for people who will not buy an e-car while the charger infrastructure is still lacking compared to the gasoline infrastructure. Then we have the electric bikes which are a growing trend in Copenhagen. They are not as environmentally sustainable as the regular bike, but it is popular with the elder generations, as it is giving them better conditions for biking where their body would usually fail them. In order to create a better flow in the Copenhagen traffic for both bikes and cars, has the municipality begun investing in Smart traffic light regulation (ITS), which will reduce the queuing time and increase the biking popularity by creating so called "Green Waves" for bikes. For the public transport has the government and municipality invested in a new metro, which will be done in 2019 and hopefully decrease the car traffic. They are also creating more bus lanes in order to prioritize the public transport which are affecting the car traffic, by taking their lanes and parking spots.(Copenhagen Municipality, 2015) In the public transport system is it also seen that mixing it with biking is popular, by using the bike to s-train station where it is possible to either park the bike there or take the bike with them in the specially developed bicycle-carriages. It does not only have to technologies emerging from the niche level, it can also be social movements. An example of this could political party, called Alternativet, whom have escalated greatly in recents user polls. One of their main directions is pushing for a 'Green' Transition of Den-

mark' and within this the mobility belongs.

The government and municipalities are also affecting the transition by creating visions and policies in order to control the transition. The government had the fee reduction on e-cars and have made a pool of 25 million kroner to boost the e-infrastructure. The municipality of Copenhagen have created a vision of more cycling and public transport in Copenhagen for which they are aiming for, by improving the conditions both, like wider bike lanes, "green waves", and bus lanes.

So from this Multi-level perspective we can conclude that we are in the middle of a transition phase or so called window of opportunity, as a result of the pressure from global warming and diminishing oil resources. We see that the municipality is trying to control the transition towards their goal by investing in the infrastructure which favor the bike and public transport. The mindset of people is changing slowly towards a more awareness of the environment, but only a limited about of citizens ready to invest in an electrical car because of the lack of relating infrastructure or in changing their usual practice, so they are instead investing in more fuel efficient cars or in some cases the hybrid car technology, which can not be seen as a sustainable solution as it only postpone the issues.

DISCUSSION

By applying multi-level perspective on the historical transitions of Copenhagen mobility, has it been possible to find some factors which seems to have been having a an important role in succeeding in an transition. Through the historic development it can be seen that political interaction have been an important element that have been pushing for change, as it is seen with the finger plan and the division of industrial and residential zones, yet it was encouraged or pushed to change because of an landscape pressure. A tendency shown with the political powered transitions is that a niche technology is needed to support the transition, e.g. the bicycle or tram was needed as the citizens now needed to commute longer distances than before the political involvement. In the transition towards cars, it seen that the landscape pressure of an economic upswing made big impact on the citizens. While the political agenda from the finger plan, was aiming for a controlled city growth and development, did the economic upswing, give the general people a greater wealth which made them able of to buy cars. So here an interaction between economics and the mindset of people was creating the transition despite of the political agenda. A decade or more

later as the politicians finally begun accepting the car in Copenhagen, a new transition took place in Copenhagen as a result of the landscape pressure from an oil crisis and economic halt. On the niche level was a social movement occurring about the city space and this social movement together with the oil crisis and economic halt managed to make a transition in Copenhagen which meant that bicycles and public transport became more popular. So here is the important factors for transition the users themselves in form of their mindset and social movements, while economy are a big supporting factor as well.

From the Multi level perspective on current mobility situation it is seen that a transition is in progress. The window of opportunity is created by the environmental issues now seen in the globe, and so for a transition to take place is does this window needs to be used, which is currently being seen with the new metro city ring, electric cars and increased cycling. Yet there are still a long way to go and the transition is going to slow.

If the relevant transition factors found in the historical perspective, is used on the current, it is possible to discuss what is the current transition lacking. The niche technologies needed for a transition already exists and are quite known, so this is not where the issue lies. The political willingness and wishes, at least in the municipal scale, for a sustainable mobility is also present. So the issues can possibly be the lack of proper social movements or in the economics.

Evaluation of Practice Theory with MLP

This section will evaluate on the use of practice theory and Multi-level perspective in order to find a way to combine these two methods so they support each other and thereby provide a better basis for developing and evaluat possible concepts which will have an effect on the transition towards sustainable mobility in Copenhagen.

Practice theory gives deeper understanding of people's practices, which can be structured and give a foundation for comparing the different practices. Practice theory work as the main method of analysis and evaluation throughout this project, as it has the focus of users, and creates therefore better circumstances for user involvement. This is shown later through a workshop with the users which are based on practice theory. The user perspective of practice theory fits quite well into the MLP analysis made of the current mobility situation in Copenhagen that shows it is in middle of a transition and while factors such as political willingness and suitable niche technologies are present, does it seem to lack the factors of the correct user mindset or willingness and to some degree economical lack.

A fault in practice theory is that it only accounts the elements involved around the practice, and therefore do not look into the outside elements around creating a transition. Whereas with MLP it can be seen the otherway around, as it has the holistic system view towards transition, where it respects that more than just one factor is needed towards creating a transition. Tut the perspective of the users is quite superficial, and therefore it is missing a great important element in transitions, as users are in the end are the decisionmakers of their own mobility.

So with the objective of this project which is to get user involvement into the transition process, does a combination of practice theory and multi-level perspective make sense as to increase the success of the chosen concept.

In order to make use of these Practice theory and MLP as an evaluation tool of the concepts, a structured form for evaluating is need. So first a look into the skills, meanings and materials to see that the proposed concept will have an effect on, and then secondly look into what factors of MLP the concept can contribute or affect in order to succeed in a transition towards sustainable mobility.

To make an example is the grocery delivery services, like Nemlig.com, of re-

levance. These kind of services, have an effect on the practice of commuting by car, as now has the regular trip to the supermarket on the way home from work, been removed. This means that a factor of convenience within Meanings is gone, and the typical family do not have the same need for a car. This means that the change of practice from car to cycling or public transport should be easier made as an important factor is removed. Now knowing that it might have a diminishing effect of the dependance on the car, it is possible to say that the societal support for the sustainable methods might have increased, which means from a MLP perspective an higher increase for transition success towards sustainable mobility.

Another example of how concept can change the needs of the users within their mobility could be the "DriveNow" service, where you can rent a car cheap, without booking it day in advance. This whole car sharing movement changes the needs of many users, as not owning a car are no longer the same as not having access to a private car. So now is the meaning of freedom which usually follows with the car also possible for non-car owners. This means users would be able get rid of their, but still retain the freedom of the car. Knowing this means that by people can sell their car and commute by cycling or public instead and save high amount on their monthly budget. This economical factor can be an important factor for creating a transition according to the MLP analysis.

Practice theory have been introduced as a method for assisting with a design outcome. Yet the process is somewhat debatable, as it does not provide a specific roadmap to how, and the outcome of is merely skills, meanings and materials that might help in focusing on issue that have to be solved. As this does not seem very efficient has workshop with the users been established, and this workshop is developed around the principles of practice theory, as suggested by Kuijer, S.C. 2014.

So the further work will be that of co-designing, inviting the participant into a workshop to co-design solutions, to identify the their conflict and presents them to other users, and the facilitate a process that allows them to develop solutions to the conflicts, which fits into their current practice or configures it into a more healthy part of the society.

Concept Development:
The Process of Concept Development

This chapter uses co-design methods through a workshop with practitioners to help develop concepts for solutions to the problems that the practitioners themselves identify. Co-design is used as a part of the practise theory to actively involve stakeholders and other actors in the project, to increase the chance of creating a successful product and service solution which meets the needs, wishes or demands of the end-user. To create this co-designing process a workshop took place to involve the practitioner into the concept development, and to become an active part of the project.

Co-Design in Practice Theory

Co-designing is a method or term for designers to create value for the products or services since it contributes to the contextual integration, making sure that the chance of success and user requirements are met. Co-design is about involving actors and understanding actors needs and practices.

Participatory design and Co-design are understood in this text as two different things. Participatory design lets the actors or users design their product, and the designers take the role as facilitators and experts in the process. Co-designing is about taking the understanding comments and analysis of the actors and users, but still allowing the designers to be involved in the design of the product. Both methods enable an idea among the actors of ownership. The reason we let ourselves become involved in the designing process was to ensure that the solutions would affect our problem statement which was to make a societal transition towards sustainability and make citizens take more responsibility in the future .This was something that the participants did not focus on when crafting solutions that would enhance their experiences in their practices to make the sustainable alternative more attractive.

"We believe that involving actors as co-designers of new solutions is extremely valuable both in designing an artefact/system that fits the local context but also in creating ownership and pride among the different actors involved in the process." (Appendix 11)

In this project several methods of analyzing user needs have been used to understand the uses and practices of the given practice, as described in the earlier chapter: practice theory. This chapter will contain information about the Co-designing process where the users/practitioners were brought in to contribute to the concept development process.

Staging and framing the project to the involved actors is important to gain a coherent collaboration which can benefit the process and the progress of the project. This was achieved by communicating to a specific area wherein the work would have effect. This was defined as both a physical space and a product type. A predefined goal was made for the collaboration and how the collaboration would benefit both project and user. The goal was defined as creating solutions to the identified problems, which the participants themselves had found.

"Thus, to create ownership of the design process and the artefact to be co-developed among all actors in the network, it is important to consider how to stage and frame the design process, and which means to bring into the design process to engage all relevant actors." (Appendix 11)

Workshop

As a part of the co-designing process the workshop was meant to develop deeper understanding of the practices of the users, to get their perspectives on problems and conflicts there might occur within the practice of traveling in Copenhagen City, and to facilitate and design processes where possible solutions and concepts could be identified. The workshop is based the perspective from Practice Theory and was intended to make the participants make an analysis of themselves without realising it. The workshop wasn't presented as focussing on environmental sustainability in the everyday travels, but only on the practises of which the practitioners participating in the workshop identified and on the problems they saw and described. Not presenting the project as focussing on environmental sustainability was done to avoid the social norm of describing the stuff the participants expected us to hear, so by not mentioning environmental sustainability we could actually figure out the "true practice".

Workshop Steps:

Step 1: Goal
- Find and identify meanings, skills, materials as part of the analysis and find conflicts and possible solutions. This will provide information to the practice theory and help the concept development.

Step 2: Participants
- The participants in this workshop will consist of people in the cage frame between 25 and 30, with different backgrounds, such as service designers, craftsmen etc.. and people who already know and uses some platforms that motivate more sustainable behavior, such as GoMore, Endomondo etc.

Step 3: Locations
- The workshop is taking place at an area in Copenhagen called Sydhavn.

Step 4: Agenda

- Define and identify the meanings, skills and materials to support the analysis of the practice of doing the everyday trip to work or school.
- Find their personal conflicts with the practice of traveling in Copenhagen.
- Brainstorm solutions and concepts by using the results of the workshop so far.

Step 5: Follow up
- Ending with a questionnaire will help evaluate the workshop and the results for both current and future work. Understanding the issues or positive experiences the participants had during the workshop might help to understand the outcome.

The Process of the Workshops

The workshop is set as a social event, to try and get the participants comfortable before starting to ensure full participation by all attendants. The start up consisted of food and beverages, and took around 45 min, this would make people talk with each other and get more comfortable with each other.

While eating the participants would get an introduction to the project and what the project was about. Here they were able to ask questions about the project and the workshop.

1. First the participants had to individually identify the meanings connected to their everyday commute, understood as the trip to and from work or school. The participants were introduced to this step as an association step, where they had to write down on a post-it what they associated with their everyday commute, whether it being good or bad.

2. Second step was about identifying the skills needed on their everyday trip individually. Also here the participants had to write it down on post-its.

3. Third step were about defining the materials/object the participants use on the everyday trip and write them down on post-it individually.

   Note: All the meaning-, skill- and materials post-it's were separated into three circles.

4. The participants would now be tasked to walk around in between the circles

to find post-its from the three different circles that they felt were creating conflicts or problems and try to match them with a post-it from another circle. Then they would write the problem down on a post-it and put it in the middle.

Note: The conflicts/problems were now divided into two piles.

5. Now the participants were separated into groups of three. The groups were kept small to insure participation by all. The groups would now be handed a pile of problems/conflict which they were tasked to solve. They would brainstorm solutions to the problem/conflicts don't on post-its while a supervisor was present to take notes.

6. here groups would individually be told what they have done, and explained a bit about the practice theory and the ideas behind it.

7. The seventh step is an evaluation where the participant could come with positive and negative experience with the workshop as a whole

Workshop Findings

The main findings that came out of the workshop are:

- People do not have a "green" way of thought when coming to their own mobility, they do or take what is easiest within their price range or availability, as they are never faced with the consequences of their choice. Also health is not a big factor either when choosing type of transport either.

- Nudging people towards change might be a solution, based on people's opinions/beliefs towards transport in Copenhagen, e.g.. by using pollution numbers from around the Copenhagen central points and making them easily accessible. This idea originates from "REN Kærlighed til KBH" where a constant influence would prove to improve the situation by reducing the amount of waste left in parks and chosen areas by 41% since its launch in 2012 (Rostrapr, 2016).

- The biggest problem from the user's perspective seemed to be the presence of annoying or weird people. Whether you would bike, walk or take the train, these were the most common problems that the participant would write down and talk about.

From the workshop we got an general idea that people do not think about sustainability on their everyday trips, but more what is easy, or which they can afford. This fact also goes for being more healthy if you take the bike, getting more healthy seemed more like an extra bonus rather than a goal. Politiken wrote *"At the same time the survey shows that a solid majority of 65 percent believe that the green transition is 'very important' or 'fairly important'. And an entire 78 percent is very or fairly aware of living energy efficient and sustainable. And not just for saving money, the biggest motivation is to care for the environment and the climate."* (Saietz, D., 2016), yet we found that people do not think about the environment when choosing the type of transport they use every morning and evening, contradicting this statement that 78 % are aware of the environment, at least during traveling to and from work. The article also stated that people did not know how to be or become more sustainable.

The main reason seemed to base their choice of transport on what is easiest or fastest , and people did not associate themselves by the way they traveled. It was estimated that 75% of the opinions/beliefs were related to other people and mostly in negative ways, described as annoying weird or incapable of understanding the rules of traveling by public transport or by bike.

The workshop also showed that most people do not necessarily live green, but choosing green options once in awhile, when presented with a green alter-

native. Eg. you might not always be focussing on buying ecological products, but when presented with the option between organic or regular eggs, you are more likely to choose the most sustainable solution, if the price difference is not too great.

It is worth noting that the workshop took place in april, and that some ideas about the practice could and can change depending on the season and its weather. People's opinions/beliefs about how and why they might take a certain type of transport could possibly depend on and change due to a numerous amount of reasons, one being the weather. On a cold rainy day it might be okay to take the car, but on a sunny day you might be less likely to do so, as the meanings have changed.

Evaluation and Discussion of Workshop

After the workshop the participants would, in small groups of three, provide feedback and opinions on the workshop and their result to the facilitators. The reason for this was to ensure understanding of the whole workshop and to make future improvements. This would also help in the understanding of how the participants perceived and understood the workshop.

Participants main comments and critique:

- More explanation about the meaning of the workshop in the beginning, so that they would have an easier time seeing and understanding what they were doing, to see what they were producing or going towards.

- A time limit on each exercise so that they would be pushed to think faster and be more creative.

- Maybe make it into a focus group for more continuous work.

The workshop went quite well, since all participants were participating, debating and sharing knowledge. The vision was to make every participant share their perspectives and knowledge on their everyday trip and their observations and conflicts. All participants participated in the conflict solving phase which was the most crucial phase for the workshop, as it was here concepts would be developed and where the participants would have to work and talk together to develop concepts. A thing that could have been done here, instead of brainstorming fast solutions, could have been to make a design game involving these conflicts and in that way solve the conflicts and find the solutions.

A goal or reason we made the workshop was to create a concept development process, which could facilitate our project's concept development phase. Yet we experienced that many of the solutions made were small product based solutions which would solve or affect very small specific situations (?). The solutions would not change the practice of the users, but make the experiences more bearable. Here it can be discussed that issues they came up with was mostly of the social nature, as 'weird persons on the bus' or angry cyclists. A reason for this could be that these issues are something the people can relate to and experience, whereas sustainability is harder to have relations to as CO_2 emissions is not something that really can be seen nor felt in Copenhagen.

Concept Suggestions

This Chapter contains the information of the concepts developed throughout the course of the project. The concepts are developed based on research done both late and early in the project. Each concept is first described and evaluated, before the final concept is picked.

Communication Platform

This concept is about connecting citizen and municipality to co-interact and solve conflicts and problems together to improve the surroundings in Copenhagen. supposedly it is a web-based platform for creating communication and flow between relevant actors as DSB, Movia, Metro, the Copenhagen municipality and the users so they can better co-exist, and thereby improve the joy of using more sustainable solutions. The municipality already has a platform where citizens can write and mark broken roads, trashcans and etc. throughout the municipality, where the Copenhagen Municipality can respond and solve the issues by contacting relevant actors and give the citizen feedback on how far in the process their problem is in terms of getting solved, called givetpraj.kk.dk.

Why - The process of contacting relevant actors can be long, difficult, confusing and very different and at at times unstructured. Involving the citizens more in projects can help create ownership which can means less complaints, but the citizens are usually the experts of their area, and they could be used as a valuable resource to improve the success rate of projects.

Expected Outcome - A dedicated and established platform that can facilitate and function as a boundary object for the relevant actors in different situation alongside the citizens, and that can structure and show a process for the citizens, to give them a better understanding of a variety of situations

Open-Source Platform

A structured sharing platform for the DIY people to share and further develop concept, ideas and product together with guides so that other people can benefit and contribute to the development and process of new and better so-

lutions, and thereby taking things into their own hands to develop sustainable transport means along with other things.

Why - To give users a new form of responsibility and ownership towards a positive development, and to progress the growing trend of do it yourselves and life hacks as seen on many social medias and blogs (eg. pinterest, facebook, 9gag and IKEAhackers).

Expected Outcome - A platform that provides the user with the means and instructions that enable people to construct possibly cheap and sustainable products that can make their journeys more enjoyable and sustainable.

Free Public transport

This concept is about providing free public transport in Copenhagen. Among a different and large variety of experts there is common an understanding, that free public transport could provide some amount of socio-economic benefits by moving some of the private car users into the public transport sector, as described by the Danish technology council. The rewards wouldn't be economical but rather social, and in a long-term perspective a reduction in traffic and pollution (Perspektiver ved indførelse af gratis offentlig transport 2006).

Making a free transport system could mean an increase in tax in order to fulfill the monetary demand such a project requires.

"Gratis offentlig transport medfører flere passagerer indførelsen af gratis offentlig transport skønnes at ville medføre en stigning i antallet af passagerer på op til 75 % på langt sigt, dvs. pa mere end 5 års sigt. Denne stigning skyldes flere forhold: Den gratis transport vil umiddelbart tiltrække flere rejsende, og mange vil skifte fra andre transportmidler, især gående og cyklende. 20 % af de nye passagerer forventes at vare tidligere bilister. Blandt de nye rejsende vil man især finde personer med lav indkomst, som nu i højere grad har mulighed for at benytte det offentlige transportsystem"
- Lohmann-Hansen et. al. (2006)

Free public transport will help distributing the societal benefits and economy, and will help with connecting the surrounding areas to the central part of Copenhagen. In 2006 the taxpayers were already paying for 52% of the public transport operating costs (Lohmann-Hansen et. al., 2006).

Why - Free Public transport could contribute the transition from private motorized vehicles towards the use of public transport, due to the economical

advantages of using it compared to the private car.

Expected Outcome - High increase in public transport users, more reliable public transport, fewer cars, but also fewer bikes. Expects many conflicts from politicians and relevant actors..

Environmental Calculator Platform

An easy to use environmental calculator which estimates the CO_2 and air pollution of the current transport method and compares it to other transportation methods and "show" effects on a local scale. CO_2 footprint calculators already exist in many places on the web, but not in the local scale, and the user friendliness is limited. The Idea is therefore to put up sensor that shows the local pollution and that can give an indication on how much the user contributes to this pollution. Pollution is of a local issue, therefore it can be easier for people to relate to the issue if they are made of aware.

Why – Our studies shows that the sustainability issue is still not prioritized by the users.

Expected outcome – More willingness to change and act on own transportation needs and method as a result of a more relatable local scale. By putting the "numbers of pollution" up in front of people they could be motivated to change behavior.

Evaluation of Concepts

First each of the projects will be evaluated to find Strength, Weaknesses,Opportunities and Threats as seen in the SWOT business model. Even though this project does not revolve around a business, it is important to evaluation theses factors to ensure success and survival. Not considering these factors can mean that the project isn't sustainable, and won't survive for long as the basis of making each project possibly does not exist and therefore quickly will dissolve and resources will be wasted. After the SWOT model, will the concepts be evaluated the combination of Practice theory and MLP, as to see they will have an effect on the transition at hand.

After the evaluation, the final concept will be picked and continued into a further and more thorough product development phase, to bring the concept close to real life implementation.

Communication Platform

The communication platform builds on an issue of communication between the relevant actors in a local area. This concept would improve the communication between the stakeholders in the local areas to improve the situation and solve current conflicts. The platform would make it easier for the citizens in the local areas to get in contact with the appropriate actors for the given problems, thereby solving the problem that they might have. Having such a platform could also make it easier for the municipality to do citizen-involvement for their projects, which is a part of the city's renewable planning, as this has become an increasing demand. During a workshop with Peter Munthe-Kaas and two different municipalities, one from Frederiksberg and another from Jutland on the 17th of march 2016, it was found that it was often a challenge for the municipalities to tackle and handle and meet these kinds of demands, as they did not posses these types of tools.It was found difficult for them to identify the values of local citizens and interact and communicate with them, because they had no basis and no boundary object for communication. Having a communication platform that could function as a boundary object would possibly mean better and increased communication and user involvement in future projects.

The downside of this platform, based on the results of the workshop, are that only small number of problems will be solved, as these are the

problems the citizens are faced with, confronted with and reminded of everyday. The workshop showed that the problems that people noticed the most were the ones they would see and experience everyday, such as annoying pedestrians and other fellow travelers and obstacles on the roads. Copenhagen Municipality already have a platform for handling small problems as road obstacles called "Giv et Praj", where you can report in an obstacle and the municipality will respond, and find the proper actor for handling that specific problem, should they decide the problem is worth solving (Copenhagen Municipality., 2016.)

Strength	Weakness
Better collaboration between actors	Only solves small problem
Citizens feel heard	Sustainability transition limited
Citizens will know who to contact	Citizens don't take reponsability
The small problems will be solved	Does't change the practice
Opportunities	**Threats**
More user-involvement for CPH municipality in city projects	
connect DSB, Metro and Movia for more and better user involvement	

Table: Communication Platform SWOT

When evaluating from a practice theory and MLP perspective, it can be discussed that such a communication platform would create a 'meaning' of ownership for the citizens, as they now have 'helped' with a specific problem and now have the feeling of being a part of it and have a better understanding. This can lead to a social movement which is needed according to MLP, but the chance for developing into a social movement support sustainable transport, seems quite low with this concept.

Open-Source Platform

To have an open-source platform that provides ideas, knowledge and guides on how to develop and produce sustainable transportation products, or products that make the practitioner's journey more convenient, could help or further promote a sustainable transition going from personal fuels based means of transportation towards a more green alternative.

This platform would mean that the citizens would be able to be more responsible in taking care of themselves and taking responsibility towards environmental sustainability, as they will be provided with information on how to do and be so. The platform could provide a more personalized product for the uses as they themselves would be able to add and change certain things, so that each specific product would meet their requirements. Having a do-it-yourself platform also fits into the current trends of other DIY platforms popping up on social media, such as IKEAhackers.

Yet the platform will possibly only reach a limited amount of people, as some product ideas and solutions might require a larger amount of skills and material available, since not everybody has a 3D printer, laser cutter, power tools or access to such facilities.

Strength	Weakness
More responsability to citizens	Limited target group
Better educated Citizens	requires individual resourses from each citizen
Fitting DIY trend	requires expert knowledge to develop solutions for the platform
No societal investment	
Potentially reduce motorists	
Opportunities	**Threats**
Provide solutions to other sectors	Other Open-source platforms
expand for a globale target group	

Table: Open-Source Platform SWOT

From a practice theory perspective, would this concept create the meaning of personalization and a kind of selfish pride about a person's DIY transport. Such a relation could be expected to become a niche social movement of DIY mobility. Yet so far is DIY users, still a limited social group, but it is on a rise again with the so called 'hipster' culture. So the potential for transition exists here, but it will take time and would not be for everyone.

Free Public Transport

Creating a free public transport sector will help dividing resources and help ensure equity in the societal society(?), thereby creating a more socially sustainable society. It would help move motorists from the road towards a more sustainable alternative, as the benefits of changing habits will be greatly increased. This concept would help decrease the amount of cars on the roads, thereby making more room for busses and other alternatives, making for a more convenient situation in the Copenhagen traffic.

It can be difficult to motivate current car drivers to change into using public transport, even though it is free, to a noticeable degree. As people are already set in their habits, but over time less people might be less motivated to buy a car (Lohmann-Hansen, A., et al. 2006). The chance of cyclist changing are very much present here, as they are also provided free public transport, which would mean packed train, busses and metro. The concept doesn't provide the citizens with the ability of taking responsibility for their own actions and choices, these are more up to politicians. One choice the politicians would have to make would be to make a tax increase in order to cover the extra expenses. The tax increase would be around 0.5% (Lohmann-Hansen, A., et al. 2006). The chance of more vandalism in the trains is also present if done free, as described by Lohmann-Hansen, A., et al." (2006), meaning a less joyful ride. The system is also less likely to be improved as this will cost the government money, and the individual company won't earn more by fixing or solving problems.

Strength

More societal equlity

Less motorist

No ticket control

Radical change

Weakness

Less cyclists

More vandalism

Less responsability

Requires large finances

Depended on political change

Opportunities

Expand to rest of DK

Threats

Polical interest might change

Funds might run out

Table: Free Public Transport SWOT

The meaning of being 'free' might move people over to the practice of commuting with public transportation, but it will also create the meaning of increased taxes and unnecessary, with other users. From an MLP perspective it has contradicting economy factors, as the users might see it as cheaper while the municipality will see at expensive. And a political support for such a concept will be a necessarily. So the transition towards such a concept would be hard and time consuming.

Environmental Calculator

Creating an environmental calculator that could show the amount of pollution in the air around central Copenhagen, and make the number available to the public. Putting the numbers out in public spaces might motivate people towards more sustainable thoughts when making choices in the morning when going to work or school, as they are more frequently reminded about the consequences of their choices, and take more responsibility for their own actions. It could possibly help educate the public about the pollution around in copenhagen and it would only require a few resources to do so. There are considerable chances that this concept could make a noticeable different in

the local environment. The chance of the concept not having an impact is also a very present factor. Whether this concept will provide a radical change is difficult to say, but it could reduce the pollution by 40 procent, as "Ren Kærlighed København" did.

Strength	Weakness
Few resources	
Educate citizens	
Citizens will get more responsability	Might not be taken seriously
Provide good research data	

Opportunities	Threats
Expand to other cities	
Provide research data	Current pollution Apps
Sensor can possible measure other data	

Table: Environmental Calculator SWOT

An environmental calculator would create awareness to people and the new focus of pollution might have an impact on people as it is more relatable. So this will nurture the meaning of sustainability, at give it more focus. This could very likely create a social movement, that will impact the regime. And a social movement has shown to be an important factor for creating a transition in our current mobility. Yet the economical factor seems to be missing with this concept, but is not a necessity for when the other factors are present.

Selected Concept
CPH Mobility Check Platform

A user friendly and structured platform that can calculate the user CO2 emission and local air pollution. The platform allows the user to compare their current transport status to alternative transportation means. It will be able to provide fast information about current issues (eg. air pollutions), and collect users to gather and discuss conflicts, problems, issues and solutions.

Why - provides information about the current situation of CPH to make the practitioners more aware of the consequences of their actions, and help them find better solutions.

Expected Outcome - More informed practitioners in the streets, which understand the consequences of the way they transport themselves and how to change their behavior towards a more sustainable solution.

The concept provides a platform from which users can get information on how to change their daily practices and or improve specific things in their context, in order to achieve a more sustainable way of living, which fits with the problem formulation goals. Getting it out to the users and ensuring a steady use of and interaction with the platform can turn out to be an issue as there are no immediate benefits of using it, or using it continuously. Yet it could provide a basic platform for a "social movement niche" to grow and develop, forwarding a more general opinion on sustainability in the local city environment, to help decrease the number of cars in the city.

The Platform could be cheap to set up as it basically only requires information on different types of data, and possibly a webpage to share the knowledge on. Getting the information and the platform communicated out to the target user are the weak points in this concept as it would require a great deal of marketing, and the "right" type of marketing to influence the users.

Strength	Weakness
Opportunities	Threats

Table: CPH Mobility Check Platform

This concept is kind of mixture of some of the above, so here are several of the previous meanings included. By creating awareness and a more relatable context to sustainability, should the sustainability meaning become of higher priority of the users. As it also contain a forum for social debate it can be easier for users to assemble and thereby create a social movement that can have an effect on the current regime. This can lead to a transition of the mobility in Copenhagen.

Product:
CPH Mobility Check,
a Platform for the Future

This Chaper present the solution and final concept. It represents the outcome of using Practice Theory and Multi Level Perspective as a tool to design a product which can provide responsability to citizens and help them transition the mobility sector of Copenhagen towards environmental- and social sustianability.

Analysis show that not most people think about environmental sustainability, even though you ask them if they think about it, yet it seems like there is an interest in thinking more green. This product will motivate/nudge people to think more green and more about their environment.

The product is a service called "Clean Mobility CHP" and consists of a two part solution.

Part One

A sensor box with a particle sensor, which can count particles like, NOx and CO2 and other particles, that are in the air. This means the sensor can see the local air pollution in the area, and through statistics can calculate the amount of dangerous/harmful particles. The sensor is put in the local areas around highly trafficated roads and parks. The sensor will show on a display how many particles are in the air for the local resident to see. Then sensor will show a number that is based on the particles in the air and present them as cigarettes smoked, for an easy understanding of the severity of the problems in the local areas.

Part Two

A web-based platform which communicates and facilitates transitions processes, solutions and alternatives towards a more sustainable private mobility situation for the individual. Helping the individual to take more responsibility for their mobility situation, by providing possibilities and options for a more sustainable way of moving around in the local environment.

Sensor Box

The sensor box contains sensors which can count particles in the air, by using modern sensor technologies. Connected to the sensor there is a WiFi-shield and a screen. The WiFi-shield allows the transmission of data to the web-based platform, resulting in a map with pollution numbers around in the local areas within Copenhagen. The screen allows for the sensor to post recorded data, for the local residents in the area to see. On the side of the box will be a QR-code, allowing for direct access to the web-based platform.

Web-based Platform

The platform provides information of the local air pollution in Copenhagen based on the data received from the sensors around in Copenhagen City. The information is communicated to the public through a City map. The platform contains information about the local environmental challenges and how each individual can change, by providing alternatives, comparison models and fo-

rums.

The Service "Clean Mobility CPH"

The Clean Mobility CPH service combines both real-life data from local copenhagen city areas with a web-based platform that allows local residents and passers-by to follow the particle levels from around the city online. The information is continuously being updated by the sensors around Copenhagen, which record and transmit data instantaneously, keeping local residents and responsible actors updated on the particle levels in the air.

As described in "Table: Service Steps" cean mobility service not only provides particle levels updates on the web-platform, but each sensor has a monitor which show the particle levels from that specific area, and translates them into a easily understandable information, so that local residents can see how these particle levels influence their lives. After the data has been displayed on the monitor the data is sent directly to the web-platform, as a part of a local city map where the information from all the sensors is being gathered to give a picture about the worst areas, which should be avoided. A QR-code on the sensor allows for easy access to the platform for the local residents. Here they can interact with the map on pc and mobile devices for easy air navigation through the city. The platform then provides information about current implications with the current air pollution issues, explaining the risks related to the particles flowing around in the air from industries and traffic. After this the local resident can calculate their own CO2 footprint and particle pollution, to see how they influence the air quality of their local areas, and compare it to other residents from around Copenhagen City. After completing the evaluation the resident will be provided with information about how to change and adapt towards a more sustainable mobility situation.

Step 1	Step 2	Step 3	Step 4	Step 5
Sensors measures particles in the air, and show result on display and sends data to web-platform	QR-code allows the local residents and by-passers to enter the platform directly. Here information on the local air pollution are shared on a map.	The platform will provide date on the current air pollution problems, informing the local residents about risks.	Local residents can put in their own data on private practices and see the CO_2 Footprint and compare it to others.	Locals residents can find informations on how to change their mobility sistuation towards a more sustainable one.
Record and Analyse Data	**Show Pollution Map**	**Information on Problems**	**CO_2 Footprint Calulator**	**Process of Change**

Table: Service Steps

Implementation

The process of implementing the service will first be described through the business canvas model, since this method provides an overview of the key actors and gives an overview of the agenda surrounding the business around the service, and how enrollment will be made to each customer and partner, to insure enrollment when introduced to the market (Osterwalder, A. and Pigneur, Y., 2013). After that a SWOT model will be made to identify key point to be aware of while introducing the the service to the local areas and their resident. After that an implementation plan will be described to how the services will be introduced and how long the process will take before it starts putting out data and result.

Business Canvas

The business canvas shows an illustration of how the project is facilitated out to the key actors and presented to the user and customers. It has the perspective of a consultancy, which isare developing a solution for Copenhagen municipality tofor make a push towards a sustainable transition. Because of this the business canvas will not illustrate the business of a company, but show how the project creates values.
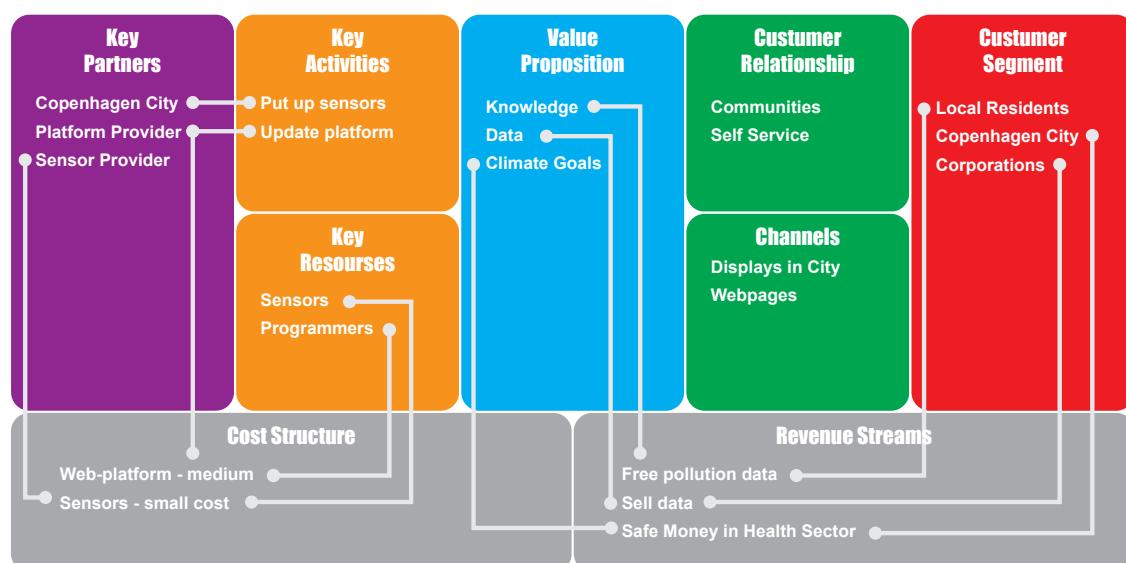

Table: Business Canvas

Customer Segment , Value Proposition and Revenue Streams

The customer segment consists of two main targets and a third secondary customer. The reason for the division is to point out whom is in focus, as the service should still operate, as long as these two customer segments are supported, using and operating with the service. The Key segments are the local resident, who also consist of by-passers that travel around with the local areas of copenhagen city, and the copenhagen municipality which support the service.

The First Key Customer are the local residents and passers-by as these are the end user of the service, and the ones influenced by it. The local residents and passers-by will be provided with free access to the recorded air pollution data, not only in their area, while going through it, but also from other areas around in Copenhagen, and they will be provided this information on their home computers and mobile devices. This should provide this customer with knowledge about which areas to avoid at certain times, and the risks about traveling through them. Secondly this customer will be provided with information about how to make incremental steps towards a better living standard and a more environmentally sustainable way of living, by changing configure means, skills or materials (referred to in practice theory) without changing the needs of the local residents. This will benefit not only the individual, but the whole of the community in which they interact.

The Second Key Customer is the Copenhagen Municipality (Copenhagen City). This customer is also the key partner, as the customer will help finance the development and production of the sensors and service. The reason for them to do this is a part of their transition plan of being a fossil free city by 2025 (Copenhagen Municipality, 2012). The service will for the Copenhagen municipality communicate the process of transition, and help the citizens of Copenhagen taking part in the transition. The service will influence the citizens to make more rational choices that focus more on environmental sustainability and health than only the convenience, time and money. The Copenhagen municipality will save finances on expenses within the health sector, as its is estimated that the air pollution cost 500 mil. kr. a year, due to for example, lost incomes and bad health in the community as a direct cause of the bad air quality and pollution in Copenhagen City including frederiksberg (Brandt, J, et al, 2013, pp. 10). The Copenhagen municipality is the one that will eventually take control and have ownership over the project, this means the Copenhagen municipality can decide to sell data to private companies to finance part of the project, if they decide to do so.

The Third Customer assembles companies interested in the collection of data, for research or further distribution of data. An example of a customer could be CityDataExchange.dk or similar coorporations. These types of companies could either pay for a membership or for specific data.

Customer Relationship and Channels

The locals residents will be gathered through the web-page into communities which can through web-page forums develop ideas and solutions together with the interaction of the municipality and local councils to help develop their areas to become more aware of the air pollution and help them develop their area towards clean air solutions creating a better environment for the local city area community.

The Municipality will function as the one responsible for the web-page, updating political and technological issues and developments, for the local residents to see. These thing will be translated into fishable information so that the local residents can see and understand how this can influence them, thereby they can adapt for a more healthy and environmentally clean living style.

The Channels from where the main key customer is enrolled are through the displays on the sensor, which are located throughout the city. These screens will remind and update the local resident about the air quality data every time they walk outside. The sensor will also have the QR-code, which allows for easy and direct navigation to the web-page, so they can keep themselves updated on the development of the air pollution and new policies, which could benefit the local residents or create new conflicts.

Their corporations can access the data through a licence on the web-page, allowing them to get the access they seek, or set up arrangements, to get the data sent directly to their personal servers.

Key Partners, Key Activities, Key Resources, Cost Structure

The key partners are the Copenhagen Municipality, the company responsible for providing the sensors and the company responsible for maintaining and building the web-page. The Copenhagen Municipality will be responsible for putting up the sensor and the one that will eventually be responsible for the service and moderate the communication between the other key partners, making sure that the activities are done and that the key resources are facilitated. The key activities are keeping the web-page updated with new data, new information and new campaigns which the company providing the sensor will have to develop and provide Copenhagen municipality with sensors and data. Both the company handling the sensors and the company handling and managing the web-page will have to use programmers which is the biggest expense. Each sensor costs around 150 kr. in materials according to Sørensen K. (Appendix 3) using open source sensor products Arduino. Developing a web-page with a map showing data from different sensors is estimated to cost around 250.000 kr. plus a yearly maintenance fee of 20.000 kr. and the salary of the programmers supporting the web-page, which can vary a lot since it is dependant on the amount of support needed. according to an interview

with Olsen, J. from Kraftvaerk.dk taken place the 20th of may 2016. The estimate will change depending on the number of elements, type of data codes, and function etc.

Prototypes

As a part of the design process to develop the solution/product, tests were made to figure out what type of information could be put up on the platform, to help people change their behavior towards a more sustainable pattern. One of the ideas was to provide people with cheap, organic and light means of transport, by providing information on how to make it themselves. For this reason a template model of a bamboo bike was made, to help DIY people build their own cheap, ecological and light bike (Appendix 10).

Private Fotos

The Vision

The vision is that this service will make citizens around in Copenhagen more aware of their local environment, and help take responsibility for their practices. Copenhagen municipality have a vision to be fossil free by year 2025, and this service is a part of that vision by creating a transition platform for the citizens (Copenhagen Municipality, 2012). This is done by communicating out information about how to change and why it is important, by showing the severity of the pollution on a local street level, compared to previous regional levels, which does not give a clear pictures of the severity in the highly trafficated(?) streets and local areas of Copenhagen.

The figure below shows some of the key numbers related to service. It illustratesd the resource prices of creating the sensors and creating the platform and compares them with the estimated cost of the air pollution. It indicates that the situation only needshave to be improved by 0.26% before the expenses have been covered. Yet the vision is to make Copenhagen fossil free by year 2025, and that the service will be a part of the solution of transitioning Copenhagen towards this goal.

Key figures

Price of 99 sensors	49.500 kr.
Price of Platform	270.000 kr.
Total Expenses	**319.500 kr.**
Estimated Cost of Air pollution from traffic in Copenhagen City	125.000.000 kr.
Expense compared to cost of the air pollution in Copenhagen	**0.26%**

Table: Key Figures
Sources: Sørensen, K. (2016), Olesen, J.S. (2016) & Brandt, J. et al. (2013)

Expected Effects of the Solution

It is expected that his solution will have the effect of creating a higher degree of awareness among the citizens of Copenhagen. By giving them an understanding and a way relate to the pollution issue, will the citizens be more willing to convert or at least reduce their unsustainable behavior. When using the perspective of practice theory, will this solution attempt to press on the meaning of sustainability and health, in order to making them a bigger priority to the citizens. With these two meanings in mind, is the hope to create a social movement within the current mobility regime in order to push for more sustainable methods. It has been shown in previously in the report that factor of social movements is missing towards initiating a transition, therefore the hope that together with the already existing factors of politics and niche technologies, this could help pushing towards the needed transition.

This solution is only seen as a part of a system of many solutions, so the effect is not expected to be of huge impact, but it will assist and it will be nudging people in the right direction, and only a small portion is needed to change for the solution to be financial sustainable.

Conclusion

The solution developed is a service which provides information that could very well nudge local citizens towards a more sustainable behavior, or even a conscious choice of being more sustainable by making small changes to the individual's behavioral patterns. It does so by providing the information and knowledge about the situation and providing information about alternative practices. This was the end result of the project, which used practice theory and MLP to develop a solution to a growing problem of air pollution in the city and a lack of individual and social responsibility with the sector of mobility in Copenhagen. The expected outcome of this service is to present it to the municipality as a possible tool which can help raise the awareness for air pollution within the city. This can provide a platform for informing the citizens about how to make small changes in their practices by making small configurations in their consumption and practice patterns. The solution is a part of a larger movement of transition currently undergoing in Copenhagen municipality and within danish politics. The effects might be quite limited but the cost are possibly smaller than the gained benefits from this solution as we have compared it with the expenses created by the bad air quality in Copenhagen as described in the research chapter.

One the critiques about the developed solution is that it will not provide clean air or more sustainable mobility to Copenhagen, and the air quality won't be affected immediately. It will also later be difficult to argue, should the air quality improve, that this service were a partly a reason for this, and not other technological solutions or policies. Similar issue is seen on providing data on how much the service reduced the expenses of the costs related to the air pollution, the numbers would always be estimates based on different perspectives rather than measured.

During the project we found that both practice theory and MLP have its flaws, and we therefore tried to make each theory complement each other as much as possible. The flaws we found in using Practice theory were that practice theory does not consider the surrounding elements outside the practice which still might have an effect indirectly, and even though stating it uses sociotechnical systems to analyse a practice, it only describes the ones related directly to the practitioner. We found that the practices are dependant on political infrastructural choices of politicians and engineers, which often are not included in the analysis of practices we have read or described ourselves, as the practitioners don't interact with these. Investing in car infrastructures (though biking related infrastructures is also invested in) makes it more acceptable to use the car, as this becomes more convenient, and this affects the choice and practice

the citizens use or do, even though this is not directly visible in the practice theory analysis. This means there's less understanding of why driving the car is an unacceptable practice than represented in the practice theory. Meaning that the solutions possibly developed would not have been focusing on the surrounding context but only the small conflicts in the practitioner's limited surroundings. What was identified by using practice theory was the lack of attention to the environmental elements in the everyday practices and choices. As discussed in the chapter of co-design it was found that people do not think about sustainability in the everyday practices, but they like to "press the sustainability button" when provided the option. We would argue that using practice theory and the co-designing elements did not generate radical innovations or anything close to it, as the practitioners did not try or want to change their behavior, they were more focussed on making as small changes as possible to their own practices, and changing the materials or actors surrounding them.

Multi-level perspective provided from a historical perspective insight into which factors have throughout time had influence on the transitions of mobility of Copenhagen. Here it was seen that factors like political determination, new technologies, social movements and economical changes often had a influence on the transitions. An analysis on the current situation provided a status on the current mobility in Copenhagen, showing that it is in the middle of a slowly developing transition. By applying the historical factors it could be seen that political determination and the technologies were present, but the lack of social movements and economical investments have been missing. While MLP provide the factors which to push on for a transition, does it lack the proper depth in the social or user understanding. The user understanding is a quite complex, therefore a combination of MLP and practice theory creates a better foundation for the problem at hand.

Practice Theory and MLP do not work as design tools. But they both provide a good basis for evaluations but never any proper design facilitation. Practice theory had a few suggestions about how to design solutions by using co-design according to Kuijer, S.C. (2014) yet it was found that the practitioners only focused on small annoyances within their own practice, and would try to develop solutions for those, even though the assignment was presented to make the alternative to the car more attractive and appealing, in order to move motorists away from the car. It seems to us that the practitioners were not aware of their surroundings, and they would therefore only focus on small incremental technological solutions. The practitioners did identify societal issues, such as the amount of traffic on the roads during rush hour, yet this did not seem to be the most important for them. It was also discovered that they never talked about pollution, emissions and other environmental issues. This discovery became a new approach in order to make societal changes, which would influence the general welfare of Copenhagen. The combination of Practice theory and MLP for evaluating the concept is great to evaluate on from a transition perspective. It combined the user's focus into a societal system,

which means that it points out which factors are relevant to push on for succeeding with a sustainable transition.

To sum up on the conclusion have this project contributed with a user-oriented solution towards assisting with a sustainable transition of the mobility of Copenhagen. WIth the use of practice theory as a design it has been discovered that it practice theory do not provide the proper design solutions to assist with the transition as the solutions was to incremental. The combination of Practice theory and Multi-level perspective have shown to be a good platform of evaluation to see a coherence between users and the sectorial, by finding the right factors to push for in order to have an effect on the transition of mobility in Copenhagen.

Evaluation of the project

It was decided to focus on a local and specific area, to get a better understanding of the practitioners within this area, which was Copenhagen. Widening the analysis to include practices from other regions in Denmark or even further to other western countries, would possibly have provided a solution which could easily be implemented in other areas outside Copenhagen. Looking at areas outside of Copenhagen would actually also have provided a better chance of reducing the air pollution in Copenhagen, as a significant amount of the air pollution in Copenhagen is background pollution from other municipalities, or that of pollution from ships passing Copenhagen. Yet it was decided to keep at a local level to ensure that it would work in the area of Copenhagen, and fit into the practices of a local in Copenhagen. We figured it would be easier to influence small things and practices within a small area, than changing practices and provide new meanings on a more global level. Practice theory is very locally focused, in order to provide a strong social analysis on a practice. MLP are more holistic focused, as it provides strong understanding of elements outside the practice, so both technology, economy, social movements, politics and global uncontrollable situations.

During the workshop it was found that the solutions developed were all small and incremental, in the report it is argued that this was because of the Practice theory approach trying to make changes in people's practices that do not wish to change, yet this might not be the reason. Several reasons and arguments could be made to defend the Practices theory in its ability, but in this project, it was only providing small incremental solutions. This could be because of the workshop did not facilitate a proper process that would change practices, and therefore the participants only came up with smaller incremental solutions, or

maybe the mobility system in Copenhagen is so well structured, that the citizens really are satisfied, and can not see any of the big issues. The problem we identified and set out to solve is a hidden problem which people can not see so easily.

MLP was used to ensure the societal perspective and ensure that the regime of mobility in Copenhagen was taken into consideration.. Yet one of the problems meet, which can be argued as a weakness in the analysis, is that many of the analyzed participants were people mostly in the twenties and thirties.. I was a particular difficulty in getting hold of users who were of another relevant age and social group as they were not interested or tOo busy to line up for an interview. This was more difficult than anticipated and therefore a weakness in the project.

A weakness to the developed solution lies in the fact that it is difficult to reach the motorist, as these users only will see the sensors as they move from the car into their office or workspace. Therefore it would be relevant to have the sensors placed in areas like car parks to create a better visibility and develop the option for better interaction. Yet this could provide a strong message as the pollution in underground car park, would indicate and show data mostly based on the air pollution from the car within that car park, as the air is more trapped than when driving out in the open.

Were we to have started with a workshop, the possibility of making more workshops and creating a focus group would have been possible. This could lead to having the involved participants understand the societal context, and make them understand a broader view of conflict and need for larger changes within the society, thereby making them generate "better ideas" which would have a bigger impacts on the society.

Reflection of Process and Further Work

It was learned through the study that Practice Theory provides good analytical tools to describe and understand user through their practices. We started the Practice Theory analysis by observing the the surroundings of the practice, shadowing the practice and taking pictures to gain more inside knowledge of the practice. this type of data did not provide enough information on the specific individual practices which is why we also conducted interviews on commuters near car parks and train stations. Through this newly gained in-

formation we started to understand previously hidden insights about people's practices, that didn't show from just observing. These insights gave new perspectives on each person's needs, realising that people's needs change from each individual more often than not. We found that each story, connections between and meaning, skills and materials, changed from individual to individual. Yet these different connections and patterns were difficult to map. We decided to make a workshop in order get a better understanding of these patterns and to draw in users into the product development phase, to ensure ownership and a soluti-on that would fit the wishes and needs of the user themselves. What we actually learned from the workshop was that the user themselves didn't understand the real issues, and the patterns they made and the issues they defined. The participants didn't really suggest any major issues or provide any radical changes, and it could be argued that it didn't even provide incremental changes, as many of their solutions were about avoiding the conflict rather than solving it. One of the problems descri-bed was that of annoying people in the public, and the solution was to provide headphones for people on the trains and busses as seen in appendix 6. We did find some other interesting information about their meanings during the workshop, that people did know and think about their environment, when they had to think for themselves. Only when provided with the option to pick sustainability would they choose that as a thing surrounding their practice. Looking back, having this information from the start rather than closer to the end would have provided more opportunities to design several workshops hopefully nurturing new ideas and developing concepts with a stronger focus on the social re-sponsibility towards the everyday behaviour in the sustainable mobility choices. This could have helped develop a stronger and more precise product solution which fitted the local context of which we wanted to put it in.

The MLP model here helped ensure this societal perspective, as it was the identified regime and its openings, which made our solution better fitted to inter the regimes, without creating any new conflicts. The MLP gave us the knowledge we needed to understand the context, which the practice theory didn't and that the workshop didn't manage to provi-de in time. To have understood the context better we would have had to have had workshops with more than just the practitioners, but also ac-tors from the rest of the regime to ensure a collaboration or solution that didn't create conflict among other actors, and possibly other regimes. Yet at the current state it was pretty obvious that besides the practitio-ners, the municipality of Copenhagen would be the most important and influential actor. Copenhagen municipality is one of the more difficult actors to involve in these kinds of projects as they are always busy and often lack interest, but we did manage to set up an hour long interview, to gain insight in their standings and perceptions of our concept as

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well and feedback on the development of the concept. With this new perspective and this new information would could confirm our theory of there being an ongoing transition and some openings in the regimes, as the municipality were changing and allocating their resources to other departments to focus more on projects that would bring more societal and environmental sustainability to Copenhagen.

After the workshop we developed a concept which we could present to the municipality. The interview didn't make any big changes to the concept, but provided us with knowledge and understanding about the municipality, in order to figure out how to implement a finished solution in the City of Copenhagen. So before we can present the final solution/product to the municipality and implement it in Copenhagen, we have to produce some prototypes, and put them up in the areas around Copenhagen to test out if the citizens and passers-by in the areas register any of the sensors, possibly interview people walking by the sensor, which displays information, about their thoughts on the information they just received and their meanings and thoughts about their opinions before and after walking past it. Secondly we would have to create a workshop to figure out how to build the platform, by inviting users and possibly programmers we would be able to figure out how such a platform should work.

For the future research on whether practice theory can work in practice and be used as a design tool for future processes, we suggest that more research on practice theory connected to an actual design tool would improve on the theory to make product development, as either MLP and practice theory provided this. We do suggest combining practice theory with MLP as this provides a better understand of the context of which you operate, yet the lack of designs tools and design thinking in general can be a barrier, as workshops where practitioners develop the concept didn't, in this project, provide enough material to develop a product solution which suited our goals of making practice change, as practitioners don't want to change.

References

A.Ojgaard 2016. Historien om sporvogne i København, magasinet KBH [https://www.magasinetkbh.dk/indhold/historie-sporvogne-i-kobenhavn] (last accessed 30-05-2016)

Astrup. S, 2016. Slut med favorisering: København vil tage plads fra bilister - og give den til cyklister, Politiken. [http://politiken.dk/forbrugogliv/forbrug/din-transport/ECE3220669/slut-med-favorisering-koebenhavn-vil-tage-plads-fra-bilister---og-give-den-til-cyklister/] (last accessed: 30-05-2016)

Barr, S., 2015. Chapter 5: Beyond behavior change: social practice theory and the search for sustainable mobility. Putting Sustainability into Practice.

Bertelsen. T. N, 2008. Ekspert: Hævet befordringsfradrag giver mere CO2, Altingen.dk. [http://www.altinget.dk/artikel/ekspert-haevet-befordringsfradrag-giver-mere-co2] (last accessed 30-05-2016)

Bjørn Godske, 2016. Elbiler: Danmark står stille, mens resten af Norden spurter derudad, Ingeniøren.

Brandt, J., Jensen, S.S. and Plejdrup, M.S., 2013. Sundhedseffekter og relaterede eksterne omkostninger af luftforurening i København. Aarhus Universitet, DCE-Nationalt Center for Miljø og Energi.

Bredsdorff, M., 2016. Analyse: Nu er fremtiden for letbaner i København på spil. Ingeniøren. [https://ing.dk/artikel/analyse-nu-er-fremtiden-letbaner-i-kobenhavn-pa-spil-183488]. (Last accessed: 16-05-2016).

Brintbiler.dk., 2016. Tank Stationer. [http://brintbiler.dk/tankstationer/]. (Last accessed: 16-05-2016).

Capital Region, 2014. Regional vækst- og udviklingsstrategi: Luft- og støjforurening i Region Hovedstaden

Copenhagen Municipality,. 2015. København investerer 60 millioner i intelligent trafik. [https://kabell.kk.dk/artikel/k%C3%B8benhavn-investerer-60-millioner-i-intelligent-trafik]. (Last accessed: 16-05-2016).

Copenhagen Municipality., 2011. Fra God til Verdens Bedste: Københavns cykel strategi 2011-2025. Technical and Environmental Administration. [https://www.kk.dk/sites/default/files/edoc/f13dc0f5-2728-4bf5-bacc-

210962bf9565/670e00bb-1dac-49c9-a05b-2847853be1d5/Attachments/ b92833b0-3e7f-4b00-a28e-11c0091ccaaa.PDF]. (Last accessed: 16-05-2016).

Copenhagen Municipality., 2012. CHP Climate Plan 2025: a green, smart and carbon neutral city. Technical and Environmental Administration. [http://kk.sites.itera.dk/apps/kk_pub2/pdf/983_jkP0ekKMyD.pdf]. (Last accessed: 16-05-2016).

Copenhagen Municipality., 2012. Fakta om cykelbyen København. [http://www.kk.dk/indhold/fakta-om-cykelbyen-k%C3%B8benhavn]. (Last accessed: 17-05-2016).

Copenhagen Municipality., 2014. København Cyklernes By: Cykelregnskabet 2014. Technical and Environmental Administration. [http://kk.sites.itera.dk/apps/kk_pub2/pdf/1362_cFTGCXHzmE.pdf]. (Last accessed: 16-05-2016).

Copenhagen Municipality., 2015. Copenhagen Climate Projects: Annual report 2015. Technical and Environmental Administration. [http://kk.sites.itera.dk/apps/kk_pub2/pdf/1437_jKjlNNQ38N.pdf]. (Last accessed: 16-05-2016).

Copenhagen Municipality., 2016. Giv et Praj. Technical and Environmental Administration. [http://givetpraj.kk.dk/]. (Last accessed: 16-05-2016).

Dansk El-Bil Alliance., 2016. Årlige salgstal for elbiler i Danmark. [http://www.danskelbilalliance.dk/Statistik/Salgstal_Aar.aspx]. (Last accessed: 16-05-2016).

Dansk El-Bil Alliance., 2016. Lade-Stander Kort. [http://ladekort.danskelbilalliance.dk/]. (Last accessed: 16-05-2016).

Dansk El-Bil Alliance., 2016. Månedlige salgstal for elbiler i Danmark. [http://www.danskelbilalliance.dk/Statistik/Salgstal_maaned.aspx]. (Last accessed: 16-05-2016).

Den Store Danske, various writters. http://denstoredanske.dk/Bil,_b%C3%A5d,_fly_m.m./Biler/Teknik/bil, http://denstoredanske.dk/Bil,_b%C3%A5d,_fly_m.m./Biler/Teknik/omnibus, (last accessed 30-05-2016)

Fruensgaard, N.O., Date Unknown. Den integrerede cykel - et forsøg på at udvikle en velegnet bycykel.[http://arkiv.cykelviden.dk/filer/nof.pdf] (last accessed: 30-05-2016)

Effersøe, H., 2013. Omnibus. Den Store Danske. [http://denstoredanske.dk/Bil,_b%C3%A5d,_fly_m.m./Biler/Teknik/omnibus]. (Last accessed: 16-05-2016).

Gate 21, 2014. Formel M: MOBILITET I DANSKE KOMMUNER [http://www.gate21.dk/wp-content/uploads/2016/02/Mobilitet-i-danske-kommuner_popul%C3%A6rfolder.pdf]

Geels, F.W. and Schot, J., 2007. Typology of sociotechnical transition pathways. Research policy, 36(3), pp.399-417.

Geels, F.W., 2010. Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. Research policy, 39(4), pp.495-510.
Godske, B., 2016. Elbiler: Danmark står stille, mens resten af Norden spurter derudad. [https://ing.dk/artikel/elbiler-danmark-staar-stille-mens-resten-af-norden-spurter-derudad-183794] (Last accesed: 30-05-2016)

Hansen, J.L., 2015. DI angriber besparelser på grøn succesforskning. Vores Omstilling. [http://voresomstilling.dk/artikel/di-angriber-besparelser-p%C3%A5-gr%C3%B8n-succesforskning/652]. (Last accessed: 16-05-2016).

Hansen, T.H. 2013. Test: Så meget forurener elbiler. Ingeniøren. [https://ing.dk/artikel/test-saa-meget-forurener-elbiler-165111]. (Last accessed: 16-05-2016).

Jensen P.B., 2012. Rulleskøjterne skal blive på fortorvet & skateboardet skal blive hjemme. Fyens. [http://www.fyens.dk/indland/Rulleskoejterne-skal-paa-fortovet-og-skateboardet-skal-blive-hjemme/artikel/2052822]. (Last accessed: 16-05-2016).

Jensen, S.S., Brandt, J., Ketzel, M. and Plejdrup, M.S., 2013. Kildebidrag til sundhedsskadelig luftforurening i København. Aarhus Universitet, DCE-Nationalt Center for Miljø og Energi.

Jeppesen, J.G., 2011. Cyklen og byen. - en undersøgelse af cyklens tekniske og brugsmæssige udvikling samt analyse af cyklismens interaktion med byudvikling og byplanlægning, Aarhus Universitet, Institut for Historie og Områdestudier.

Jonassen, N., Dietrich, O.W., 2013. Bil. Den Store Danske. [http://denstoredanske.dk/Bil,_b%C3%A5d,_fly_m.m./Biler/Teknik/bil]. (Last accessed: 16-05-2016).

Knowles, R.D., 2012. Transit oriented development in Copenhagen, Denmark: from the finger plan to Ørestad. Journal of Transport Geography, 22, pp.251-261.

Kristensen, F.B., 2015. Regeringen indfører gradvis afgift på elbiler: Elbiler vil i

2020 være pålagt fuld registreringsafgift. Politiken. [http://politiken.dk/indland/politik/ECE2879509/regeringen-indfoerer-gradvis-afgift-paa-elbiler/]. (Last accessed: 16-05-2016).

Kuijer, S.C., 2014. Implications of social practice theory for sustainable design. TU Delft, Delft University of Technology.

Lauta, N., 2015. Bilers øgede vægt går ud over miljøet. Politiken. [http://politiken.dk/indland/ECE117307/bilers-oegede-vaegt-gaar-ud-over-miljoeet/]. (Last accessed: 16-05-2016).

Lohmann-Hansen, A., Holmberg, B., Jørgensen, C., Ege, H., Larsen, M.M. and Jespersen, P.H., 2006. Perspektiver ved indførelse af gratis offentlig transport. arbejdsgruppe under Teknologirådet.

Lomborg, B., 2013. Lomborg: Elbilens beskidte hemmelighed. Berlinske. [http://www.b.dk/kommentarer/lomborg-elbilens-beskidte-hemmelighed]. (Last accessed: 16-05-2016).

Lund, M., 2013. Københavns sydhavn var krumtappen i det danske bil eventyr. Ingeniøren. [https://ing.dk/artikel/koebenhavns-sydhavn-var-krumtappen-i-det-danske-bileventyr-165090]. (Last accessed: 16-05-2016).

Lund, M. 2013. Københavns sydhavn var krumtappen i det danske bileventyr, Ingeniøren [https://ing.dk/artikel/koebenhavns-sydhavn-var-krumtappen-i-det-danske-bileventyr-165090] (last accessed 30-05-2016

Mortensen, M.T., 2013. Fingerplanen før, nu og i fremtiden. Kroppedal Museum. [http://kroppedal.dk/wp-content/uploads/2012/05/Fingerplanen.pdf]. (Last accessed: 16-05-2016).

Næss, P. and Vogel, N., 2012. Sustainable urban development and the multi-level transition perspective. Environmental Innovation and Societal Transitions, 4, pp.36-50.

Nordhanven.dk, 2012. NYE BYOMRÅDER ER FREMTIDENS KØBENHAVN [http://www.nordhavnen.dk/presse/nyheder/2012/nye+byomrader+er+fremtidens+kobenhavn.aspx] (last accessed: 26-05-2016)

Nørgaard Jensen, 1981. Cyklisme, bilisme & trafikkens politik : en sociologisk magisterafhandling

Osterwalder, A. and Pigneur, Y., 2013. Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons.

Pineda, A.F.V. and Vogel, N., 2014. Transitioning to a low carbon society? The

case of personal transportation and urban form in Copenhagen: 1947 to the present. Transfers, 4(2), pp.4-22.

Pinholt, K., Sørensen, L.M., 2013. DR måler forureningen i København: Denne gade er værst. Danmarks Radio DR Nyheder. [https://www.dr.dk/nyheder/indland/dr-maaler-forureningen-i-koebenhavn-denne-gade-er-vaerst]. (Last accessed: 16-05-2016).

Press release by Copenhagen municipality, 2015. København investerer 60 millioner i intelligent trafik. [https://kabell.kk.dk/artikel/k%C3%B8benhavn-investerer-60-millioner-i-intelligent-trafik] (last visited 30-05-2016)

Puggaard, A., Liisberg, E., Thormann, A. and Carlsen, L., 2014. Mobilitet i Danske Kommuner. Formel M, Gate 21.

Regeringen., 2011. Energi Strategi 2050: Fra kul oile og gas til grøn energi. Klima- og Energiministeriet. [http://www.ens.dk/sites/ens.dk/files/forbrug-besparelser/energispareraadet/moeder-energispareraadet/moede-energispareraadet-16-marts-2011/Energistrategi2050_sammenfatning.pdf}]. (Last accessed: 16-05-2016).

Ritzau., 2016. Salget af elbiler er gået i stå efter politisk aftale. Børsen. [http://borsen.dk/nyheder/politik/artikel/1/324166/salget_af_elbiler_er_gaaet_i_staa_efter_politisk_aftale.html]. (Last accessed: 16-05-2016).

Rostrapr, 2016. Ren Kærlighed til København. [http://rostrapr.com/reference/ren-kaerlighed-til-kbh/] (last accessed: 06-05-2016)

Saietz, D., 2016. Vi Fatter Ikke den Grønne Omstilling. Politiken. [http://politiken.dk/oekonomi/2050/ECE3144953/vi-fatter-ikke-den-groenne-omstilling/]. (Last accessed: 16-05-2016).

Sørensen, K., 2016. Appendix 3

Spradley, J.P., 1979. The ethnographic interview.

Spurling, N. and McMeekin, A., 2015. Interventions in practices: sustainable mobility policies in England.

Spurling, N., McMeekin, A., Shove, E., Southerton, D. and Welch, D., 2013. Interventions in practice: re-framing policy approaches to consumer behaviour. Manchester: Sustainable Practices Research Group.

Stampe. P., 2008. Bilens Historie. Historie 1, pp.72-73. https://white-album.s3.amazonaws.com/files/HI_DK_01_72_Historisk.indd

Transportministeriet, 2010. Den kollektive trafik og miljøet, pp. 1.

Verbeek, D. and Mommaas, H., 2008. Transitions to sustainable tourism mobility: The social practices approach. Journal of Sustainable Tourism,16(6), pp.629-644.