PROJECT HELIOTROPE

EXPLORING THE FUTURE OF A VEHICLE OWNERSHIP

Sami Laiho
MFA Transportation Design
Umeå Institute of Design
Umeå University
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The Heliotropium Etymology

Heliotropium is a genus of flowering plants in the borage family, Boraginaceae. Species in this genus are commonly known as heliotropes. The growth habit of ascent heliotrope is shrill and upright.

The name “heliotrope” derives from the old idea that the inflorescences of these plants turned their rows of flowers to the sun. Ηλιος (Helios) is Greek word for “sun,” τρέπειν (trepein) means “to turn.” The Middle English name “turnsole” has the same meaning.

This project is using the heliotrope etymology and color as an inspiration for the design and presentation style of the concept. The way in the plant and its inflorescence behave ideally reflects the ideology of the Lexus heliotrope concept and how the vehicle and infrastructure work together. For example, its optimum way of collecting solar energy identifies heliotrope specific behavior.

The Heliotrope Color

Heliotrope is a pink-purple tint that is a representation of the color of the heliotrope flower. Heliotrope color can also be folded into two other colors, heliotrope gray, and old heliotrope. I will be using the heliotrope gray as my theme color in this project (wikipedia, 2018).

Heliotrope gray CMYK: 0, 11, 1, 33
I would like to thank everyone who supported me here in Sweden and in Finland on my way to my master thesis. First I want to thank especially my family and my lovely girlfriend, who have supported me even though I've been away from them and home. Secondly, I would like to thank Demian Horst, Jonas Sandström and Tomas Lindhell for great support help at school. Without their help and support I would not have reached such a high level in my project. And thirdly, I would like to thank my loyal friends in Finland who have traveled to visit me overseas and all UID Transportation Design students at the school who gave peer support in difficult moments.

I would like to send special thanks to my beloved and respected 90-year-old grandmother, who was diagnosed with lymph node cancer during this project. She has been a great example and given me additional motivation and strength to continue working with this project.

Sami Laiho, June 2018
Problem Area

In year 2030 approximately six out of every ten people will live on the urban area. This movement is especially strong in Asia's mega cities like for example Tokyo, Delhi, Mumbai and Shanghai. Accelerating globalization is driving us towards the situation where each little peace of transportation must be optimized to gain space, time and efficiency to reduce the greenhouse effect. Personal transportation is a sector which will inexorably face major changes. It might not be as acceptable as it is nowadays.

It is simple. Cars are inefficient the way they appear at the moment. To be able to accept them as a part of the future traffic, they need to be designed differently. Future personal transportation must be able to multitasking outside of traffic. It is important that the usage ratio would be improved considerably compared to the current one. When autonomous driving technology enter the market, a big step towards expanding the scope of the vehicles will be taken. It is still consequential to understand that improving efficiency will not only require Cutting-Edge technology. With re-designed constructions and the creation of new ideas and preferences, one can also go far. While the vehicles are being redesigned, it is also necessary to renew the way people perceive it. If users adopt a new kind of vehicle ideology, it will lead to a positive development curve.

Design Process

The used design process was rather traditional. The research phase was started in January being followed by an ideation phase. After ideation the project moved in to the refinement phase and ultimately to the execution of the design in form of 3D-model and at the end physical model.

Measurements and proportions were tested in Virtual Reality and in 2D 1:1 scale so that the correct size of the scale was secured since the project incorporates a space intended for living and longer stays.

Final Result

The Final Result is a new type of vehicle construction that appears in two main piece. It is designed to be more efficient and to serve the user in another dimension as well. Project Heliotrope combines future transportation with temporary living by transforming the vehicle's cabin into a part of your housing while traveling. The secondary function will in fact become first-rate importance in the optimal situation, when traveling time will be shorter in relation to living time. This is the way that future transportation should be seen and designed. Driving becomes the secondary function.

The Lexus Heliotrope styling is audacious and different. It does not obey the proportions or main lines of existing sedans. One of the main goals of the design has been to show the vehicle's duality, which is an important part of the concept. The architecture comprises two side-forming panels, the interposed capsule forming the vehicle cab. The design respects Lexus's traditional front graphics giving it the familiar softness from the past, instead of current murderous sharpness. The center of the visual balance is closer to the rear axle that is well known Lexus trademark. The top view introduces a beautifully flowing design that also shows the typical organic nature of the brand. A long, streamlined body can be seen as a very long lasting design.
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What if a new kind of ownership would allow you to own only the most important part of the car, the cabin?
The Future Role of the Vehicle

In a globalizing world, the role of the personally owned passenger car as the most used way of transport has been attempted to decrease. Climate, infrastructure, and people are no longer able to flex for private vehicles on the scale where it occurs today. The automotive world has been trying to find a solution to this problem during recent decades. Reducing emissions, as well as alternative power sources such as natural gas, hybrid, and electric motors have landed on the market, giving an excellent example of what the future of passenger cars can develop into. However, at current rates of consumption, this will not be enough and problems culminate especially in megacities such as Shanghai, Tokyo, Mexico City or Delhi, where brutally fully packed public transportation, pollution and congestions are making everyday commuting unpleasant.

It is inevitable that the number of private cars will be reduced compulsorily using various prohibitions and legal reforms. Average income future city residents have no need or opportunity to own a car because public transport and general car-based services will cover the demands of everyday life. Private vehicles and even the possibility to hold personal vehicle will become more expensive and more difficult to implement. In few decades the option of owning a car is no longer the default, and it can be equated with premium goods. It does not necessarily mean that vehicles become more luxurious and uncommon, but the prospect of owning a car will probably be a privilege of a wealthier minority. There are already indications of this change in today’s mega cities such as Sao Paulo or Singapore. The annual cost of vehicle ownership will rise to more than tens of thousands of dollars, which will significantly reduce the profitability of the ownership of a car in the city.

The Car of the Future Must Earn Its Existence

The culture of owning a personal car will still not disappear quickly. They will possibly exist as long as people have any reasonable chance to buy them. To obtain the approval of their existence, car must earn its place among the future zero-emission traffic, where it is inevitable that the user should be able to maximize the efficiency throughout the whole life cycle. The role of the car as a pure transporting instrument has to be reformed. It needs to adapt to serve its owner in a broader area, for example outside the roads in the office or at home.

The purpose of this study is to consider the position of a vehicle as a “premium right” in the future metropolitan traffic. It needs to support the user by expanding the operating range that exists in the world of current vehicles.

Japan was chosen to stage the scenario of the project. It represents strongly ongoing urbanization and the top of technological development. It was clearly an appropriate option to make the project more believable. By choosing Japan I also decided that the chosen brand for the concept should be Japanese as well. That is one of the reasons why I ended up with Lexus which has strong market in its home country.

These thoughts will eventually raise some reflective questions. How traditional vehicles need to be able to change and adapt to urban future traffic where space and time will be highly optimized? What functions the car can include along transporting people and goods, for example thinking living, working, leisure time or producing energy for example? How this type of vehicle takes its place as a status symbol and everyday tool of people who will still be able to afford them? What if owning a private car would still make sense?
1.1 The future of urban car ownership

Future Megacities Inspiring Smart Mobility Solutions

Department of Economic and Social Affairs of United Nations shows that 2015 the global population reached 7.3 billion. It is expected to reach 8.5 billion until 2030, 9.7 billion until 2050 and 11.2 billion by 2100. This level of information always comes with a degree of uncertainty, but it is still believed to raise the growth of the global urban population. World Health Organization reports tell that this is set to rise by 1.84% per year between 2015 and 2020, and 1.63% between 2020 and 2025, and 1.44% between 2025 and 2030. This trend will be most visible in China, the US and across Europe. The phenomenon will be more moderate in less developed countries like India.

The growth in the global urbanization will increase the number of megacities. The number of metropolitan areas larger than ten million people is expected to rise globally. 54% of the world’s population lives currently in urban areas. The UN expects this figure to raise dramatically as employment and various social factors are driving people towards megacities.

According to Moovel Group’s Matt Jones (2016):

“There will be many more megacities in the near future. The housing in these places is becoming denser, space is at a premium, and people still want to travel from A to B and make good use of their time while doing so.”

The rising amount of megacities sets high standards for the city planners that are trying to predict the way that mobility will change in the future. Highly connected autonomous vehicles and low and zero emission transportation solution developed by the automotive industry OEMs will also be part of this view.

Kate Roberts from Zipcar says (2016):

“There’s a clear trend already forming that car ownership will decline across cities and megacities in the future. There’s also a convergence around the idea of paying for a trip, not for a car, which represents a considerable change in consumer behavior.”

Accelerating Rate Of Change

The automotive world has gained a lot of new way of thinking over last decade, and the current atmosphere is unprecedented. Changes in consumer behavior and needs are taking place at a rapid pace. OEMs need to react with dispatch to new transportation innovations and business models. Arriving megatrends drive automakers to work tirelessly to find solutions that meet becoming consumer needs.

Carlos Ghosn, the Chairman and Chief Executive of Renault-Nissan Alliance, sums up his view of the current situation:

“There has been a lot of talk about disruption, about new competitors who promise a new approach to what a car can be. Much of this unease over potential disruption has resulted from the rapid emergence of new technologies and so-called mobility services, all of which are competing to establish a new vision of our industry’s future.”

Challenges For OEMs And Suppliers

It is setting many challenges for OEMs and suppliers. Consumer behavior has changed to accommodate the need to be continuously connected. Millennials are used to staying connected to facilitate daily activities. Staying online in social media or handling lunch order while moving is natural for them. They know already that they don’t have to procure their vehicle. Using a car-sharing service is enough for them. It is especially challenging the industry to design cars that can be connected with the consumers who are not owning the vehicles they use making them personalized and efficient at the same time.
Urbanization

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage of Population in Urban Areas</th>
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<tbody>
<tr>
<td>1900</td>
<td>2 out of every 10 people lived in an urban area</td>
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<tr>
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The role of the car may evolve - but it will have a role to play anyway

Challenges For Authorities

OEMs are naturally working to find thriving solutions which could lift them above competitors, which places the authorities in an important role.

As Ben Foulser, Associate Director, Transport Technology at KPMG states (2016):

“If you leave the development of technologies and services such as car-sharing down to the OEMs and suppliers, they will all come up with conflicting solutions,” Foulser noted. “There is a big risk that the best outcome for mobility in the megacity will be lost as a result. Authorities must ensure that the best interest of the city and its inhabitants are at the heart of mobility.”

Keeping a car connected to a megacity is also causing problems for the city planners. Vehicle-to-infrastructure (V2I) technology must be evolved further to achieve the optimum environment for mobility and consumers. According to Foulser: “Planners and infrastructure providers are already working together to integrate technology into the megacity,” Foulser affirmed. “They are looking at embedding Wi-Fi receivers and transmitters in street furniture, like street lamps and traffic lights, and even in the roads.” This kind of solution has naturally proved to be expensive. Foulser continues: “In my opinion, all authorities are struggling with investing in these ideas and finding an optimum balance in market investment and a solid business case.” Foulser states that the issue with the author-
ities might be the difference between their interests to invest money in megacities.

James Fu, The Director of Singapore Operations at nuTonomy - a company in Singapore developing autonomous driving tech and services - believes that high-cost investments in infrastructure for transportation are genuinely unnecessary and that the right approach towards developing autonomous driving is not to add new infrastructure. He suggests that the prevalent autonomous driving should affect the way that future cities are planned. Less parking space would be needed, and even less road space as autonomous driving would allow people and vehicles move closer to each other.

Towards Smart Cities

As megacities are expanding, money and development have also been deployed to design new types of smart buildings. “Public buildings are also set to become smarter and aware of their surroundings by 2050. They will monitor data in a bid to constantly improve themselves. They’ll use this data to run at optimum efficiency and also ensure each occupant is safe and comfortable. Through the use of technology like solar windows, buildings will gather their energy and become entirely self-sufficient. If they have any energy left over, it’ll be offered to vehicles in the local area to ensure no one runs dry.”

Megacities, of course, are a wave of development, but also smaller cities are seeking smart mobility solutions. For example in the Finnish capital Helsinki, the city planners are on their way to make owning a private car entirely unnecessary in the next ten years. This could be possible by combining new modes of transportation with app-based services and new business models. They are also considering pedestrian when planning traffic and transportation systems, before thinking about the rest of the road users like public, goods and private transportation.

Pihla Mehlander, the Transportation Engineer at the city of Helsinki, believes that both OEMs and city planners are facing several issues as megacities keep on developing.

According to Mehlander (2016):

“The main challenges are related to how to serve all the needs we have in the city, which often have conflicting interests,” she said. “Increasing the use of sustainable modes of transport is a challenge, as well as finding resource-efficient ways to develop and enable the growth of the city without weakening accessibility or safety of the transportation system.”

Wide Range Of Services

Next big question is how future mobility will look in ten or fifteen years? Experts seem to firmly believe in a scenario where vehicles will be molded into autonomous, smarter and more connected. These vehicles still need to be able to operate among other vehicles with non-autonomous driving and older technology. Moovel’s Matt Jones (2016) zthinks that the development of vehicles must also compliment other transport systems. He says it could be achieved by connecting multi-modal transportation systems to optimize everyday movement in mega cities as efficient as possible.

In Future urban mobility, public transportation will become a utility. It should be available anywhere and anytime. Daniela Rus, Principal Investigator of the Future Urban Mobility and Interdisciplinary Research Group predicts (2016):

“It will consist of a network of vehicles providing backbone transportation for many people over long distances. There will also be fleets of transportation pods that will cover the transportation needs of individuals for short hops and the first and last mile part of their long journeys.”

Rus also thinks that the transportation network will connect with the information technology infrastructure and together create a system which ensures that supply meets the mobility demands (2016):

“Taking a driverless car should be as easy as using a smartphone.” What we know at the moment is that much will change, but one thing is sure: the future megacity will require innovations regarding transport. Ownership of a private car is seen as an incompetent alternative, but people are always willing to travel from A to B and have all the benefits to make traveling easy and comfortable to implement. The role of the car may evolve - but it will have a role to play anyway.” (Nash, 2016)
1.2 Owning a Car Even In The City With Comprehensive Public Transportation.

Social Computing Group at the Massachusetts Institute of Technology has been researching different types of transportation and their efficiency. They have gone through several major cities in the US and mapped how time-consuming moving between any two points in the city is. In this study, they have taken note of walking, cycling, and driving by car or by public transit.

They gridded up the city at the block-group level and then computed the time using each way of transportation from the centroid source block group to the centroid of the destination block group using the Google Maps. When considering private driving, they also added some extra time for parking and walking. In the end, these four ways of moving were compared and visualized on the map based on the minimum time of travel. Different colors are representing areas around the city where each mode of moving is the fastest.

Afford Saving Time

It doesn't take much to understand that more than half of the city in Washington will be reached fastest moving by bike (light purple). Dark purple areas representing private driving are still covering most of the city maps especially outside the core of the city. Public transportation (green) is covering only minor areas, which is mainly noteworthy. When looking at the other cities, the situation turns even more favorable for private car owners. This information becomes interesting because we are looking at significant metropolises like Chicago, Philadelphia and San Francisco with advanced public transit systems. Unfortunately even living on a transit line does not help you. In this light, public transport appears to be a slow and incomplete alternative to bicycles and vehicles if you are looking for gaining time.

This study points out precisely why people make rational calculations to still use their private cars so much, even in modern metropolises with accessible public transportation. Part of the reason, in this case, is the fact that private car driver will save time. Using a private car still includes a lot of money-consuming costs like car payments, insurance, and maintenance cost, which are often perceived as a sunk costs. It proves that travel decisions are usually made from time-saving perspective instead of saving money. It means that people who can afford driving personal a car personal most likely do so. Vice versa if you can't afford private transportation you will probably pay it dearly in time. (Badger, 2014)

It might be somehow difficult to understand. Public transportation has been there for ages, possibly before private cars. So why it still seems to remain unwieldy compared to personal transportation? It is mostly because the cities we’ve built are designed for the vehicle. These megacities have grown together with the private car and built around their needs. With town piercing highways they are meant to fulfill more or less the demands of individual cars instead of public transit.

Travel decisions are often done from time-saving perspective.
1.3 Vision Autonomous

Driverless transportation has been the primary topic in the car industry for the decade. Probably all those who lived in the 70's and 80's have been waiting for the revolution of flying cars, but that breakthrough has unfortunately not been possible so far. The main reason is probably not the lack of technology, but the external obstacles such as legislative issues, security problems and the amount of testing that it requires. Like creating a flying personal mobility society, autonomous driving has also proven to be a complicated and not so unambiguous challenge for OEMs, who are racing against time in developing the autonomous driving technology.

To understand the core it needs to be put in specific frames so that it can be confined in a controlled manner. As Wikipedia describes "An autonomous car also known as a driverless car, self-driving car, robotic car and unmanned ground vehicle is a vehicle that is capable of sensing its environment and navigating without human input." (2018) It is a technology, which aims at reducing or eliminating human control from vehicles. Now year 2018 driverless technology a priority for most car manufacturers.

Benefits

Human control is often believed to be one of the most hazardous factors in traffic, and human errors are often the cause of crashes and accidents. Unmanned vehicles correspondingly are expected to increase safety and a lot of different potential benefits. For example reduce mobility and infrastructure costs, improve mobility, increase customer satisfaction and reduce crime. Specifically a significant reduction in traffic collisions the resulting injuries; and related costs, including less need for insurance.

Autonomous cars are also predicted to increase traffic flow...
provide enhanced mobility for children, the elderly, disabled and the poor. On top of that, it is seen to relieve travelers from driving and navigation chores, lower fuel consumption, significantly reduce needs for parking space and facilitate business models for transportation as a service, especially via the sharing economy."

Obstacles And Disadvantages

However, the case has its negative aspect as well, what comes to technological and social disadvantages. Swedish economist and economic historian Carl Benedikt Frey and Oxford University professor Michael Osborne found in their article that autonomous driving would, for example, threaten the importance of many driving oriented professions in the future. It might cause resistance for instance in trade unions, who are threatened by losing jobs.

Discussion about obstacles has also covered the risks of software and information security, which, of course, is an essential passenger safety issue. The security of the system should achieve 100% imperviousness, for example in situations where it is attempted to hack through an outsider. In this case, its safe use should be guaranteed to all passengers. One major problem is the situations where car software is forced into an inevitable situation where each option contains a destructive result. These types of scenarios raise unavoidably ethical question. (Wikipedia, 2018)

Classifications And Current Stage

Autonomous driving can usually be divided into five different stages all away from fully manual to fully automated systems. This classification system is based on the amount of driver intervention and attentiveness required. It is used identify and explain what kind of requirements each step sets for the driver and the vehicle. (Walker, 2017)
The current stage of autonomous technology is difficult to define. We already know that the development and manufacturing of technology is not necessarily the biggest problem in creating a driverless vehicle. Creating a high-level autonomous vehicle that can operate under test conditions is already a reality, but putting it in the right traffic is an entirely different thing. Dozens of companies have been examining and analyzing their lengthy testing in several conditions, which makes their commercialization extremely slow. According to the CEO of NVIDIA, Jensen Huang (2017), it would be four years before fully autonomous vehicles are a reality.

Tesla is one of the companies holding a place in the top spot, and the brand is well known for its dedication to driverless technology from the start of its days. Tesla’s CEO Elon Musk continues to shoot big plans, and the company is already ambitiously offering autonomous features to its vehicles. Scott Miller, General Motors director of autonomous systems, has said that Elon Musk’s plans to update current Tesla vehicles with Level 5 autonomy is something of a pipe dream. (Jones, 2017)

Although there may be some disagreement about how far advanced technologies are we discussing at the time, most of the companies working in the field believe in one and the same thing. Development is still needed in high volumes. This year State of California will expand its current testing program by allowing completely driverless vehicles on streets, and approximately more than 280 self-driving cars will roll out. It boosts the real autonomous driving research tremendously. (Birnbaum, 2017)

All in all, autonomous driving will most likely revolutionize road traveling as we know it now during the becoming decade. It is a powerful technology with a lot of potentials to change the way we behave in our vehicles and what we can do while moving. It is our decision where we take it, and how we use those benefits, it is offering us. We must be patient and develop it responsibly so that its final launch is safe and peaceful. Among other things, it will require the development and application of new laws and regulations, which certainly takes its time. So far it is truly impossible to understand all the possible disadvantages and effects of autonomous driving before more advanced testing among real traffic has been completed.
1.4 Vision - Tokyo Post 2025

Chosen Location

Japan was chosen to stage the scenario of the project. It represents strongly ongoing urbanization and the top of technological development. It was clearly an appropriate option to make the project more believable. By choosing Japan I also decided that the chosen brand for the concept should be Japanese as well. That is one of the reasons why I ended up with Lexus.

Tokyo formerly known as Edo is the capital city of Japan. In 2018 the great Tokyo area remains the most populous metro-
As one of the largest metropolises in the world, the demands for city infrastructure are challenging especially when the required level is set high. According to Mori M Foundations Urban Strategy Study (2011):

“It is an urgent issue for Tokyo to enhance its position and attractiveness in light of globally-intensifying competition among cities. Cities, recently confronted with the unprecedented world financial crisis, may struggle to depict their future images due to increasing uncertainty about socioeconomic conditions. Therefore, new methods and ideas are required to configure future city images.”

Tokyo is currently using a lot of resources to increase the city’s performance. They will be hosting the summer Olympic for 2020, and it is the first stage goal of urban development. Smooth flow during the Olympics will be the key to a good tourist experience and a successful event arrangement. The Tokyo Metropolitan Government is pursuing integrated transportation policies which consider not only the needs of the Tokyo 2020 Olympic and Paralympic Games, but also Tokyo’s post-Games transportation requirements. Tokyo Metropolitan Government has created an eight-paragraph plan to explain how the city will be improved in the future. (MMF, 2018)

Tokyo Metropolitan Government Goals For The Future:

1. Sustainable City

Tokyo is looking for energy initiatives to ensure sustainable development of the city. It includes a broader introduction of energy management measures and expanded use of hydrogen for example. At the moment zero-energy (ZEB) buildings are seen as the future solution. These buildings consume zero net energy through energy efficiency and renewable energy.

Tokyo is planning to drop the city energy consumption 30% from the year 2000 to the year 2030. In 2012 6% of Tokyo’s energy consumption was renewable. The year 2024 this figure is expected to be approximately 20%, which would mean 1000 megawatt. It allows Tokyo to achieve high energy level efficiency, and disaster preparedness to support the city growth in the long run.

When it comes to vehicles, Tokyo is aiming to realize a hydrogen society. In real life, this would mean for example 100 public transportation buses with fuel cell technology, 35 hydrogen stations. The private fuel cell vehicle figure is expected to hit 6000 units.

2. Leading Global City

Tokyo is the most abundant metropolis in the world, but the city is also willing to achieve the title of the best city in the world and increase international competitiveness through activating the roles played by women, youth, community, development education and city diplomacy. The plan is to make Tokyo the best place in the world to do business along New York and London. Tokyo needs to be flexible and adaptable. It needs to be able to offer a dynamic hub for international business, and a fascinating destination for tourist and urban culture and fashion trendsetter.

The city will support young people, who are seeking work. The goal is to create a program to help employers and job seekers to find one another more easily. The ratio young people engaged to work was 78.2% in 2012, but it is expected to rise to 81% until 2022. Tokyo is also planning to half the amount of job seekers who are unintentionally employed as non-regular workers between 2012 and 2022.

3. Safe And Secure

Colossal population sets high requirements for safety. Minimizing damages caused by natural disasters such as earthquakes, tsunamis, and torrential rain will help the city to build a strong sense of trust among the citizens. Ensuring safety requires proper planning. Building earthquake-resistant buildings and fire-resistant communities are the initiatives to increase preparedness and awareness among Tokyo citizens. However, infrastructure construction alone is not necessarily enough. Personal preparation is also needed. In 2020 scenario, every economy should store food and supplies. The figure
would be 60% more than it was in 2014. The Tokyo Metropolitan Government will ensure that every economy has a disaster manual for use so that residents can behave appropriately in the event of an emergency.

For the last 11 years, the number of crime has been reduced to the city, but the promotion of its reduction remains an important theme. Cybercrimes, kiken drugs, and scams targeting senior people are still worrying issues among the citizens. Taking care of these security factors will give every resident and visitor a firm feeling that they can be safe in Tokyo.

4. Evolving Infrastructure

To be able to transform Tokyo into world’s most convenient city, Highly-Developed infrastructure has high importance. Tokyo is aiming to build an easily accessible transit system that is safe for all including residents, commuters, and visitors. The project will also include an extensive bicycle-sharing system and outdoor cafeterias along the streets alongside roads, port, airport, and railways.

One of the significant infrastructure projects is the three ring-way express plan, which is meant to improve traffic flow and reduce congestion, which has been Tokyo’s weakness. It will also make the city safer in the event of a disaster when transport people and goods need to be efficient and effective.

The development of infrastructure is not limited to the design of the car and public transport lanes. The carefully designed urban environment also requires the well-designed environment to accommodate the elderly, young children, families, and disabled people. (TMG, 2014)

Base for the scenario

By researching Tokyo and TMG:s plans for the future it is easier to understand where the city is heading and how it might look in the future. Several plans show that they are willing to evolve and make Tokyo even more efficient than it is now which justifies the fact that it is a suitable place for the thesis scenario to happen.
1.5 Japanese Housing Culture

Tokyo

“In Tokyo, there are no boring conversations about house prices because they have not changed much. Whether to buy or rent is not a life-changing decision. Rather, Japan delivers to its people a steadily improving standard, location, and volume of the house.” (Harding, 2016)

It is a good illustration of Tokyo from the housing point of view. It is active, busy extreme, but still. Smart housing solutions are needed since there are around 1.68 million condominium units, the equivalent to approximately one-quarter of the total number of households, making this an essential living arrangement for residents of the city.

Building A House In Tokyo

The land is costly in Tokyo. Quite often you will be more or less able to buy just a small piece of land. Some plots are barely two meters wide and inadequate enough to park your car. If you want to build a house rather than buy a flat, you need to be ready to make some sacrifices. According to Japanese Architect Yoshihito Ikeda (2012): “More and more people think that small is beautiful.” Ikeda, for example, is specialized to design small houses. People who are living in Tokyo, are turning to compact living to avoid the problem of expensive and scarce housing. (Buerk, 2012)

Nagakin Capsule Tower Tokio

Nagakin capsule tower is mixed-use residential on office tower designed in 1972 by Japanese architect Kishō Kurokawa. What makes this building unusual and exciting is the fact that even it is a 13-floor building it was completed in only 30 days. It is one of the few rare remaining examples representing metabolism, a Japanese architectural postwar movement, that fused ideas about architectural megastructures with those of organic biological growth. At the same time, it was also world's first example of capsule architecture built for permanent and practical use.

The construction of the capsule tower is particularly interesting. The building contains two interconnected concrete towers, which are respectively eleven and thirteen floors high. The whole premise houses 140 self-contained prefabricated capsules “Each capsule measures 2.5 m by 4.0 m with a 1.3-metre diameter window at one end and functions as a small living or office space.” (wikipedia 2017) Every capsule is bolted to the core shaft with four high tension bolts, so they could be easily replaced later if needed. However, no capsules have ever been replaced. Functionality is one of the Nagakin tower strengths. By combining the capsules, larger spaces are created, allowing them to be used more flexible way.

“Salaryman”

The Tower was originally created to fulfill the needs of the bachelor Tokyo salarymen. The term “salarymen” often refers to a man whose income is salary based and particularly those working for a corporation. Often also gradually accepted in anglophone countries as “white-collar worker” or businessman. “The term salaryman refers exclusively to men; for women, the term career woman or, for lower prestige jobs, office lady is used.”

Salaryman is expected to work long hours and additional overtime. They are also often expected to take part in after-work leisure activities like drinking and visiting hostess bars with colleagues, and to value work over all else. They are known to be loyal to the companies they go to after they graduate and often work there their entire career.

Salaryman lifestyle is firmly connected to the way they live. The dedication of the work takes most of the time. Work weeks are five to six days depending on the corporation size, and overtime is more like a rule than an exception. Leisure time is a smaller part of everyday life, and there is little time at home. It is the reason why houses are modest and small, as it is responsible mainly for sleeping, washing, and eating. Compact housing also enables savings in money. (Wikipedia, 2018)
Tatami
Housing & Living Room

A traditional complete Japanese housing unit consist of five rooms that are kitchen, bathroom, toilet, and genkan (vestibule) with one multipurpose living space. It differs slightly from the typical western housing sentiment. It is common that every room does not have a designated purpose. For example, any room except genkan, bathroom, kitchen and toilet can be living room, dining room, bedroom or a room for studying. This is possible, because all the furniture is often portable. However, It is also common that toilet, bathroom and even kitchen can be communal. This is often the case with the cheapest rooms available.

Living room represents Japanese home culture.

Like modern offices, Japanese homes are also using portable sliding doors called fusuma, which are made out of wood and paper. They are commonly used to seal different partitions from the top to bottom creating mini rooms within the house.

Housing advertisements usually quote the sizes of the living room, which is the most important. Measurements are given in Tatami mats, which are woven from a rice straw and the standard size. In Tokyo region the standard is 176 cm by 88 cm and in western Japan 191 cm by 95.5 cm.

A Living room represent the center of Japanese home culture. It is a place where the whole family dines together. Nowadays Tatami mats are used to cover the entire floor, unlike before when they were so expensive that only the areas were people sat were covered with Tatami mats. It is an important note that living room in Japan is expressed as ima, which stands for living “space”. The reason for this is that the room size can be varied according to its needs by varying its partitioning.

Ryokan

The traditional Japanese inn is known as Ryokan. They are the oldest hotels in the world, dating back to the eighteenth century, which tells about their tradition. It is, however, difficult to find Ryokans for example in today’s Tokyo. Often they can be found near the motorways where they serve travelers. Nowadays Ryokans can be regarded as an expensive alternative to hotels.

Typical features of traditional ryokan include tatami carpeted rooms, communal baths and other public areas. Traditional Ryokan offers a relatively large entrance hall, with couches and chairs where guests can sit and talk. Modernized versions may even have a television in the hall as well. Traditional Japanese construction methods like sliding doors are commonly used even when the hinged door is just for safety. (Wikipedia, 2018)
To make business, meeting customers in person is very precious way to boost your company everywhere in the world. Whenever you are selling or buying something or whenever money is involved, it is important to create personal relationship with people who you are doing business with. It is an habit intended to create new business relationships or warm up old relations between the parties.

Business Traveling

Travel for pleasurable purposes is actually a fairly new concept. Throughout the history people have traveled for religious reasons or economic necessity. And business type of traveling might be the oldest form of travel. Profession at sales means a classic high-travel occupation. Sometimes business trips can take weeks or months and turn more like long distance commuting. In general any very specialized job where customers are few, but can afford fly in experts will tend to mean quite high travel. A traveling salesman has actually become a sort of a cliche.

Upsides & Downsides

Business traveling can offer you world touring for free or at least low cost. For example flight tickets, taxis, hotels and meal can all add up to a significant sum. Generally the company takes care of these things. Over weekend-time trip is
usually paid for a substantial weekend fee, which can be used to explore local life or other activities, for example. A short personal holidays can be often connected with business trips and in best case company takes care of the accommodation and food.

When you are flying frequently, the employee may keep the travel points accumulated on their own. This of course will benefit later when buying personal flights. One on the greatest thing in business traveling is gaining experience and facing new challenge each time. You will face new people and situations, which will guarantee plenty of learning experience and expand your world view.

Business travel may sound only a lot of fun, but it is still hard work and certainly does not fit for everyone. Work caused stress and travel hassle often boils down the traveling experience. Working alone in unfamiliar environment without the ability to walk down to your colleague’s office and ask for advice can be lonely. When your are flying it means your are not in control of your own schedule and often you have no time to explore the destination, but more time is spent at airports and moving from one place to another in a hurry. As time passes the glamour of traveling business lifestyle will die at the end. Being abroad has also huge impact to your relationships. Being away from your family can be really depressing and frustrating. It can also have negative health effects. Often you might not have time for sport or healthy eating while you are traveling. (Wikivoyage, 2018)

Japanese Business Culture and Etiquette

Business culture is really strong and traditional in Japan. The etiquette is highly appreciated and differs from western business etiquette. Foreign visitor are also expected to respect the etiquette, although Japanese hosts are often forgiving and helpful for strangers as long as they show respect and effort to understand the Japanese culture.

Before entering a Japanese business meeting, it is reasonable to be familiar with the meeting protocol. It is polite to understand the habits required by situation, which help you avoid embarrassing situations. The general rule is: play safe. this applies, for example, to the dress code and the hierarchy-based habits.

In Japanese business culture, dress code is often quite formal, so in all situation it is better to be over-dressed than under-dressed, with the exception of for example sport activities. The point is, however, that you do not want to stand out from the rest of the party being the only one under-dressed.

The same rules apply to movement and gestures. The behavior must be restrained and restful. Coarse behavior often decreases the appreciation and credibility among the customers. Being different is not useful. What comes to facing the unknown customer for the first time or sitting down, it is good to wait for instructions or direction how to act. As an example, do not sit down if the rest of the party is still affected. This example can be applied to all activities included in a meeting such as eating for drinking and other. What comes to business gifts, they are a traditional part of the Japanese business meeting culture. It is not a mandatory habit, but more like a nice gesture. If you receive a gift, make sure you show your appreciation and thanks for everyone involved in the presentation. If the gift is wrapped, make sure you open it only after leaving the event. (Japanese Business Resource, 2018)
1.7 Car As a Status Symbol

During the twentieth century, the car has become undoubtedly one of the strongest status symbols in our society. So how a status symbol can be defined? It is a visible, external denotation of one’s social position and the indicator of economic or social status. High fashion and jewelry and other luxury goods are often perceived as common status symbols. Yachts, luxury vehicles, and privately owned aircraft are the most extreme examples of modern status symbols, mostly because only a few people can afford to buy them.

The thing to note, however, is that all status symbols are not objects or items. Also, intangible things such as changes in the body shape have been seen throughout history as distinct types of status symbols. “In the past times being pale and fat was a status symbol, indicating wealth and prosperity.” (wiki-pedia 2018)

All in all, they are exciting objects and signs, which tells a whole lot about its owner without saying a word. When you drive your car, people are often ready to draw conclusions from you, your life, and for example your financial situation. And if someone buys a nice car, we often fall to think that they are rich and they have a need to show off. Is it so black and white? Maybe they just like more delicate things.

An Overstatement

Many brands are known to be expensive, and these brands often tend to represent the examples of strong status symbols automatically. But why? The answer is usually cost. If you want to buy the most obviously expensive car, you will go with the performance model for example. Performance models are also often visually boosted looking. It can be more or less because higher output usually requires some modifications what comes to aerodynamics and such. Nowadays there is an opportunity to buy incredibly powerful cars whose resources the driver is never able to utilize among ordinary traffic. Sounds a bit strange, does it not?

But those performance specs come with a cost, especially for the owners who are for the most part not able to press their foot to the floor. A Larger engine means high gasoline consumption. Sporty tires are wide and low profile which means they are noisy and often ride bad. Sporty cars tend to make sacrifices, to support its high-speed needs. These sacrifices are mostly uncomfortable and costly. Such vehicles are still often bought by customers who can afford them even without any reasonable need to have an extremely powerful and impractical car. It is an excellent example of how in the cases mentioned above the car is inevitably a definite status symbol. (Orlove, 2015)

Brand Loyalty

When it comes to cars as status symbols, the brand marking is clear, and it’s playing the dominant role when evaluating what it represents. Each brand has built their image around defined customer group to gain as much buyer’s favor as possible. According to website thestreet.com 2014 article Ford, Toyota and Kia have the most prominent customer return percentage, in each case nearly 40% or more. In this case, the study was done by the Frontier Group, and the U.S. Public Interest Research Group Education Fund only includes the US market,

“That’s because everyone sees how I drive, but no one sees how I live.”
but it gives a subtle hint of how these brands perform when competing about customers.

Preserving your existing customers has become important during past decades. Car sales have been dropping since 2001 until hitting its bottom 2009. It has driven automakers into a situation where keeping your customers loyal is now more essential than ever. “Loyal customers provide a ready-made source of sales and constitute an important element of maintaining or expanding market share and profitability,” says Jeffrey Anderson, director of consulting and analytics for Experian Automotive. (Notte, 2014)

Millenials

Last ten years have proved that the number of drivers license owners has dropped by close to 20% in the whole US. This development has taken its place mostly, because of car-sharing, environmental consciousness about carbon footprints and other alternatives. The shift between how consumers see cars compared to how do not feel the need to own a car as their seniors did is significant. According to fin24.com article (2015), this movement is most visible in Europe and the United States. It is essential to understand that Generation Y will become the significant part of potential buyers in 2025. The figure will reach about 75%.

Studies point out one exact reason why buying a car might not be interesting for the Generation Y-ers. A traditional car buying process seems inconvenient for them. If they possibly buy a car, they aren’t just comparing dealerships. They are comparing the buying process experience. Most of us know how marketing works nowadays. Apps can recommend different products which are based on your preferences and browsing history that allows you to pay and have products delivered to your door with few clicks only. As a summary, in the future, buying, using or renting a car or service should be easier and faster to meet Y’s needs and lifestyles. (fin24.com, 2015)
to maintain their long heritage as a car manufacturer by researching new business models, which might not necessarily include the launch of new cars in the market the way it occurs today. If less car will be sold in the future, what would be the possible right path to focus on?

There are several examples of companies who rejected their original business and successfully exchanged it in another. Let’s take Nintendo for example. This 1889 found Japanese company used to be known as a playing card manufacturer. During the late 1960s, they jumped into hotel-, Taxi- and TV business which finally led them to the video game industry in 1974. Another worthy of mention example is the Finnish based Nokia who started its business in the paper industry since the mid-1800s, ending up to become one of the world’s leading telecommunications manufacturers in the 1980s. Sounds unbelievable, doesn’t it? Also, musicians and athletes must have been able to grow and develop to achieve the long and successful career of decades. These stories are great examples of companies who found an alternative way to cope with the emerging world by renewing and re-inventing themselves in a narrow space. (Tart, 2018)

As an example, one of the biggest OEM’s like Toyota and Volkswagen have both dozens of different models produced for several different markets. It simply feels that it is highly unlike that these brands have a similar range of cars after few decades. Perhaps focusing on the specific type of vehicles would narrow down their product range. Fewer models per segment would mean more user-specific models and leave more space to expand their service business simultaneously. (Wikipedia, 2018)

The current amount of car manufacturers is quite broad. This figure is estimated to be something between 50-100 different brands. If the number of private cars will decrease in the future, it is inevitable that the number of models available will also fall. This means that a shrinking market drives carmakers to the extreme and with high probability, there won’t be space for those who are not ready to adapt and develop. It is likely that strong traditional brands will retain their necessity as their business machinery can carry them towards a new era, even if it means significant changes in their vehicle production.

1.8 Staying Relevant

At the moment it seems like staying relevant will be the key concern for the traditional OEM’s. They need to find their way
1.9 The Daily Inefficiency

Due to accelerating urbanization, future traffic and private driving are most likely to happen in megacities around the world. This, unfortunately, raises the truth about private owned cars being parked more or less approximately 95% of the time. Paul Barter notes that this figure is surprisingly in similar all over the world. It often ranges between 92%-96% no matter the location. This information was discovered in 1995 by UITP Millennium Cities Database numbers, which only gives mostly indications of what these figures may be today. (Morris, 2016)

These calculations could be done by using three different methods. Option one is based on the number of cars, the number of car trips and the average time duration of car trips. Option two is based on time drivers spend driving (from transportation surveys) and assuming one car per driver. The third option is based on using car kilometers per car and overall average speeds.

For example, for Singapore in 1995, we have a 24/7 speed of 35.2 km/hr and 18,486km per car. This gives 525 annual hours of operation per car and, since there are 8,760 hours in a year, we get 94% as the percent of the time a 1995 Singapore car was being parked. (Barter, 2017)

So Why Should We Care?

These surveys make it clear and the daily inefficiency of cars seems evident at least what comes to parking and vehicle’s overall utilization. This is part of the reason why car-sharing services are seen as an exciting solution, especially for the younger generation.

By exploring and pushing a new type of ownership ideology for the younger generation, who will later be the majority of the possible clientele, we could influence their perception of vehicle ownership in the future. As the distribution economy becomes more common, it could also be applied to the ownership of passenger cars where the use of the vehicle could be more focused. By using more focused utilization, the use of the vehicle could be more efficient and ultimately lead to a situation where the customer’s use of money would be targeted on one part of the car such as a cabin. As an example, sharing the part of the vehicle which is in charge of the cars moving, would make sense because today’s cars, in general, are mostly standing still.
1.10 The Rotating Motion Experience

Throughout the history, buildings have been mostly stationary structures, which are like immobile monuments of their own environment. To fulfill its mission as a public or private space, mobility has not been seen as a factor in building and designing an architecture. Moving parts tend to complicate structures, and perhaps their benefits are considered to be small compared to cost increases. For example, the use of rotation in architecture has been harnessed to maximize energy efficiency. For example, in the sun energy hunting, the rotating motion of the building has been utilized to optimize solar cells to point in the direction of sun rays.

Rotating Architecture

Building bigger, wider and higher has been always an ardent goal of architects and borders breaking architectures have always remained in history. Even the construction is more expensive, designers have still found ways to add motion to their creations. Technology has now made fourth design dimension, Movement, possible. This for example has also led sustainability to become the key to future architecture.

The Heliotrope House

Rolf Disch designed a building called The Heliotrope House, which is located in Freiburg Germany. It rotates very slowly but just enough to track the sun and ensure the sail-shaped solar energy collector on the roof receives the optimum amount of sunlight.

The Suite Vollard

The Suite Vollard is a 11 floors high building in Curitiba, Brazil. It was designed by architect Bruno de Franco. The building is made special by all 11 floors being able to spin 360° in one hour independently. Each apartment is sold by the floor. It was the world’s first spinning building, when it was completed in 2001.

The Dynamic Tower

David Fischer was the father of the proposed project called Dynamic Tower also known as Dynamic Architecture Building or the Da Vinci Tower. "Similar to the Suite Vollard completed in 2001 in Brazil, each floor is designed to rotate independently, resulting in a changing shape of the tower. Each floor is designed to rotate a maximum of 6 meters (20 ft) per minute, or one full rotation in 180 minutes." (Steve, 2018)

Tower Principle

As mentioned earlier, more moving parts is often causing more complicated construction. To understand how things would work in Lexus Tower, a product called Tornado stacker crane can be used as an example. It is a modern computer controlled storage solution to simplify vertical warehouse storage systems. Same system is flexible for different spaces and its size can be optimized according to the floor space, height or the size of the product used to be stored.

The operating principle explained in the simplest terms is as follows. The storage tower is rectangular in shape. It is usually higher than the wider. In the center of the elevator is a vertically moving pallet elevator which is designed to pick up the goods which are stored vertically on the different layers of the tower. So-called collection point is located at the bottom of the warehouse tower whereby an employee can finally fetch ordered products. Ordering products from the elevator is handled via a computer program. Since each product has a name, code, or other identifier that is entered for a specific placement, the machinist does not need to know where to find it. One level pallet can at its best include tens or even hundreds of small products. In such situations computer program assists the machinist with coordinates, which makes the product easier to find.

Using the basic principle of this system in use in modern factories and warehouses to mobilize the concept does not solve all possible problems, but it gives an idea of how the possible implementation should be planned to avoid elevator congestion and extra movement. The computer controlled system is easy to engage with anybody using the right type of user in-
terface design, so each resident would be capable of using the elevator for their own needs.

Timing

The external elevator operation principle and performance would be based on Algotechnics SR-U 1500 stacking crane, which can lift and move objects weighing less than 1500 kg. Calculations show that a 44m high round 14m diameter tower top capsule lifting operation would cost about 109 seconds. This calculation is based on 5 different phases the elevator needs to go through.

First phase includes a 44m vertical free lift, which takes 29 seconds with a speed of 1.5 m/s. In phase two the floor starts its rotation movement. If each floor is able to rotate both directions the mandatory maximum revolution is only 180 degrees. With a speed of 1 m/s the 43 m circumference would take approximately 21.5 seconds to spin 180 degrees. In the third phase the elevator attaches to the capsule, which takes 15 seconds. In the fourth phase the elevator starts its trip down. The maximum load handling speed is also 1.5 m/s, which means the trip to street level takes again 29 seconds. In the fifth and final phase the capsule is detached in 15 seconds. This calculation is an example of a situation in which the elevator would be able to work smoothly without a queue. In the most optimal situation, the floor rotation movement may simultaneously start with the ascending elevator movement, which significantly reduces the time taken to lift. (Algoltechnics.com, 2018)

Motion, Speed and Time

Rotating building is perhaps not everyday business, but it has been there for decades already. Revolving restaurants made their debut back in 60’s. Unlike some other dining concepts from the same era it has succeeded in maintaining its glamour until today especially in Asia and the Middle East.

Most often the speed of a complete rotation was set near 40 to 50 m/min. Restaurant professionals found that customers return to buy more drinks after a full turn. When looking for better business, the turnaround time was reduced to 30 minutes, but it was found to have unpredictable effects. The excessively fast rotation movement began to cause malaise in customers.

In case of Lexus Tower the motion is not continuous. Actually the rotation would happen only when someone from your floor would be moving their capsule in or out. It would be possible by using the default position of each floor instead of using a flow-through sectors. A default position would allow the external elevator to work continuously without extra movement because of recreating the path for the elevator again for each occasion. Minimizing the rotation movement would strive for the best possible peace thinking of living and sleeping of each resident.

To avoid schedule collision, the elevator to remove the capsule, could be ordered in advance which would allow the time spent waiting for a single person to be minimized based on the tasks in progress, since it would be possible to calculate the estimated arrival time of the elevator in advance. Optimizing the movement of an external elevator, however, does not allow total seamless movement of the capsules and it is inevitable that the occupant will face situations where the elevator is already in use or congested.

The fact that you can not leave at the same minute as you have planned is human and fairly easy to identify for example when you are a car owner in country with decent winter. As a parable of this situation, thing like weather conditions are sometimes causing you headache and slowing down you daily life. Unexpected overnight snow storm for example may waste your time in several tens of minutes just because your car has been buried beneath the snow.

The distraction caused by inevitable spinning motion is also an other worrying issue, when thinking about harmony. However there are, numerous examples of housing styles which inevitably address the disturbances created by the environment on a daily basis. For example urban railroads in Berlin, which sometimes literally travel less than five metres from the local residents’ bedroom windows. It is important to understand that getting used to certain types of standards can take time, but it is certainly possible. These examples are things that resident can learn to get along with. They can be anticipated when they are taken into account in sufficient time.
2.1 Project Goals

In this project, I am aiming to design a flexible exterior design oriented concept which demonstrates that private cars ownership still has its role in the shared transportation future. I intend to research and find out how the future of private car looks in the scenario of the growing mega cities with shared transportation. I will investigate how the digital revolution and the automotive revolution affect the possibilities of future vehicles to spread their operating environment outside the roads.

As an exterior focused designer I am aiming to obtain a discreet design piece which combines elements from organic, linear and disciplined design. I believe that it is essential to be able to create a relevant and distinguishable product, which will earn its place in evolving urban environment. As a vehicle designer, I also want to believe that aesthetics and beautiful design continues to play an essential role in the reduced and simplified world of the future. My work will be driven by changing trends in working and living.

I hope I will be able to push my skills further and learn to use new tools. I am aiming to respect my schedule to avoid extra stress and anxiety, which would also allow me to maintain the best concentration. I hope I will stay patient, while I am doing my writing and make my decisions only when I have done enough research. I expect myself to be ready to create the best design study I have done so far.

As a tangible goal, I am willing to build a 1:5 scale model to express my design solutions. This model should show highly defined exterior design alongside part of the interior. It should be able to demonstrate well executed design. In this process, I will use milling, 3D printing and other essential workshop equipment to achieve a satisfying result, which I can be proud of.
The Goals of this project are:

_ to develop a vehicle concept for the year 2035 including both exterior and interior design. However, the primary focus of the project will be exterior design. The project is based on a future user scenario, where the daily life of the user defines the needs of the vehicle. The chosen brand and the connection with architecture will be inspiring the project driving the design forward._

_ to study how personally owned vehicles could survive in the future and how they could support their owners in new territories._

_ to suggest the future scenarios where traveling and temporary housing could be combined with a new vehicle concept and service._

_ to analyze and understand what type of problems such advanced concept would face when traditional car construction and building architecture are profoundly challenged and modified._

_ to show advanced knowledge of a master’s degree level vehicle design by understanding the transportation design basics, but still being able to forget them to take the visual aesthetics further into the future for example in the form of proportion and construction changes._

_ to show the latest level of my skills and even raise quality during the project in the form of photoshop visualization, 3D-modelling, scale model, and presentations._

_ altogether, it shall demonstrate the learning curve that I have gone through in past three years. It shall also represent the high level of Transportation Design in Umeå Institute of Design._

### 2.2 Project Conduct

The process to achieve the desired result will include the following stages:

1. **Inspiration**
   - Research
   - Moodboards for the Brand, User, Technology, and Materials

2. **Ideation**
   - Sketching, Analog & Digital
   - 3D-Mockups
   - Moving Parts and Scenario Ideation
   - Storyboard
   - Evaluation and Exterior Architecture selection

3. **Refinement**
   - 3D Modelling in Autodesk Alias
   - Detail Design

4. **Execution**
   - 3D file preparation
   - VR scene preparation
   - Scenario & Context Renderings

5. **Presentation**
   - Examination & UID18
   - Exhibition

A complete schedule will be found from the appendix of this report.
The creative development was executed in twelve weeks. Workflow followed the traditional formula from analog sketching to digital sketching. From 3d-mockups to the final construction of the VR scenario model.
3.1 The User: Daiki Takeuchi

Lifestyle
Daiki is a 37-year-old Japanese Sales Consultant from Tokyo. He spends most of his time away from home. He is single but continually looking for a partner. Finding a permanent relationship seems difficult, because of his traveling way of living caused by his profession. He appreciates the traditional products and things that work and facilitate his life. He is a kind of gadget guy. He admires the minimalist lifestyle that appears in his habit of living and on his property. He does not own a lot of stuff but invests more in their quality and style. Daiki is especially interested in photography. It's a hobby that fits well with traveling and his interest in exploring new places.

Point of View
Daiki is a traveling salesman who works for Sharp, which is a Japanese multinational electronic product manufacturer. His responsibilities include Yamanashi, Shizuoka, Aichi and Kanagawa prefectures, which means he needs to travel weekly along Tomei expressway near the coastline to meet new domestic customers. He spends a lot of time away from home, so the quality of traveling and temporary housing is emphasized. Owning a private vehicle is a desire for him. It is a status symbol and represents him. However, instead of driving he enjoys traveling in his car, and that is why he has chosen to own a Lexus. Heliotrope is a premium vehicle including a service, which can offer a quality ride and housing for Daiki who spends a lot of time in his car and away from home.

By choosing a Lexus Heliotrope service, which connects transportation and housing into one package, Daiki can avoid traditional and tedious hotel living and spending time at the airport. Instead of that, he is able to combine his desire for premium traveling with his own living and relaxing preferences. Lexus Heliotrope is a way for him to carry his lifestyle and home feel with him wherever he goes.
Lifestyle

- Reduced lifestyle
- Traveling
- Good food
- Dating
- Quality items
3.2 Storyboard

The following storyboard explains how The Heliotrope system works and how Daiki uses the concept. It is demonstrating how his daily lifestyle gets supported by the vehicle and the building on his way from Tokyo to Shizuoka to meet new clients.

Locations

Heliotrope service can be found in biggest the cities near the coastline which makes the service easy to obtain.
Monday Meeting

Monday morning starts with a weekly meeting at his headquarters in the center of Tokyo. In the meeting, Daiki is given a week schedule for meeting his new clients.

1.

Travel to Shizuoka

Customers are located along the southern Japanese coastline. After the meeting, he starts his trip towards Shizuoka. On his way, he can prepare his work, or learn the facts about his customers or relax in his Lexus Heliotrope capsule.

2.
Meeting New Clients

Daiki meets the host company purchasing manager. After a quick personal meeting with the manager, he meets rest of the purchasing team and has an intensive business negotiation with them.

Presentation

In the meeting, Daiki is also presenting Sharp’s new products for the host company board members. Unfortunately, there is no agreement, and no deal gets done.
Arrival to Heliotrope

After long and frustrating negotiation Daiki needs relaxation and heads back to the Heliotrope and is attached to his capsule to the apartment booked for him. The car is parked on the launch pad waiting for the capsule to be detached.

Detachment

Elevator crane comes and picks up Daiki’s capsule. It is taken to the right apartment booked for him.
Docking

The rotating Floor allows the right place to be accessed, for example, even from the other side of the building. After docking the floor will rotate back to the default aligning the elevator rail again for next user.

Netflix and Chill?

He contacts an old friend from Shizuoka and suggests for a date at the Heliotrope.
Enjoy

The heliotrope apartment allows him to cook his meal and is more versatile than the average hotel room. It is perfect for frequent travelers like Daiki who is also able to enjoy the view Heliotrope offers for him.

Relax

The capsule offers a cozy space for two.
3.2 Storyboard: Schedule Comparison

Lexus Heliotrope

By using Lexus Heliotrope service the user will avoid visiting airports and obligatory waiting times. It will optimize the schedule by allowing the user to be responsible for his own schedule and movements. Moving from directly from A to B it saves time but also nerves. Personal travel guarantees a familiar experience without any surprises. This comparison shows clearly how using a private transport decreases different steps.

Regular Business Trip

Usual traveling style can sometimes cause unexpected and uncontrolled issues. Delays and a busy schedule can cause extra stress along long business trips. Waiting at the airport, checking in to hotels and continuously changing transportation can be uncomfortable compared to the stability of personal transportation.
3.3 Materials

The materials are rapidly developing, and new super materials are launched on the market. It is good to be aware of their development, as they also have a significant impact on vehicle design and construction solutions. New materials will eventually lead to new design solutions. An advanced vehicle concept like this needs advanced materials. They can boost the design and at the same time increase the plausibility of the concept.

This project never relied on super advanced space technology solutions, but a few details require advanced material solutions. A sizeable sun-collecting panorama roof belongs to the advanced features of the car. In addition, the height-increasing capsule needs flexible, lightweight and advanced material solutions to get rid of hard and heavy parts to save space. A fabric-oriented door requires technically responsive solutions.

Traditional Lexus material is represented by leather upholstery, brushed metal details and polished trim parts.

A transparent solar panel will be used in the panoramic roof window.

Nike Hyperadapt - a self-lacing shoe gives a working example of how soft and flexible materials are harnessed in mechanical functions. This principle will be used in the soft capsule door.

Solar Panel textile fabricates the external soft walls of the capsule increasing the solar panel area.

A transformable topological mechanical metamaterial is a new MIT University innovation, which can switch its composition between hard and soft depending on the geometry given to the material. It will be the primary structure of the external elastic wall.
3.4 The Brand: Lexus

Experience amazing

The brand

Lexus is a Japanese car manufacturer known to be luxury car division of one of the world’s biggest car company Toyota. It was initially a corporate project started in 1983, which ended up being a real car brand in 1989 when The LS sedan was launched for the first time. Later on, the line up has been supplemented by some other saloons, estates, SUVs, and convertibles. Its most significant market areas are in Japan and North America.

Lexus design has traditionally emphasized targeting specific vehicle development standards. Design targets are focused on highlighting aerodynamics and the quality of the ride. The brand quality impression is based on the backronym “IDEAL,” which stands for “Impressive, Dynamic, Elegant, Advanced and Lasting.” The manufacturing process also covers approximately 500 specific products standards, known as “Lexus Musts.” To meet these standards, the car needs to achieve the specified level of quietness, durability and environmental performance for example.
Suave / Convex - Concave

Gills

Incision

Pattern

Suave / Convex - Concave
3.4 The Brand: Lexus

Experience amazing

The L-Finesse

The L-Finesse is represented by the three Japanese Kanji characters. These characters stand for “Intriguing Elegance, Incisive Simplicity, and Seamless Anticipation.” The L-Finesse also includes fastback profile, lower-set grille and the use of both convex and concave surfaces. The design culminates in details that respect Japanese cultural motifs and embrace distinctive Japanese culture. The spearhead shape front light, for example, is inspired by Kirikaeshi, an exercise move in modern Japanese martial art Kendo. (Wikipedia, 2018) (Thenewswheel, 2018)

Name and Logo history

The company name of Lexus was an original word chosen to represent luxury and high-end technology. Early suggestions that were dismissed included “Alexis” and “Lexis,” and it wasn’t just the firm’s word marque that underwent prelaunch changes. The brand’s logo was also subject to a process of evolution. Three iterations of the nonfamiliar circle-L marque are shown beyond.

An early Lexus logo featured a semi-circular L, which was later changed. Another version featured a more robust and recognizable L shape within a perfect circle. The final logo. The oval around the L is not a true ellipse but a mathematically based shape.

(Blog.lexus.co.uk, 2018)
The current line up is represented by nine different vehicles from hatchbacks, sedans, SUV’s all the way to coupes. The collection is convincing with its simplicity. Lexus focuses heavily on traditional segments which are already familiar with the brand. An estate, for example, cannot be found from the current line up.
3.5 Moodboards and Inspiration:

With Moodboards I searched for the styles and details I tried to combine with my design. Lexus’s design was easy to find, understand and open, but combining it with architecture brought me a different type of a challenge.
The exterior design represents the emotional and advanced design language of Lexus. The Aim is to add a touch of simplicity and softness to smooth out the deadly sharp design that the brand has executed in recent years.

The Interior design is the representation of a Japanese living room type of pace, which respects people’s intercourse with their simplicity and harmony. Lexus is represented by hard part design and patterns which is typical of the brand.
3.6 Ideation Sketches 1

The initial analog sketching process aimed to find perfect architecture for the vehicle concept. In the early stage, the style of the construction was researched by layout construction doodles. Removable capsule set high demands for the layout. The original design architecture was born while sketching basic shapes like squares and ellipses.
The initial interior sketching process was started at the same time with the exterior. I tried to find the right shape for the capsule also regarding building architecture. Different layouts or individual pieces were not sketched on purpose at this stage. The emergence of their form was determined automatically at later steps because of the evolving scenario research about Japanese housing culture.
Right after the basic shapes and volume were defined, a CAID mock-up file was created to speed up the sketching process. Naturally, analog sketching stage would take more time, but this time the transfer to digital sketching happened at an earlier stage due to its speed and convenience.
The interior design was following the development of the exterior which defined the borders for the interior package. The interior was intended to serve as a 1 or 2 person relaxing living space.
3.7 Design Development

The development phase contained for example search of shut lines, detailing and other types of package modifying. From the beginning, my goal was to keep the side silhouette modern, simple and different. I wanted to create a typical essence of a Lexus vehicle for example by designing decorative rims and sharp front lights. Keeping the visual point of reference closer to the rear axie also added the wanted brand feeling typical for Lexus.
3.8 CAID model, Virtual reality & 1:1 scale tests

February 16th

February 26th

February 28th

March 15th

March 15th

April 2nd

April 13th
Even before starting this project, I was well aware of my modeling skills. My goal was to build my best Alias-model so far and learn something new. However, I did not intend to build any high-level surface which is visible in the final model. It can still fulfill my quality requirements in Keyshot rendering program. Photoshop was much needed at least on more significant external surfaces after 3D editing.

Virtual Reality

In this project, I was using virtual reality for the first time to help the design process. It was more exciting and compelling, what I thought previously. I can make you really enjoy your work and somehow awakens the whole product. By feeling the vehicle in real life, you understand much more about it.

It can also be condemning. Small errors in the 3D model appear in a remarkable size in 1:1 scale. My 3D model was never supposed to be high quality, so VR was mostly used to evaluate proportions and basic volumes.

1:1 Scale Testing

After mid-review I started to define the basic dimensions and layout. To keep track that both passengers would have enough room to ensure comfortable traveling, I did some 1:1 scale 2D testing. I projected my alias model in real scale on the wall and check how much headspace and foot space would be left. The same method was used when testing the entrance height later. Simple technology, but it helped me to manage the dimension in 3D.
3.9 Final Concept

The final concept was slowly shaped as it is with 3D model and high-speed Photoshop sketches. Minor changes keep happening all the time along the design process, and sometimes it seemed like never-ending. Interior layout was mostly shaped by the function of the capsule. In its simplest way it has two chairs and a table. The has only one door on the right side of the body.

The top view opens up almost an iconic view of the car. Interior and exterior have a harmonic connection popping out the flowing lines of the vehicle.
3.10 System components

Vehicle

The final form of the vehicle comes in two main pieces. The external part is an independent, autonomous platform, which includes all the technical elements. The inner part is the core of the vehicle, which offers two seats and comfortable way of traveling for two passengers.

Capsule

The capsule sums up the functionality of the vehicle. It has two modes. One for traveling and one for temporary living as it is attached to a building. In the living mode, the capsule will expand to increase its height approximately 40 cm, making space airier. The flexible door mechanism works. The Capsule can be removed from the vehicle by an elevator crane, working on the outside of the building.
Exterior door function

Capsule default height

Capsule extended height

3850 mm

1800 mm

1300 mm
Heliotrope Building Concept

The Heliotrope building incorporates 11 floors of apartments for a temporary living. Each floor layer is divided into ten sectors. Nine parts are residential units and one part of the elevator through-flow sector as well as a general facility for laundry washing. Each layer is also able to rotate independently, in cooperation with the external elevator, allowing the insertion of the capsules.

Each 13.4 square meter apartment contains all the everyday life necessaries like, bed, sanitary facilities and a kitchen corner making it feel more home than a regular hotel room.
Building floor and separate living unit

- Flow Through Sector / Public space for laundry washing
- Sanitary facilities
- Cooking corner
- Bed
- Capsule

- Travel
- Capsule detachment
- Capsule lift
- Capsule attachment
- Living
The ultimate concept will mark the future automotive traveling and temporary housing, which stands out from today’s vehicles as a result of architectural but yet extravagant appearance. It represents Lexus brand image as it is today, but also what the brand might look like in the future as it goes beyond the traditional automobile design.
The ultimate concept will mark the future of vehicle travel and temporary housing, which stands out from today’s vehicles as a result of their architectural but yet extravagant appearance. It represents Lexus brand image as it is today, but also what the brand might look like in the future as it goes beyond the traditional car design.
The interior is following a basic principle of two seats and a table. It offers a cozy lounge for two passengers while traveling or staying. It is easy to access and has several functions to support the desired lifestyle. Storage for shoes and clothing ensures that all the necessary items are always there.
4.2 Final Context Renderings
5.1 Project Outcome

After the outcome is achieved, I am pretty happy with the result that I managed to design. It is mostly following those goals that I set for myself at the beginning of the project. My design often ends up being quite a product like, so it was paramount importance for me to design a vehicle with a different type of organic design language. I wanted to create something advanced and futuristic that would stand out in my portfolio. As a rational person, I decided to look at my portfolio and understand the shortcomings of it. From the beginning, this project was also supposed to be my best project so far and the one that shows my current skills. I firmly believe that I succeeded in it.

From the beginning it was clear for me that this concept was not aiming to reduce the actual size of a car to save space. This belief was based on the idea of how autonomous traffic would allow saving space, for example when traveling with smaller safety lanes. By creating a business model mixing sharing and ownership the vehicle could be used more efficiently on daily basis.

The final outcome is a balanced 4.7-metre long autonomous premium limousine for long distance hauling and temporary living space. It fits two passengers comfortably and it is designed to meet the wishes and the desired lifestyle of the target user. I believe in long lasting design, and I wanted to create something that would also look good in the future. Most of the design solutions are based on sharp graphics and geometric shapes alongside Lexus essential DNA, which I believe to supports the original idea well.

At the end I managed to create a whole system with the realistic operating principles. It is easy to note that plenty of questions about all the construction solutions cannot be fully answered. For example the connection between the capsule and the building was never designed completely. I believe that it is important to understand some of the points could be only solved while spending longer period with the project. For myself it is fundamental to understand that there is weak point in my work and I thinks as long as I can recognize them it is ok. It will help me to evolve as a transportation designer and teach me to look back every once in a while to re-evaluate the decisions I have done earlier during the process.

What I am trying to suggest is more like an example of what type of thinking could be implemented in car design in the future. It is a study which questions how a future vehicle could perceived. And since it does not rely on high-tech solutions or materials, its implementation in the real world might perhaps be more or less a monetary issue in this case. It is a futuristic but still realistic concept.

It is important to understand that there is always room for the improvements and already at this point, I would change some of the approaches to polish the fundamental concept idea. From the beginning, this project was comprehensive, which made it bit difficult to understand where the focus point is. In mid-review I was told narrow down the topic, to justify the relevance of the concept. Creating a specified user scenario helped me to clarify the concept image.

Throughout the project, it was clear that the scope of the subject makes it challenging to manage and implement. Many parts of the product require a lot of attention, and of course, in the lack of time, the number of prioritization is emphasized. Designing a two-part vehicle, a building, and an operating system between them is time-consuming. The exterior oriented vehicle design was with a high priority from the start. Design of the building and other peripheral equipment was also done alongside, as their function was essential to embody the functionality of the system in principle.
5.2 Personal Learnings

Afterward, I can say that this project went smoothly in all respects, both regarding time, work motivation, and quality of work. Only at the beginning of the project, I had difficulty finding a topic that I would be interested enough. Optimistic retention, smooth work-flow, good sleep, and decent food has certainly boosted my work progress along the project. I believe that the things mentioned above will also carry me through the rest of the remaining stages and everything will be finished on time. I can recommend observing these points to others as well. It will surely prevent the raise of stress levels.

Staying in contact with Robin Ritter, UID alumni from 2017, helped a bit. With his help and comments, I and my colleagues were able to understand what is essential at each phase. He has gone through same steps and same difficulties and was eager to tell us about his personal experiences from last year. It is good to remember that available colleague support is always really valuable. I have also been watching his thesis report regularly and following his fundamental principles to compile my report.

Doing a presentation has always been stressful for me and was never able to feel comfortable presenting my projects to a bigger audience. I still felt the same at this project, but often repeated presentations have increased my confidence. I know that I know my work better than anyone and that it’s easy to present it to others. Positive feedback and awareness of my work quality have increased my enthusiasm along the way. I have learned to interpret the criticism better and to use it as a reference for the development of my work. I have also learned, that it is sometimes good to keep your opinion to maintain the original direction that was chosen. I’ve also come to understand that it is okay to keep your ideas to preserve the unique path that is chosen.

In conclusion, this project succeeded in what was expected. I was able to create an exciting project, that was able to fill the creative gaps in my portfolio. I also managed to stay motivated and often on schedule. My workload remained constant from the beginning, and there were no dark moments. I also managed to raise my skill level and learn new things for example in 3D work. In the end, I am satisfied with the outcome, which is the most important thing.

At the beginning of this project, my point of view about the future of private car ownership was straightforward and bold. It was also quite pessimistic. I thought that the number of private cars will inevitably collapse in the near future and this is the position I base my thoughts. It was a good idea to realize that it is not so black and white, even though my scenario certainly had a bit of truth in it as well.

This project is based on the mindset where the scope of use in personal mobility is stretched out of traffic. I do not mean that this is the solution for all type of vehicles, but by taking the advantage of that approach, we could find new solutions to improve the efficiency of other types of vehicles as well.

I would like to emphasize that this thesis work has focused on thinking of the future of private cars in places where volumes and masses are already in the extreme, such as in Asian megacities. It is difficult to make more prominent alignments for the future of the automobile world without any scenario limitations. The spectrum of auto-culture around the globe is vastly broad, and the changes will be unequal in the different corners of the world.

I will continue to think about the future of the vehicle world as follows. The number of private cars will decrease on metropolitan areas, but will not go away because its optimization can be improved in the future. Hobby and leisure vehicles will always stay popular and certainly even more when autonomous cars come into the street. The economy of commercial vehicles will increase significantly as autonomous driving can at least partly take on the driver-driven jobs. In the best case, it means, for example, expanded and better access for some services such as public transportation.

We have to believe and trust that the image of the car as polluting and as a resource consuming element can be changed. Society must be ready to reimagine the definition of a vehicle and believe that bringing new changes does not exclude existing positive things.
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UN Sustainable Development Goals

In 2016, The United Nations set an universal 17 goal list to end poverty, secure world peace and protect the globe. This list is known as The Sustainable Development Goals. The role of the list was to serve as a source of inspiration and a basis for sustainable development. It is important to keep in mind what values and goals your project achieves and supports.

7. Clean energy. By using the vehicle capsule to collect energy through solar panels while it is attached to the Heliotrope building, energy sharing between the building society is ensured. Everyone benefits from collecting energy equally despite the amount of sunlight - Self-generated and shared energy.

9. Innovation and Infrastructure. The Heliotrope concept brings vehicles and infrastructure together. It seeks to reduce the time vehicles spent on standing still, by sharing the technical platform which is meant to power the car with other system users - Expand the running time of a passenger vehicle.

12. Responsible Consumption. In theory the shared technical platform allows them to be less in relation to the number of capsules an by subscribing The Heliotrope service user supports responsible consumption automatically by collecting solar power while staying in heliotrope. There is no need to make a decision to support ecological thinking. It is already done for you when being part of the community - Optimized amount of units per user.

15. Life on Land. Flexible products that are capable of multi-tasking can, when used with a larger scale, lead to material savings and reduce the amount of simple products that are made for one purpose only - Less stationary material improves space saving.