Lynk & Co Design and TU Delft

Tomorrows digi-physical driving experience

A concept and vision for Lynk & Co

Master Thesis
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This Master Thesis is written as the final piece of the MSc Integrated Product Design program at the faculty of Industrial Design Engineering (IDE) at Delft University of Technology, the Netherlands.

Preface

Currently, the automotive industry is being transformed by electrification, connectivity and autonomous driving. Parallelly, urban areas get busier as urbanisation continues, which changes the user desires and meaning of mobility. The space becomes simply too limited for a spacious passenger car for every individual, and alternatives become faster and sometimes more convenient. On top of that, the need for more environmentally sustainable mobility solutions grows every day.

I ended up doing my thesis working with Lynk & Co in line with these thoughts, together with the desire to gain working experience within an automotive manufacturer. The brand aims to offer mobility instead of cars, through their hybrid sharing model and subscription-based ownership models, which are both feasible steps in the right direction. This report summarises the main learnings from the research I did for the brand and delivers a vision and concept that should inspire Lynk & Co to create their next generation of vehicles.

I want to express my gratitude to Lynk & Co and my team from the TU Delft for providing me the opportunity to do this project and for supporting and inspiring me through it. It has been a great learning experience, both on a professional and a personal level, and therefore made the project a fitting final piece of my time at the TU Delft.

Enjoy reading!

Rens

Acknowledgements

This project would not have been possible without the support of some great people. First, I would like to thank Matthijs for being a great sparring partner, bringing expertise and a fresh perspective to every conversation and always making time in your busy schedule. Then Susie, thank you for your guidance throughout the project, reminding me of what is most important for myself, and always being kind and critical at the same time.

I want to thank David, my supervisor at Lynk, for always being supportive of any direction I took. You knew before I started already which lessons I would learn throughout, and still, you let me go my own way. As you would say; *I'm just enjoying the ride.*

Furthermore, I want to thank Ruby, Pepijn, and Ruben for taking the time to dive into my research with me and for giving your perspective. Without you I think I would still be stuck in the rabbit hole of thoughts I got myself in before getting your insights. The same thing counts for all the experts I interviewed throughout the project, from whom I learned about the product, the industry, but also the steps to take as a young designer; especially my colleagues in Gothenburg, thank you Adam, Rhodri, Aycal, and the others.

Moreover, I would like to thank Sofia and Lars for making me feel at home in Gothenburg; without you, it would have been a completely different experience, and thank you Xavier for bringing me in contact with the team at Lynk in the first place.

Finally, I would like to thank my parents for giving me the chance to study and supporting me in whatever I wanted to do. And thank you Sieme, for your support, bright thinking when I was going too far in one direction, and for being you.

Thank you all for your help!

Executive summary

The automotive industry is undergoing a transformation fueled by advancements in digital technologies and connectivity. As vehicles evolve, the way we interact with them is changing, driven by a new era of Human Machine Interface (HMI) design, and the introduction of autonomous driving. Designing a car is no longer just about the vehicle. It is about energy, data, services, connectivity, entertainment, and the relation between them (Konstantopoulos, 2024). This project addresses these changing dynamics, and aims at developing a design proposal for the future of the in-car interaction within a 2035 Chinese urban context, for the Swedish-Chinese Lynk & Co.

PROBLEM

Current automotive HMIs are overly complex, having an impact on user safety, ease of use, and brand value. It causes users to be distracted while driving, not regarding vehicle systems as meaningful, and hinders car-sharing adoption. The complexity result in a learning curve for new users, which is particularly in a car-sharing context. Additionally, the emphasis on digital interfaces leads to a disconnection from the driving experience and external environment, compromising safety and the user satisfaction.

PROJECT GOAL

Envision a future Lynk & Co HMI that is more intuitive, user-friendly and brand-differentiated, in the context of a 2035 Chinese urban environment.

ANALYSIS

The research identified key trends and user needs shaping the future of the in-car interaction. Urbanisation, technological advancements, and changing user expectations are transforming mobility. Lynk & Co, positioned as a premium brand within the Geely group, target young urban professionals who value functionality, technology, and sustainability. The analysis phase included literature research, expert interview, and user studies, providing insights into the current challenges and opportunities in HMI design. Findings showed a need for simplified interfaces, better integration and design for personal devices and a focus on safety and usability.

FUTURE FRAME

Possible futures were created by collecting and understanding the contextual factors that shape it. These were translated into a framework that shows 6 states of automobiling in a 2035 Chinese urban environment, allowing for developing future-proof concepts for these states and positioning the designed interactions between them.

UNIQUE PROPOSITION

The proposition aims to shift from 'tech that isolates' to 'tech that connects', enhancing the relation between the user and the environment they move through. The concept of a 'dark cockpit' minimises visual stimuli, leading focus to the road and their surroundings. The HMI is designed to be intuitive through physical controls for daily functions and using personal devices for more advanced settings, ensuring a seamless and personalised user experience.

DESIGN PROPOSAL

The final design proposal integrates the following elements:

- **Dark cockpit philosophy**: Minimises visual noise, showing just the information needed at the right moment.
- **Levelled interaction**: Separates daily controls from advanced settings, using physical buttons for immediate functions and personal devices for detailed adjustments.
- **Focus modes**: Adapts the dashboard display based on driving or media mode, balancing functionality and entertainment.
- **Haptic feedback**: Uses seat vibrations and subtle haptics to guide and inform the driver, minimising the reliance on visual and auditory alerts.

↗ *Figure 1 - Final concept design teaser*

Glossary

Interaction - The relationship between the user and the product - the way thee user interacts with the product

Human-machine interface - The set of all functional elements that allows a human to interact with a machine.

Infotainment system - A central digital system that allows you to control a wide variety of vehicle functions.

Layout - Placement of different design elements

Domain - The boundaries set for the ViP context

Autonomous driving levels - The J3016 standard classified by the Society of Automotive Engineers (SAE) defines six levels of driving automation, from level 0 (no automation) to level 5 (full vehicle autonomy) (SAE international, 2021). It is the industry's most-cited reference for automated-vehicle (AV) capabilities.

Level 0 - No driving automation
Level 1 - Driver assistance
Level 2 - Partial driving automation
Level 3 - Conditional autonomy
Level 4 - High driving automation
Level 5 - Full automation

Abbreviations

- **ADAS** - Advanced Driver-Assistant Systems
- **AD** - Automated Driving
- **EV** - Electric Vehicle
- **DIM** - Driver Information Module
- **CSD** - Center Stack Display
- **HMI** - Human Machine Interface
- **HUD** - Head Up Display
- **IDE** - Industrial Design Engineering
- **OEM** - Original Equipment Manufacturer
- **R&D** - Research & Development
- **TU Delft** - Delft University of Technology
- **UI** - User Interface
- **UX** - User Experience
- **ViP** - Vision in (Product) Design; Design methodology by P. Hekkert & M. van Dijk
- **VR** - Virtual Reality

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PHASE O

Project outline

Phase O lays the groundwork for the project, defining the project's scope, objectives and approach. This part of the report begins with an introduction to the automotive industry's transformation driven by digital technologies and connectivity, and describes the project's scope within. The stakeholders are stated, being the TU Delft, Lynk & Co design as a client, and me as a graduate student. The chapter defines the problem statement, and the project assignment and goals, followed by the approach to get to the desired result.

MAIN TAKEAWAYS

Problem definition

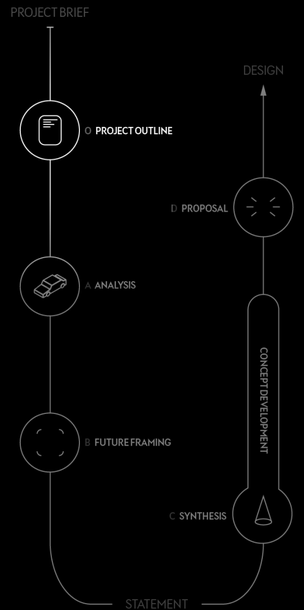
Automotive HMI's are overly complex and affect safety, ease-of-use and brand value. This leads to increasing concerns about driver focus and safety, dissatisfaction among consumers, and hindering car-sharing adoption.

Project goal

Envision a future Lynk & Co HMI that is more intuitive, user-friendly and brand-differentiated, in the context of a 2035 urban environment.

Criteria

- Fitting the lynk & Co brand
- Design for first use
- Inspiring yet realistic



↗ *Figure 2 - Top view of the Geely Design Centre building in Gothenburg*

01. Project introduction

1.1. Introduction

The automotive industry is undergoing a transformation fueled by advancements in digital technologies and connectivity. As vehicles evolve, the way we interact with them is changing, driven by a new era of Human Machine Interface (HMI) design, and the introduction of autonomous driving. Designing a car is no longer just about the vehicle. It is about energy, data, services, connectivity, entertainment, and the relation between them (Konstantopoulos, 2024).

This master thesis, a collaboration between me as a student, the Delft University of Technology (TU Delft) and Lynk & Co Design, Part of Geely Design, explores the future of in-car interactions. Lynk & Co is known for their innovative ownership and sharing models, paired with bold, modern vehicle designs. This project designs for the brand in the future context of a 2035 Chinese urban environment, with a focus on partly autonomous driving.

As autonomous driving technology advances, the role of in-car interactions is shifting. Vehicles capable of handling driving tasks allow the driver to focus on other activities. How does this change the way one desires to interact with the vehicle? Is this desire the same in both driving and non-driving scenarios? Furthermore, how can this interaction be designed so that users in a car-sharing context know how to operate the vehicle on their first use? Consumers are looking for intuitive systems that are simple and not too distracting from the road. The challenge to OEMs and suppliers is translating those consumer expectations into design and functionality (J.D. Power, 2023).

This project aims to address these challenges by investigating user desires for in-car interactions within a partly level 4 autonomous driving scenario in 2035. The goal is to develop an intuitive, user-friendly, and brand-differentiated HMI for Lynk & Co that serves both owners and sharing users. Through this research and design effort, the project will contribute to the improvement of interaction with future vehicles, offering new possibilities for innovation for Lynk & Co doing so.

1.2. Stakeholders

This thesis is done as a hybrid internship in the HMI team of Lynk & Co design, part of Geely Design. Geely Design develops and executes ideas and designs for Geely Group, holding a portfolio of brands ranging from Swedish automotive brand Volvo, London's electric taxis, flying car development company Terrafugia, and Lynk & Co, offering hybrid/electric vehicles with innovative subscription-based ownership and sharing models.

Lynk & Co Design, responsible for all design-related research and design (R&D) for Lynk & Co's vehicles, is the first main stakeholder (client) in this project. The second main stakeholder is the Delft University of Technology (TU Delft). The third main stakeholder is me as a graduate student, standing at the forefront of his career as an industrial design engineer (or what else my professional path will lead to).

This project is the final step of the road towards a Master of Science (MSc) in Integrated Product Design (IDE) at the Delft University of Technology (TU Delft), the Netherlands. The graduation project team is composed by me together with my supervisors Matthijs van Dijk (TU Delft) as chair, Susie Brand-de Groot (TU Delft) as mentor, and company supervisor David Gillblom (Lynk & Co Design).

Figure 5 - Geely Design Centre Gothenburg

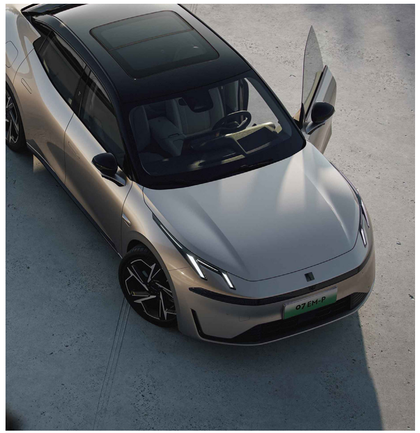


Figure 3 - 2024 Lynk & Co 07 EM-P

Figure 4 - Project focus: The automotive HMI

Figure 6 - Faculty IDE, TU Delft

1.3. Problem definition

Over the past two decades, digital technologies have revolutionised in-car interactions, with touchscreens providing manufacturers flexibility and offering users a modern experience. These displays have gradually replaced traditional physical controls with purely digital interfaces in vehicles. However, the new possibilities of these screens resulted in highly complex infotainment systems.

DIGITAL MAXIMALISM - MISPERCEIVED INNOVATION

Despite their potential, current HMI designs often feel "gimmicky" and lack attention to detail; The sleek and efficient user interfaces of our other digital devices have set a high standard that is hard to compete with (Everdell, 2015). Roughly one-third of consumers shy away from using built-in apps due to their complexity, with "difficult to use" being the most reported issue (J.D. Power, 2020).

Good design in the context of driving, should ideally disappear, allowing the driver to focus on the road rather than the screen. However, the pursuit of perceived technological innovation often results in a misunderstanding of user needs, adding needless software complexity. Cars offer lots of apps, and app stores for even more apps, chasing a perception of technological innovation.

BATTLE FOR ATTENTION - DRIVER DISTRACTION

OEM's seem to be in a battle for the customers attention. The more features teh better. However, this does not necessarily lead to better brand and product experiences, and definitely not to a safer drive. An analysis by NHTSA (2023) showed that distraction-related fatalities increased by 12% from 3,154 in 2020 to 3,522 in 2021, a total of 8.2% of all fatalities reported. This rise shows the need to address the complexity of current infotainment systems, ensuring that technology enhances rather than interferes the driver experience.

CAR SHARING COMPLEXITY

The lack of familiarity with the vehicles is currently a significant barrier for users considering sharing platforms (Mitropoulos et al., 2021). Lynk & Co's sharing platform highlights the importance of intuitive interactions, as vehicles need to be designed for 'first-time use', eliminating the need for a learning curve.

BRAND VALUE

Brands are chasing the same HMI experience - which seems to be close to the experience with our Iphones/Android phones. Most digital interfaces feel brandless, while building a strong brand is essential in the highly competitive automotive industry. The HMI is a main driver for customers to buy, an therefore brand specific design is crucial for market penetration (Fiorentino et al., 2020).

Figure 7 - HMI innovation in the Lynk & Co 08

Figure 8 - Apps and app store on the 2024 Rising Auto R7

Figure 9 - Digital maximalism in the Tesla Model S Plaid

PROBLEM

Automotive HMI's are overly complex and affect safety, ease-of-use and brand value.

WHY IMPORTANT?

Increasing concerns about driver focus and safety, dissatisfaction among consumers, and hinder of car-sharing adoption.

PROJECT GOAL

Envision a future Lynk & Co HMI that is intuitive, user-friendly and brand-differentiated, in the context of a 2035 Chinese urban environment.

CRITERIA

Fitting the Lynk & Co brand
Taking into account both ownership and sharing usage, with a global perspective.

Design for first use
Create an HMI that prioritizes intuitive and seamless interactions, making it easy for first-time users to operate without a learning curve.

Inspiring yet realistic
Ideas that are forward-thinking, yet probable for technological and market trends for 2035.

1.4. Goals and criteria

The main goal of the project is to envision a future Lynk & Co HMI that is more intuitive, user-friendly and brand-differentiated, in the context of a 2035 urban environment.

SCOPE

As the project takes place in the HMI department of Lynk & Co design, it will focus on designing the interaction with the vehicle through mainly the dashboard and steering wheel. However, the entire interior will be taken into consideration, in order to address problems and opportunities at a deeper level.

FOCUS

The project will focus on performing research on the topic of HMI interaction, the future context, and the brand within the automotive market, and develop a vision and early concepts according to it.

DELIVERABLE

A conceptual design as a way to inspire and to form a starting point for further development. Besides that physical tests and prototypes will be used as proof-of-concepts. The report forms a source of ideas, insights and other information resulting from the activities done throughout this project

TIME-FRAME AND MARKET

The project targets the Chinese automotive market for 2035, aligning with Lynk & Co's focus. The year 2035 is distant enough to allow for creative freedom, yet close enough to remain relevant, especially regarding the fast development cycles at Lynk & Co and the development in autonomous driving.

Figure 10 - Project goal moodboard

02. Project approach

2.1. Approach

This project was executed in 100 working days, starting mid January and concluding at the end of June. It follows 5 project phases, starting with the project outline, and finishing with a design proposal. The project will take place half of the time in the Geely Design Centre office in Gothenburg, and half of the time at the faculty of Industrial Design Engineering at the TU Delft. It is initiated with 4 weeks in Gothenburg to get the project off the ground, dives into the analysis phase during 8 weeks in Delft, and then concludes the project with 12 weeks in Gothenburg, where the results are presented to the company.

While these phases are presented as a linear process, they were in reality a back and forth of activities. Research led to ideas, ideas led to concepts, and concept development led to research again. However, in order to provide a coherent story, the insights and developments are presented linearly. For coherence, the insights and developments are presented linearly.

PHASE O - PROJECT OUTLINE

Phase O focused on initializing the project. During this phase, the scope of the project was defined, the project setup was established with the supervisory team, and initial research was done.

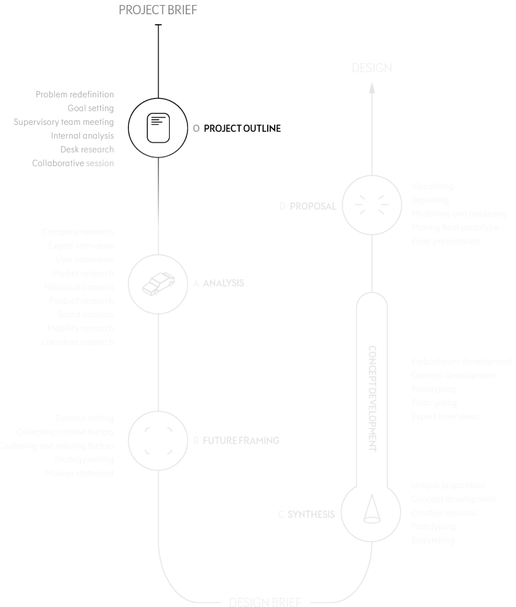


Figure 11 - Project structure diagram; Project outline

PHASE A - ANALYSIS

In the *analysis* is about analysing the project context, in order to define requirements and opportunities, and carve out the scope of the relatively broad project assignment. In the analysis phase, a clear overview of the context, company, user, and the current product is created in order to further define the design scope.

PHASE B - FUTURE FRAMING

In *future framing* the focus is shifted to the broader context. By understanding possible futures through analysing the drivers that will shape it, a framework was created to represent these futures. Using this framework, a strategy and desired interaction was created, a fitting interaction analogy and product qualities belonging to it.

PHASE C - SYNTHESIS

In Synthesis the mission statement and analogy from phase B, and the research insights, were synthesized into a unique proposition. This was then developed into concepts and a vision accordingly. One of the concept was chosen, and further developed in an iterative process.

PHASE D - PROPOSAL

Phase D is dedicated to proposing and presenting the final design concept. This involves visualizing and prototyping in order to effectively communicate the design. This phase concludes with a final presentation within Lynk & Co, showcasing the final design and handing over the work done.

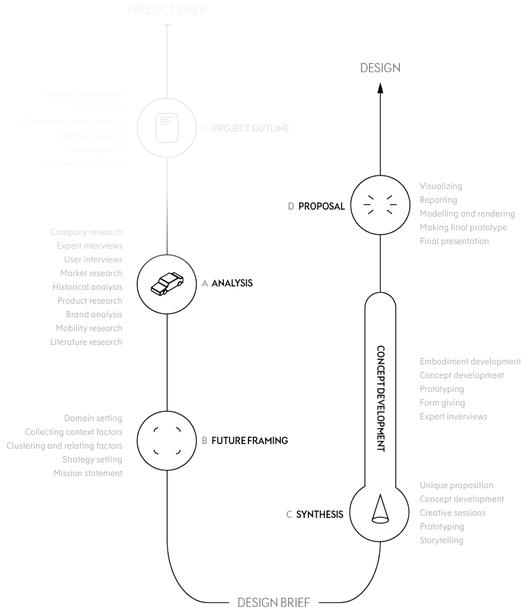


Figure 12 - Project structure diagram; future framing, synthesis, proposal, all leading to a final design vision

2.2. Methods

Throughout each of the project phases mentioned above, specific methods were chosen to end up with the desired results. During the analysis phase research was conducted through literature research, expert interviews, user interviews and by studying internal material of Lynk & Co. This was followed by the future framing phase where the ViP method was used to envision a possible future and develop a framework for further concept development. In the synthesis phase this framework was used to collaborate with Lynk & Co on a vision and concept opportunity directions, after which these were developed and converged into a single concept.

Lynk & Co was involved through update meetings twice a week, bi-weekly meetings with the company supervisor, and other meetings with colleagues. Working at the Gothenburg office throughout the analysis and synthesis phase also created unintended collaboration and involvement throughout the working days.

The TU Delft team was updated through planned meetings, commonly each week with either mentor or chair. Depending on the project stage these moments were used for updates, discussion or input from their experience.

Table 1 shows an overview of the aim and methodology of the project phases.

Phase	Aim	Methods
Phase O - Project outline	Initialising the project and setting the scope	Literature review
Phase A - Analysis	Analysing the project context and defining requirements and opportunities	Literature review, user interviews and expert interviews
Phase B - Future framing	Define possible future context and create a strategy within in	Vision in Product (ViP) design approach and collaborative interviews
Phase C - Synthesis	Synthesise insights into a vision and respective concepts	Rapid Iterative Testing and Evaluation (RITE) and design methods
Phase D - Proposal	Proposing and presenting an embodied concept	Prototyping, visualisation and presentation

↗ *Table 1 - Aim and methods used throughout the project phases*

VISION IN (PRODUCT) DESIGN

The Vision in Product (ViP) design approach by Hekkert & van Dijk (2011) was used to create an understanding of probable futures and the effect on human behaviour, with the goal of making conscious choices on how to intervene and create a more desirable future. By focusing on future possibilities instead of today's problems, choices can be made more consciously and value is created through early anticipation.

The approach revolves around 3 main values; authenticity, freedom and responsibility. By analysing the (future) context objectively, the designer has the freedom to make authentic choices, and with this power comes the responsibility to make the right ones. The goal is not to create a completely new vision for the Lynk & Co brand, but build upon the existing material and provide a new interpretation in a future context. Therefore exploring this future context contributes to the creation of unique ideas and concepts.

Vip follows 8 steps: initially deconstructing the existing context (0), defining the domain (1), collecting context factors (2), clustering and structuring (3) establishing a mission statement (4), creating a desired interaction (5), extracting product qualities from this interaction (6), creating a concept (7), followed by its detailed design and refinement (8).

ViP steps

0. Deconstruction
1. domain/time
2. Context factors
3. Framework
4. mission statement
5. human-product interaction
6. product qualities
7. Concept
8. Design and detailing

DESIGN METHODS

Throughout the project, and the development phase in particular, design methods were used to generate ideas and conceptualise them. The Delft Design Guide by Van Boeijen et al. (2020) can be stated as the source for several design methods and approaches learned throughout my years of studying at the faculty IDE at the TU Delft.

EXPERT INTERVIEWS

Interviews with experts from Lynk & Co, TU Delft, and other relevant parties were a valuable source of information. The interviews were both a way to collect context factors for the ViP process, but particularly to gain insights about the general industry and about their specific expertise.

The choice of participants was led by the process of getting an understanding of automotive HMI- and interaction design, where one interview led to another. The interviewees are a combination of Lynk & Co employees, mainly within the HMI design department, and experts from the TU Delft and from within the field of automotive design.

An overview of the interview participants can be found in table 2.

↗ *Figure 14 - Screenshot of interview with expert*

↖ *Figure 13 - Vision in Design and the Delft Design Guide - Sources for methodology*

#	Name	Company	Specialisation	Interview topic
1	Rhodri Jones	Lynk & Co Design	HMI chief designer	Automotive industry, China-EU dynamic, design to development process
2	Adam Mattson	Lynk & Co Design	Interaction designer	Haptic feedback in automotive interiors
3	Samuel Wijk	Lynk & Co Design	HMI/UX chief designer	HMI technology, connectivity in HMI's
4	Elenna Ningnan Li	Lynk & Co Design	HMI/UX designer	Chinese digital media in HMI's
5	Bram Bos	Lightyear/Freelance	HMI designer	Digital vs physical interaction in future HMI's
6	Matthew Sassman	Zeekr design	Senior interaction designer	AD interaction in HMI's, China vs EU, project scope
7	Pepijn van Houdt	RDDI / Reframing Studio	Design researcher	Vision in Product design, urban mobility
8	Elmer van Grondelle	TU Delft	Program Manager Advanced Automotive Design	Brand positioning, AD development, Chinese vs European market
9	Peter Vink	TU Delft	Prof. human factors & ergonomics	In-car ergonomics in driving and AD scenarios

↖ *Table 2 - Expert interviews*

PHASE A

Analysis

In this chapter, the focus is on analysing the context of urban mobility and its users, and their impact on Lynk & Co's design strategy. The analysis covers the paradigm shift currently taking place in the automotive industry, the developments in HMI interaction and autonomous driving, and the specific market and brand dynamics of Lynk & Co. The user needs in vehicle use are explored, and how these factors are currently shaping the design of vehicle HMI's. In this phase, design requirements are explored and opportunities are identified, which are later used for concept development.

MAIN TAKEAWAYS

URBAN MOBILITY

Urbanisation and the possibilities of new technological developments are changing mobility in the city - Electrification, connectivity, autonomous driving, and shared mobility.

LYNK & CO

Lynk & Co is positioned between Geely and Volvo within the Geely Group, as a new premium brand with hybrid ownership and sharing models. The brand is active in China and Europe, with each its own branding and product strategy.

THE PEOPLE

The main target audience are young, urban professionals who prioritise functionality over status. They choose Lynk & Co for its innovative features, bold European design, and reliability / practicality.

IN-CAR INTERACTION

The in-car interaction has evolved from relying on physical controls to focusing on touchscreens and connectivity. The industry has reached a point where cars are 'smartphones on wheels,' but this raises the question if this is what the user truly desires.

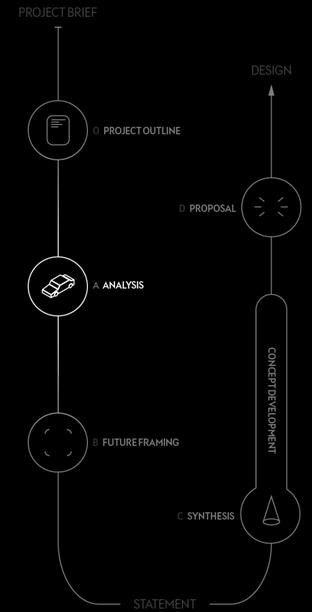


Figure 15 - The tactile HMI of a 2000 Volvo S60

03. Urban mobility

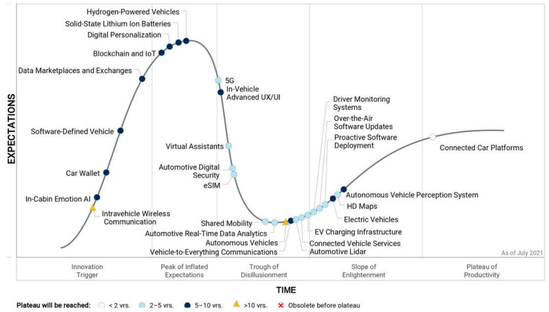
The landscape of urban mobility is truly complex, shaped by a set of influences from society, politics, culture, technology, and the industries behind it. It is rapidly evolving through emerging technologies and societal changes. According to the United Nations, 68% of the world population is expected to live in urban areas by 2050 (United Nations Department of Economic and Social Affairs, 2018). This urbanisation requires well-designed mobility systems to address problems such as congestion, pollution, and limited space.

3.1.. Paradigm shift

The way urban inhabitants move is currently experiencing a significant paradigm shift, driven by things like electrification, micromobility, autonomous driving, and shared mobility (Gartner, 2021). They lead to a change in how consumers use and experience mobility, opening up new design opportunities to add new meaning to the vehicles we move in. A set of emerging technologies that are relevant to Lynk & Co have been analysed and listed to see how they will influence the way we move tomorrow.

ELECTRIFICATION

The adoption of electric vehicles (EV's), changes urban mobility fundamentally. It is considered a promising way of boosting the energy transition and achieving CO2 targets. China leads the world in EV adoption, accounting for nearly 45% of the global EV fleet in 2018 (Zhang & Hanaoka, 2021), driven by government policies and subsidies, and a focus on building competitive brands after missing the boat on combustion engine vehicles over the last 30 years.



↙ *Figure 16 - Hype Cycle for Connected, Electric and Autonomous Vehicles, 2021*

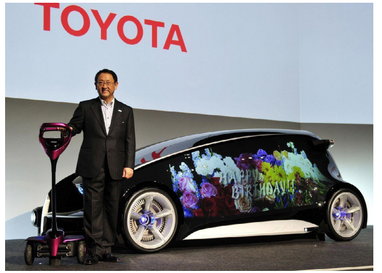
The flexibility of electric drivetrains over combustion engines allows for creating more compact and efficient vehicles and infrastructures, and a reduction of the urban air pollution in dense urban areas. While creating a completely new charging industry takes time, and range-anxiety still is the main reason for customers to stay away from EV's, it seems just a matter of time until the market will be completely dominated by them.

CONNECTED VEHICLES

Connected technology in vehicles (and our digital devices in general) are changing the way we move ourselves. These services allow us to stay connected with digital media at all times, provide real-time information, remote control and enhanced user experiences to users. Back in 2011, Akio Toyoda, Toyota's Motor Corp back then, showed off its Fun-Vii 'smartphone on wheels' concept. It envisioned that the car would work like a personal computer, something that became reality two decades later (Kageyama, 2011).

AUTONOMOUS DRIVING

Autonomous driving assistance systems (ADAS) are rapidly evolving, and expectedly going to change the way we spend our time in cars. The development and deployment of fully autonomous vehicles face significant technical, regulatory, and social challenges, which are discussed in more detail later in this chapter.



↖ *Figure 17 - Akio Toyoda presenting the Toyota Fun-Vii concept*

↗ *Figure 18 - Mobikes lined up in in Beijing*

SHARED MOBILITY

Shared mobility services, such as car-sharing, micro mobility and ride-hauling services are changing the way we move throughout the city. Services like Uber, Miles, Mobike, and many others provide flexibility mobility-as-a-service options that reduce the need for personal vehicle ownership. In terms of car sharing, this trend is mainly visible throughout Europe, with the contribution of Lynk & Co with their sharing platform, but less through Asia, where the meaning of status is still strictly connected to the automobile.

URBAN DESIGN CHANGES

In addition to technological developments, urban design changes are also affecting how habitants move themselves. Cities increasingly prioritise active transport modes like walking and cycling, redesigning cities to be more pedestrian- and cyclist-friendly. This shift is clearly visible in declining car ownership rates in the most densely populated metropolitan areas (Eurostat, 2024). However, this trend is not uniform globally. In China, the cultural meaning of car ownership seems still rooted too deeply to evoke a change in this regard. 6 lane wide highways running from downtowns to mass urban housing projects are currently the approach to cope with increasing urban density (Cheshmehzangi, 2018).

↗ *Figure 19 - Pedestrians in front of the Wukang Mansion*

3.2. Autonomous driving

Over the past decades, OEM's have invested heavily in the development of Advanced Driver-Assistance Systems (ADAS) and Autonomous Driving (AD). Despite slower-than-expected progress towards full autonomy, significant advancements have been made towards it, seen in Tesla's FSD, BMW's Personal Pilot Level 3 and Mercedes' Drive Pilot (Konstantopoulos, 2024b). These systems support the driver up to SAE's level 3, conditionally automating the driving. However, the driver is still responsible and expected to be ready to take over at all times.

China is emerging as the leader in autonomous driving technology. In 2023, China allowed level 3 and level 4 vehicles to be used (ResearchInChina, 2024), accelerating developments and the development of new business models. Brands were already allowed to do pilots in Shanghai and Beijing, but with these new regulations the barrier is removed to roll out their AD features. As a result, Xpeng announced that it is rolling out its XNGP driving pilot on all roads in China (Kang, 2024).

Rhodri Jones highlights the difference in approach between the two regions: "North Americans are a lot more vocal about their AD progress. China has AD built in, and is just waiting for the green light."

While progress is being made, the deployment of AD is not without challenges. After an autonomous Waymo car hit a bicyclist in San Francisco in early 2024, leading to a lawsuit and discussion, and in the end a Waymo car set on fire by citizens (Gizmodo, 2024).v (Templeton, 2023).

In contrast, the robo taxi business in China is growing fast.

Figure 21 - Baidu robotaxis driving an AD area in Wuhan

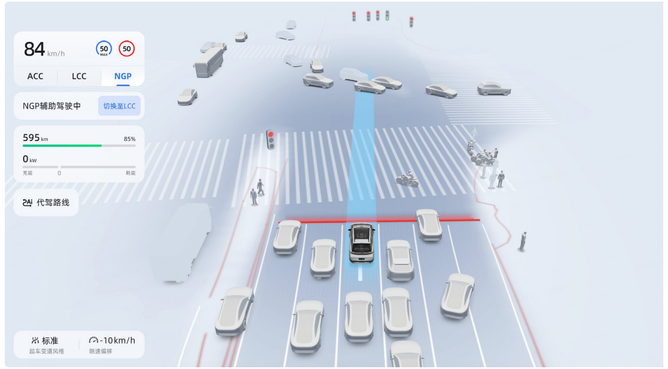


Figure 20 - Xpeng XNGP driving pilot UI

Wuhan has emerged as the world's largest autonomous driving service area, with nearly 500 driverless vehicles, including autonomous taxi and unmanned buses, serving 900.000 people each year (ML Truck, 2024). China showcases a large-scale implementation and public acceptance of AD to the rest of the world, heightlighting the feasibility and current state of the technology.

Within this project, the SAE levels are simplified to either manual driving or autonomous driving, taking the scenario of a mixed-medium car ride; partly driving and partly being driven. The complex environment of city centres and vulnerability of pedestrians make a near future of partly autonomous drives plausible, in which the driver can go 'out-of-the-loop' after leaving- and before entering the city centre. Figure 22 shows the modes and figure 23 an example of a typical multi-modal car ride.

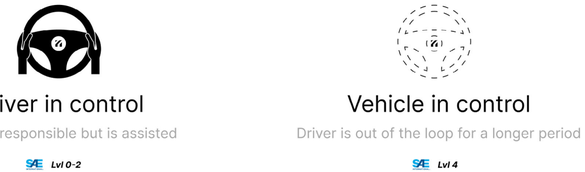


Figure 22 - The two driving modes used in this project

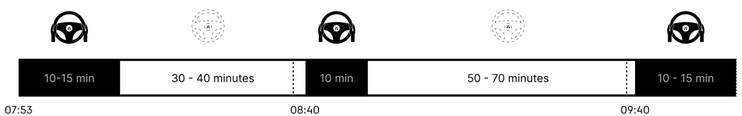


Figure 23 - Example of a multi-modal car ride

04. Lynk & Co

4.1. Company

Lynk & Co was founded in 2016 as a joint venture between Geely and Volvo. It was born as the premium brand positioned between Geely Auto and Volvo cars in the Geely Automotive group - something similar to the Skoda, Volkswagen and Audi threefold in the Volkswagen group (Chan, 2021). The brand is targeted at millennials living in urban areas, with its main market in China. Lynk & Co states to challenge the conventions in the automobile industry with the concept of being personal, open, and connected.

According to ex-CEO Alain Visser , the brand aims to tap into three major trends among urban millennials: The sharing economy, subscription models, and connectivity (Holmes, 2019). This is done through a sharing platform, a subscription based ownership model, and a digitally connected vehicle. Lynk & Co's are being described as "smartphones on wheels", aiming to tap into the needs of young, digital natives.

Towards their main customers, the Chinese, Lynk & Co communicates a company essence of European technology, European design, global manufacturing and global sales. Many Chinese urban professionals will buy a Chinese brand only when they can not afford a foreign one. Through positioning it as a global / European brand, Geely aims to appeal to the Chinese customers (Dunne, 2016).

Towards the non-Chinese customer, the focus is on the sharing and subscription-based-ownership aspect of the business. A more efficient use of vehicles, and mobility-as-a-service is what the brand communicates to its customers. Where the brand currently sells 9 models in China, it only offers the 01 in their other markets.

Lynk & Co sold its first 6.000 vehicles within 3 minutes back in 2016, and is approaching 1 million sales in 2024, and remains the fastest growing automotive manufacturer in the world through it (Lynk & Co, 2024a).

Figure 24 - The Lynk & Co 01 attracts the attion during the launch event in 2016 in Berlin

"People are more and more focused on experiences rather than ownership, almost like dematerialisation."

Alain Visser, CEO Lynk & Co

"Lynk & Co is a high-end car brand with European technology, European design, global manufacturing and global sales."

Li Shufu, founder Geely

Figure 25 - The last model released is the Lynk & Co 08, currently only available in China

Figure 26 - The three Lynk & Co brand values, as communicated by themselves

LYNK&CO

Bold

Having the courage to stand out and do something different.

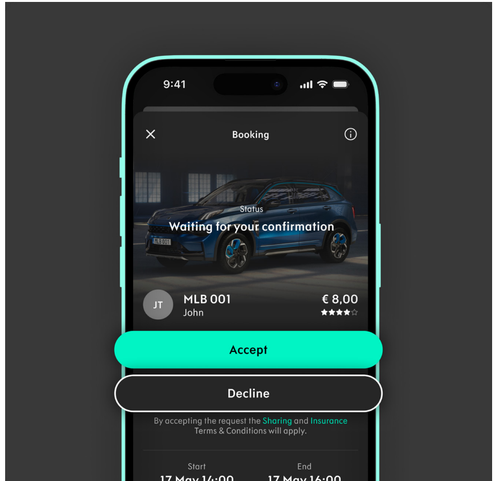
Open

We always keep an open mind and are rather inclusive than exclusive.

Connected

Committed to connecting people to people, and people to the world.

Figure 27 - In Europe the brand is known for its sharing platform and subscription-based ownedship model



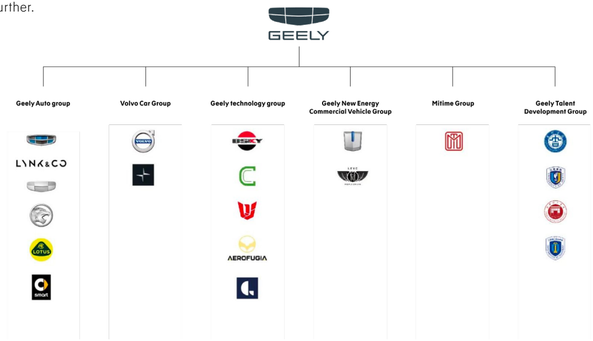
4.2. Geely

Zhejiang Geely Holding Group, better known as Geely, is a automotive manufacturing corporation, established in 1986 by the Chinese entrepreneur Li Shufu. It operates in the automotive industry under Geely Auto group, which includes Geely auto, Lynk & Co, Zeekr and Proton. Next to these brands, Geely owns the Volvo Car Group (Volvo, Polestar), and produces commercial vehicles, motorcycles, and automotive through their other brands. Also, it is the top shareholder in the German Daimler, the parent of Mercedes Benz, with a 9,69% stake (Fukao, 2018).

The Geely group is known for its significant growth mentality and power, and its technological innovation in the automotive industry. They sold 2,79 million vehicles in 2023 (Chan, 2024), of which 220,250 units were Lynk & Co's, making it the fastest Chinese car brand to break through one million units.

The separate brands within the Geely umbrella act as independent brands, but share the vehicle technology. The development of the Compact Modular Architecture (CMA) platform, the first shared platform of Geely and Volvo, finished in 2017, and is currently used in vehicles from Volvo, Polestar, Geely, and Lynk & Co. It is a highly flexible vehicle platform, allowing for ICE, PHEV, and EV's to be built on the platform, where only the distance between the front wheels and the pedal box is fixed (Volvo Cars, 2015).

Currently Geely has four platforms, namely CMA, BMA (smaller cars), SEA (purely EV), and SPA (original Volvo platform). It will aim to expand further through platform technology improvement in terms of efficiency, further electrification and developing their AD systems further.



↖ *Figure 28 - The Geely group and its subsidaries, and the brands within*

↙ *Figure 29 - Geely CMA platform*

4.3. Brand identity

Lynk & Co is the brand that brings people together - Stefano Oliva, Chief Designer HMI prospective design

Lynk & Co is a brand that aims to create something new and unique, as there is no history of heritage to rely on. Therefore the challenge for the brand has always been to create a recognisable brnad, that stands out next to other brands, especially within the Geely group (Signal, 2018).

With its roots in both Europe (Belgium/Sweden) and Southeast Asian megacities, Lynk & Co was designed for the urban 'new family'. This demographic represents young, progressive people who value mobility with high ease-of-use, while being conscious of their impact on their environment. Lynk & Co serves this audience through vehicles that stand out through their modern, daring design language, and integration of digital (connected) elements in both the exterior and interior of the product.

The brand identity prism of Kapferer (2012) is used to evaluate the brand identity of Lynk & co in figure 30. From the perspective of the sender, the brand is formed by the physical qualities of their products, and the personality of the brand. From the consumer side, the brand is constructed by a reflection element - how the consumer thinks he is perceived by others when being in contact with the brand - and a self-image element - how the consumers see themselves when interacting with the brand. The vertical middle third of the prism acts as a bridge - evaluation the relationship and contact points of both actors, and the culture that surrounds the brand and its customers.

↗ *Figure 30 - The brand identity of Lynk & Co evaluated through the brand identity prism of Kapferer*

KEY WORDS

CONNECTED | DIGITAL | BOLD | CONVENIENCE | SHARED | YOUNG | TECH

In the automotive industry, brands often tailor their identity to resonate with customers in their different target market, each having their own cultural context and consumer preferences.

Lynk & Co, with roots in both Europe and China, is a strong example of how a brand adapts its identity to align with different market expectations and their consumers.

IDENTITY IN EUROPE

We make cars. We make communities. We make it simple.

In Europe, Lynk & Co communicates community, simplicity, and sustainability. The mission is to 'Change mobility forever'. The brand is know for hassle-free subscription and flexible ownership models, challenging traditional ownership norms. The introduction of their hybrid sharing model and subscription based model made them known quickly in a saturated automotive market. Besides that, their 'clubs' in the city centers in major European cities made them visible and create a new type of brand connection for an automotive OEM.

The bold graphical elements in Lynk & Co vehicles, compared to the established (European) brands, created an image of 'that Chinese car brand', in an era were Chinese cars are just making their entrance into the European market. With Chinese brands gaining popularity, and lowered focus on the sharing element of the brand, it is the question were the identity will turn into in the coming years.

OPEN | SIMPLE | SUSTAINABLE | WOW

PRODUCT PORTFOLIO

+ car-sharing platform

IDENTITY IN CHINA

In China, Lynk & Co leverages the prestige of European design and engineering, positioning itself as a high-end brand that serves the lifestyle of their young, urban consumers. It delivers high-value, high-tech products, packed with features and new technologies. The brand's focus in China is on on intelligent and connected mobility.

The brand also emphasizes safety features and lifetime warranty, presenting itself as a subsidiary of Volvo, known of their reliability and a very premium brand in the Chinese market. The Chinese website names European design, European engineering and Global manufacturing and sales as their main values.

GOOD LOOKS | PREMIUM | HIGH TECH | HIGH SECURITY | EUROPEAN

PRODUCT PORTFOLIO

Figure 31 - Brand communication from Lynk & Co Europe

Figure 32 - Brand communication from Lynk & Co China

Being identified as a Chinese brand in Europe, and as a European brand in China, is core of the split identity of the Lynk & Co brand. By having a background in both markets and context, and design the same products for both target customers, the brand is not really one of both. Is this a strength or weakness for the brand?

While elements as 'innovative', 'community-focused', and 'tech-savy' stay consistent, the differences in brand identity between the two markets are significant. In Europe, the focus on sustainability and ease-of-ownership, and in China the emphasis on high-end technology, coming from Europe, differ, and therefore create the challenge to design identical products for both markets.

05. The people

5.1. Target audience

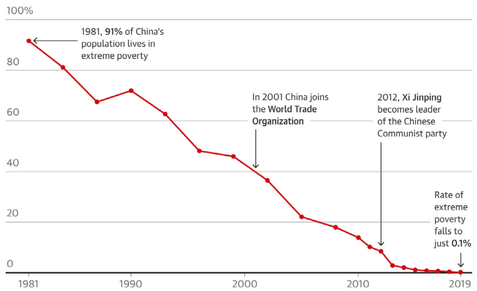
Lynk & Co focuses on young urban individuals and families, within their target markets China and Europe (Sweden, Netherlands, Belgium, Germany, Spain, France, and Italy). Approximately 78% of the revenue comes from China, where the brand launched in December 2017 and grew fast . The other 22% comes from the European market, where they introduced their models in 2021 accompanied by the sharing platform (GCBC, 2023a; GCBC, 2023b).

Historically, European automotive OEM's were associated with quality. Taglines like "made in Germany", "Italian car design", "Swedish safety" are used to describe it, in contrast to the stereotype around "made in China" - often perceived with bad quality and imitation of other brands (Uyar, 2018). However, this image is undergoing a transformation.

The rise of China's wealth played a crucial role in this shift. Where in 2000 only 3% of the population was considered middle class, this number grew to nearly 51% in 2018 (Schrag, 2021). Simultaneously, the share of people in extreme poverty shrinked from 91% to just 0,1% (figure 35). This socio-economic shift resulted in hundreds of thousands of people being able to buy their first car, turning the car into a major status symbol.

↖ *Figure 33 - Marketing images show the young, creative audience Lynk & co is targeting in Europe (or those aspiring to be)*

↘ *Figure 34 - Marketing images show the young, urban audience Lynk & Co is targeting China (or those aspiring to be)*



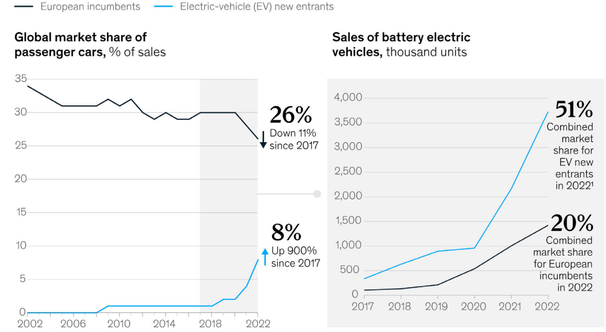
↗ *Figure 35 - Percentage of Chinese people living in extreme poverty*

As incomes have risen, Chinese customers have become more demanding, expecting high-quality products that reflect their new wealth and status. The car is a typical item, being not just about mobility, but also about prestige and personality. Having just acquired the ability to buy a car, people look for vehicles that symbolise their status and success, similar to trends seen in other luxury goods markets, such as high fashion (China Brain, 2014).

The result of this can be seen in the European market as well, as growing customer demands in China result in better products exported to Europe. As seen in figure 36, new (Chinese) entrants are rapidly gaining market share, with European OEMs losing ground (Cornet et al., 2023). Lynk & Co is in the position to benefit from both China-based advantages, and European based brand advantages.

Given this context, the key desires of Lynk & Co's target demographic are analysed in this project. The main focus is on the Chinese urban inhabitant, as this is the main focus for Lynk & Co. The European customers will also be taken into account, as designing for a culture on the other side of the world can be a complex task. In this regard I will follow the way the designers in Gothenburg work, using insights from- and interviewing designers in the Lynk & Co design office in Shanghai, and other internal sources available.

↖ *Figure 37 - Automobiles carry a similar status to for example high fashion items or owning a grand piano*



↖ *Figure 36 - European OEMs are losing market share while new (Chinese) entrants are dominating the market*

↗ *Figure 38 - Both exterior and interior and created for experienced luxury, through bold, expressive designs. [1] 2024 Zeekr 009 exterior [2] 2021 Mercedes-Benz EQS*

5.2. Interviews and test drives

To understand the desires and key drivers of the target group, a combination of interviews and test drives with users were performed.

5.2.1. INTERVIEWS

Two types of user interviews are used. In the first place, semi-structured interviews with 5 participants were conducted from their perspective to find out what is driving them in how they live and move, and what the expected drivers are for 2035. An overview of the interviewees can be found in table 3.

The second type are interviews with Chinese customers performed by the China Britain Business Counsil for the Geely Group (2021), which were made available internally within Lynk & Co Design through transcriptions and recordings. These interviews focused on the general drivers in their daily lives and the way they move around the city. The questions were categorised in the areas of living attitude, values, attitude towards cars, shopping attitude, vehicle using behaviour, vehicle brand perception and other perspectives. The recordings of these interviews were studied and relevant drivers and context factors were taken from them. Table 4 shows a list of the interviewees.

Figure 39 - User interview with Lynk & Co 01 owner

Figure 40 - Screenshot user interview recording with customers in China

#	Gender	age	Nationality	Residence	Profession
1	Woman	26	Chinese	Netherlands	IDE student
2	Woman	27	Chinese	Netherlands	IDE student
3	Man	24	Dutch	Netherlands	Mechanical engineer
4	Woman	43	Dutch	Netherlands	Psychologist
5	Man	29	German	Germany	Business owner

Table 3 - User interview participants

#	Gender	age	Nationality	Residence	Profession
1	Man	35	Chinese	Shanghai, China	Engineering consultant
2	Man	41	Chinese	Chengdu, China	IT
3	Man	39	Chinese	Shanghai, China	Sales
4	Woman	23	Chinese	Shanghai, China	Transport logistics
5	Woman	23	Chinese	Chengdu, China	Model / Agency

Table 4 - User interview recording participants

5.2.2. TEST DRIVES

Besides interviews a series of test rides were conducted. The goal of these rides was in the first place to gain insights on what the driver desires when driving the vehicle, but also as a way of benchmarking and developing ideas in practice. Table 5 shows list of the vehicles that were driving during the test drives.

During these test drive, the goal was to gather insights on what the users desire from the HMI in various driving scenarios, what factors them drive in brand preference, and what they would like to see improved.

Brand	Model	Release	With
Lynk & Co	01	2016	Owner
Lynk & Co	01	2016	Owner
Lynk & Co	01	2016	Sharing user
Volkswagen	ID 3	2021	Owner
Audi	Q8 E-tron	2021	Zeekr designer
Hyundai	Ioniq 6	2023	Lynk & Co designer
Lynk & Co	08	2024	Lynk & Co designer

Table 5 - Test drive vehicles

Figure 41 - Test drive snapshots

5.3. Split target market

During the user research, it became clear that the desires and drivers for both target markets align in many aspects, but also contradict in ways. The industry is increasingly designing vehicles purely for the Chinese market, while selling the same models in Europe (R. Jones, Personal communication, 2024). This is a mirrored repetition of what happened with ICE cars in the last century, where designs were made for Europe and the US, while also being sold in Asia.

Currently, the majority of global electric car sales are in China (figure 42), and therefore OEM's shifted their focus accordingly. China accounted for 54% of global EV sales, while Europe counted for just 22%. However, future projects show a stagnation in the growth of this share, due to new markets and EV adoption in Europe and the US. This might lead to similar demands if the current demands are driven by the novelty of these cars, or, if cultural differences are at play, the target group dynamics could change over time (figure 43).

For this project, the Chinese urban professional has been chosen as the primary target audience, as the timescope is 2035, and the industry is currently focused on this. However, the aim is to learn from the European market in terms of maturity of the market, and identify the shared (general) user interaction values that work for all customers.

5.4. Interview insights

The interviews showed several themes that are valuable for the project. In the first place, three main drivers appeared with every individual, prioritising family, wealth and status, and practicality. Their desires and preferences in their way

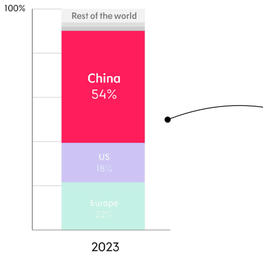


Figure 42 - Global electric passenger vehicle sales in 2023

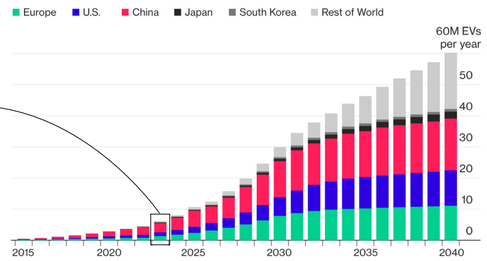


Figure 43 - Global electric passenger vehicle sales expectation - 2015-2040

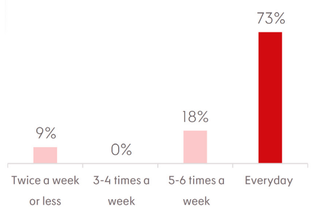
of moving themselves reflect these values, and are therefore valuable to take into account.

- **Family in the centre and well-being** - The general focus is on family, especially on children's needs and safety, and daily care for elderly family members. Weekend activities and family gathers are highly valued, and a daily topic of conversation.
- **Wealth and status** - There is a desire to show social status through possession and lifestyle choices. New technologies and brands with heritage are valued higher than products without it.
- **Practicality and functionality** - There is a strong preference for products that offer good value for money. High-priced luxury is often looked at in a sceptical way, unless providing significant practical benefits, for example great reliability.

In terms of personal transport, the main way of moving oneself around is the car, together with taxis and public transport. Taxis are relatively low priced, and therefore offering a good option for the masses, but slowing down the adoption of car-sharing platforms. The majority of the interviewed car owners use their car every day, mainly for commuting, short-distance trips and going out for eating, shopping and meeting up with others (figure 44).

When deciding on buying a car, the interviewees indicated the following aspects as most important;

- **Safety and comfort** - Features give a feeling of support when driving, and an interior that can serve a large (expanding) family, with wide back seat and optional extra seats.
- **Connectivity and integration** - Infotainment systems that connect with other devices and have apps that are used daily. The software should update for years, because currently the cars feel old quickly.
- **Functionality** - Good value for money, balancing cost with quality, features and social status. The ability to personalise is highly valued as well.
- **Simplicity in use** - Simple, intuitive interfaces are desired, as they are linked to European design, which is considered as desired. Besides that the AD functions are preferred to be simple and assisting without notion, not interfering with the driver, especially in busy traffic.



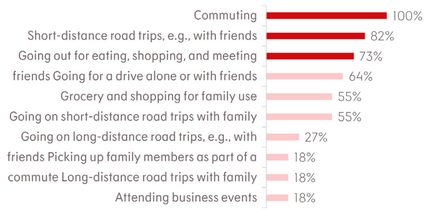


Figure 44 - Current use of the car for the Lynk & Co owner

5.5.. Why do they choose Lynk & Co

Consumers are drawn to Lynk & Co for the blend of advanced features at a good price point, young innovative brand perception, and the practicality of their vehicles. The drivers for this decision gather from the user interviews are as follows:

FEATURES AND TECHNOLOGY

- The richness in terms of features is high when compared to other vehicles in the same price range. And therefore the value for money is good.
- The connection to Volvo gives buyers confidence in the reliability and safety features of its vehicles.

BRAND PERCEPTION

- Lynk & Co is experienced positively as a premium brand, and is seen as youthful, creative and innovative.
- Customers prefer Lynk & Co, together with other Chinese brands for their modern design and value-for-money.

PRACTICALITY AND DESIGN

- The transition into having a family results in a need for more space and a safe, practical vehicle. Lynk & Co offers this at a good price point.
- The overall functionality and selection of advanced driving technology features are appreciated.

5.6. Why do they choose the competition

Consumers decide for competing brands due to their product features, the brand perception of these brands, and the product assurance they provide. The reasons for choosing these brands, as gathered from user interviews, are as follows:

PRODUCT FEATURES

- The performance and range of competitors can be a key factor to steer away from Lynk & Co, choosing for brands like
- The user-friendly interfaces of brands like Tesla and NIO are highly appreciated by users.

BRAND PERCEPTION

- Established brands like BMW and Mercedes-Benz attract for their established reputation and heritage.
- Other brands are perceived to be taking the lead in technological innovations, like Tesla or Xpeng.

PRODUCT ASSURANCE

- Assurances like NIO's lifetime warranty and services like Tesla's charging network are valued by customers.
- The maturity of the Lynk & Co company and its vehicle are concerning to some customers (e.g. Tesla over Lynk & Co).

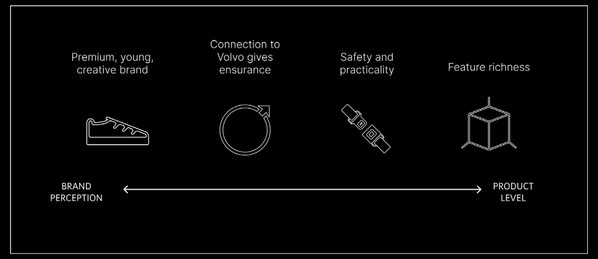


Figure 45 - Lynk & Co purchasing motivation

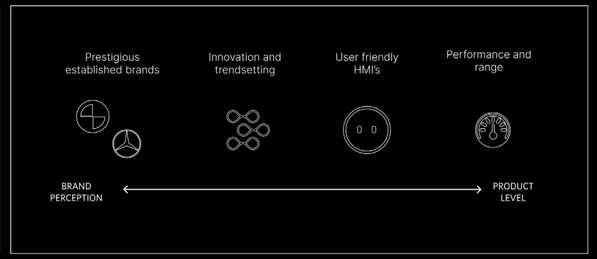


Figure 46 - Competitor purchasing motivation

5.7.. Non-driving related tasks

When talking about autonomous drivers with users, users indicate the possibility to spend time on other activities as one of the main advantages (König & Neumayr, 2017). As drivers value doing these Non-Driving Related Tasks (NDRTs) while driving autonomously, the interior and the interaction with it, should be designed according to these activities. By combining the study of Hecht et al. (2019a) and of Wilson et al. (2022), both researching desired NDRTs and their durations, the desired activities for three different driving scenarios were visualised in figure 48.

This study, together with several other studies (Large et al., 2017, Hecht et al., 2019b), showed that drivers mainly use external devices, such as phones, laptops, tablets and books to spend their time. They tend to behave like they do in their other spaces, using their digital devices for work and entertainment, and an extral display, in this case the vehicle HMI, when they want to watch a movie or play videogames. For short trips activities like smartphone use and watching the surroundings are most popular, whilst relaxing, working and sleeping are more popular for longer trips. Smartphone use, relaxation and watching the surroundings are the most popular activities, no mather the circumstances.

With a combination of both personal devices and use of the vehicles system, communication between the driver and the vehicle becomes more complex. It can not be assumed that drivers have their eyes on the HMI, and showing information there visually is not enough anymore. The importance here is to support the driver while performing these NDRTs in communicating the time budget left in automated driving mode and any relevant warnings, while interfering as little as possible with the NDRT.

Figure 48 - Choice of NDRT during a 60 minute drive and their average activity duration.

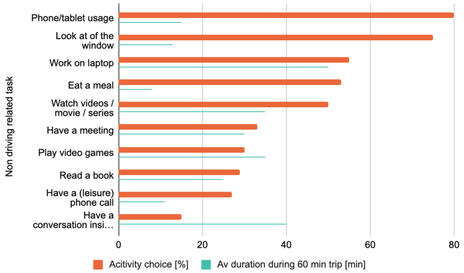


Figure 47 - Watching a movie in the Mercedes EQS, the first L3 AV allowed in Europe and the USA

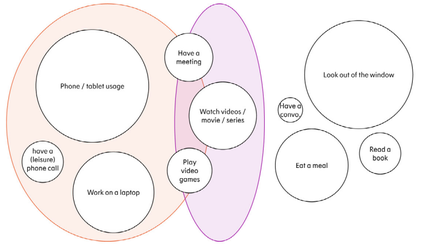


Figure 49 - Choice of NDRT during a 60 minute drive - Categorized by their medium

06. The in-car interaction

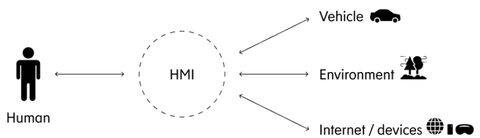
6.1. HMI definition

For this project, the focus is on the way users interact with the vehicle, environment, and other media while being on the move. The means of this communication is the human-machine interface (HMI). Despite the fact that the word HMI is currently often used to describe the visual interfaces (i.e. screens), this is a narrow view on how humans interact with their vehicles, with the environment they are driving through, and the internet. Besides visual interfaces, it includes all physical buttons, the steering wheel, all auditory feedback, and all additional haptic elements used to guide and inform the driver; pedals, vibrations, and assisted driving functions.

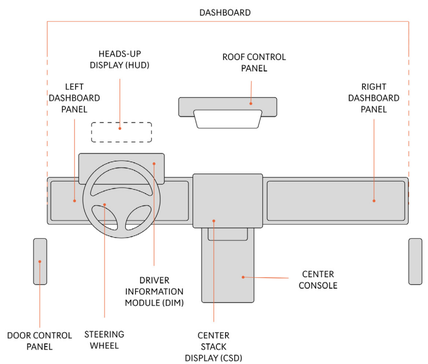
Therefore, the HMI can be seen as the window between human and machine. It gives information about the vehicle and allows the human to drive it. When using Advanced driver-assistance systems (ADAS), it gives insights into automation modes, the state of the system and the intentions of it. It serves a critical role in the functioning of the vehicle, ideally serving as an extension of the capabilities of the driver.

Besides driving functions, it also allows the user to regulate the heating, ventilation, and airconditioning (HVAC), controlling media (i.e. music), set directions, and controlling all other functions of the vehicle. It is the major touchpoint of the vehicle with the user, and therefore plays a significant role in the perception of the product, and the company behind it (Fiorentino et al., 2020).

Figure 51 shows the definitions used in this project to describe parts of the HMI, considered to be the industry-standard namings. The steering wheel, driver information module (DIM) and the centre stack display (CSD) form the main points of interaction during driving, supported by the heads-up display (HUD), projecting the most relevant information onto the windshield in the viewport of the driver, not requiring for them to look away. The centre console, dashboard panels, and door- and roof control panels provide the remaining HMI controls.



↖ *Figure 50 - The interaction between the human, vehicle, environment and the internet through the HMI*



↗ *Figure 51 - The terms and definitions in the automotive HMI*

6.2. HMI evolution

With new possibilities through new technologies and a changing context comes also new product interactions. This applies to automobiles, and especially over the last 30 years. As the HMI design of the first cars still dictates the HMI design for a big part as it is right now, it is valuable to see where the elements came from. While the standards are currently changing fast, designing for a future context is much supported by analysing the developments of the past.

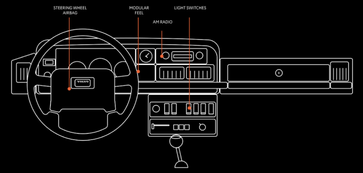
This analysis will be done through the approach of Hermans (2022). With Lynk & Co being a Swedish-Chinese joint venture, and China just entering the automotive market over the last 20 years, the analysis will be performed on the flagship models of the heart of Swedish car design of the last 50 years, Volvo cars. The selection shows the development of the brands HMI's, from the 1970's up to current day's models.

↗ *Figure 52 - Volvo 2040 dashboard (1974)*

↘ *Figure 53 - Volvo EX90 dashboard (2024)*

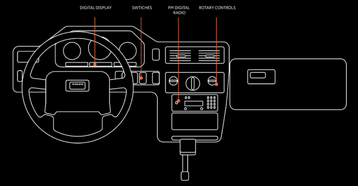
VOLVO 240 (1974-1993)

The Volvo 240 featured a basic, user-friendly HMI with manual knobs and switches for controlling functions. Volvo's (from that time) were known for their durability and safety. The model offered minimal technological advancements, but focused on improving ease of use and mechanical reliability.



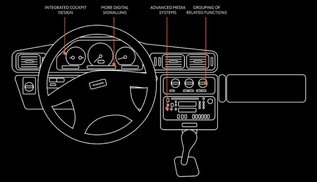
VOLVO 850 (1991-1997)

The Volvo 850 introduced several changes to the HMI, replacing many of the switches with rotaries, allowing for easier control over climate controls and radio. The indicator lights in the HMI were combined with a small digital display for climate and vehicle diagnostics.



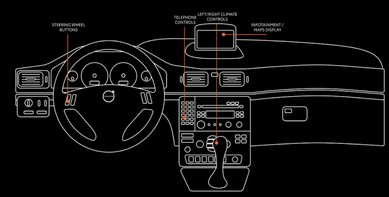
VOLVO S70/V70 (1996-2000)

The S70 (sedan) and V70 (wagon) continued to build on the 850's HMI with a more integrated approach through grouping related functions together. The generation came with better tactile feedback and improvements in the digital displays used in the dashboard.



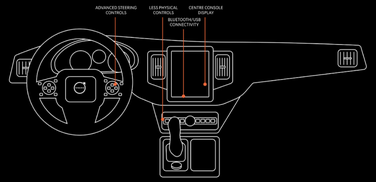
VOLVO S80 (1998-2006)

The S80 was a big step in terms of HMI interaction with the interaction of an integrated infotainment system. This system combined audio, navigation, and telephone function into a single display with a larger display. Controls became more multifunctional throughout the different version of the S80, complemented by a touchscreen in later models.



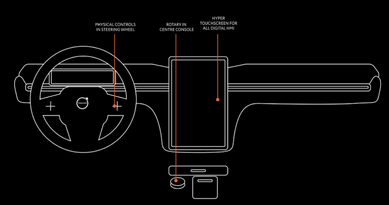
VOLVO XC90 (2002-PRESENT)

As Volvo's first SUV, the first generation XC90 laid to foundation for later HMI's with a user-friendly navigation system and an audio system with Bluetooth and USB connectivity. The second generation, introduced in 2015, centralised most vehicle functions into a large touchscreen in the center console. This system supported smartphone integration and voice controls. The model update, from 2020, improved connectivity further and introduced more ADAS functions.



VOLVO EX90 (2024)

Volvo's first fully electric SUV represents a radical shift to a fully digital HMI, focusing on connectivity and automation, partly as a result of a shifted target customer focus from Europe to China. The large central touchscreen controls basically all car's functions, leaving only a central rotary button and steering wheel buttons as conventional ways of interaction. It integrated features like automatic user recognition, adjusting settings based on each driver's preferences and habits.



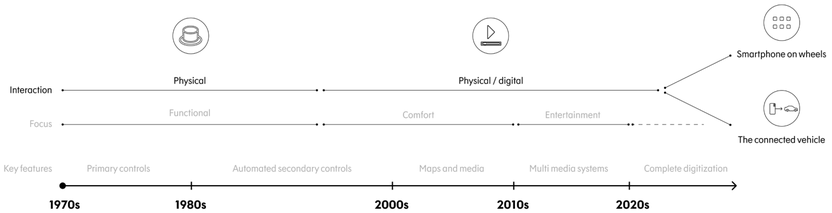


Figure 54 - HMI interaction and technology timeline

By analysing the changes in the in-car interaction of Volvo cars, there are clear transitions visible throughout the past 50 years, as a result of an interplay between the changing context and the changing automotive industry. These transitions are visualised in figure 54, building further upon the work of Hermans (2022).

Looking at the later 1900's, the interaction with the dashboard slowly moved from purely functional to a more comfortable experience. Car functions such as lights and climate settings were automated where possible, and controls were redesigned with the user in mind.

As a result of improved safety and comfort, it became apparent that the car could be more than just a tool to move from A to B. Cassette players, radios, CD players, and complete physical interfaces to make phone calls were integrated in the HMI's of the late 90s.

In the early 00's, navigation devices were introduced into cars, marking the peak of the era of physical controls in HMI's. The dashboard of these was typically designed with separate clusters for different vehicle systems such as climate control, navigation, audio, and driving functions. Each of the functions was controlled through its own set of physical buttons.

The 2010's marked the end of the physical interaction era. The introduction of touchscreens resulted in more flexibility through Over-The-Air (OTA) updates, lower cost of manufacturing, and new expectations in terms of design.

The 2020s are characterised by the final steps of the complete digitization of HMI's, but also by the major influence of the Chinese market. The growing middle class in China resulted in nearly every OEM putting their bet on the Chinese customer, with their own requirements and preferences. This new target market put an emphasis on digital media and connectivity, and showing technological features instead of integrated them - contrary to the movement of the 40 years before it.

Figure 55 - Benchmarking current HMI layouts and technology for Europese, Chinese and US market

To analyse the current landscape of HMI design, the dashboards of vehicles released after 2021 were analysed in terms of their layout, functions, and use of digital and physical elements for input and output. In figure 55, the digital elements are marked in blue, and the physical elements in purple, with the vehicles categorised based on the origin of the OEM (from left to right; Europe, China, US).

Whereas the use of technologies to control functions and display signals changed over the past 50 years, it will shift over the next years as well. Figure 56 lists the current standard use of in- and output technologies, together with the expected standard in the year 2035, based on current trends.

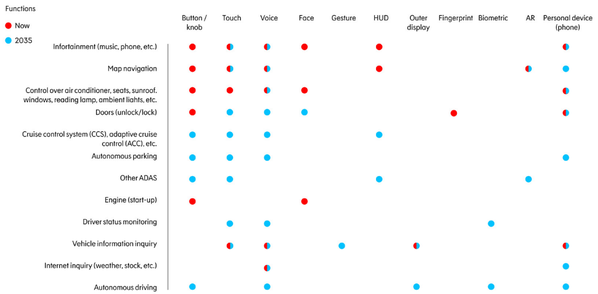
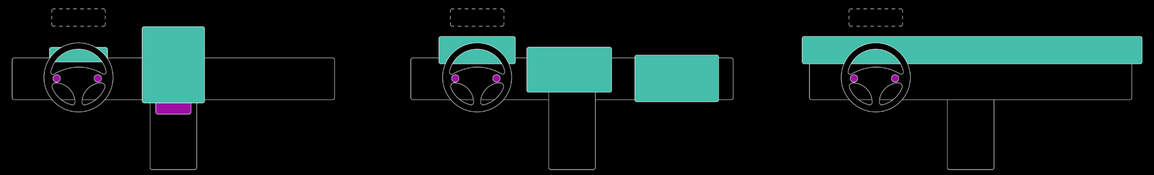


Figure 56 - Input- and output media for for different functions - Current versus projection for 2035

6.3. HMI Layouts

Technological innovations have led to a paradigm shift in in-car interfaces, creating a new domain of possibilities within the domain of HMI design. The shift from a clustered physical interface to a complete digital interface with (almost) all functionalities integrated in a single system is clear. However, the are signs of the preference of physical interaction for many users. When analysing the vehicles that were released after 2021, three types of HMI layouts can be found.

↙ *Figure 57 - HMI layout categorisation*



THE CENTRE DEVICE

This layout uses a central touchscreen to control most of the car's functionalities, located at the CSD. It is a 'minimal' approach, in the sense that the dashboard is disposed of all necessary elements except for a single tablet to communicate with the vehicle, sometimes combined with some physical controls next to it and on the steering wheel. Tesla can be considered a pioneer for this layout, influencing manufacturers like BYD and NIO in adopting similar central touchscreen interfaces, and finally becoming the current most used layout.

MORE SCREENS THE BETTER

This layout introduced even more screens, on the passenger side and in some vehicles also in the back of the vehicle. In the last 10 years, the use of more touchscreens was introduced by Chinese OEM's, as a result of a focus on in-car entertainment. Currently it can be found in models from brands like Geely, Xpeng, and also BMW.

HYPERSCREENS

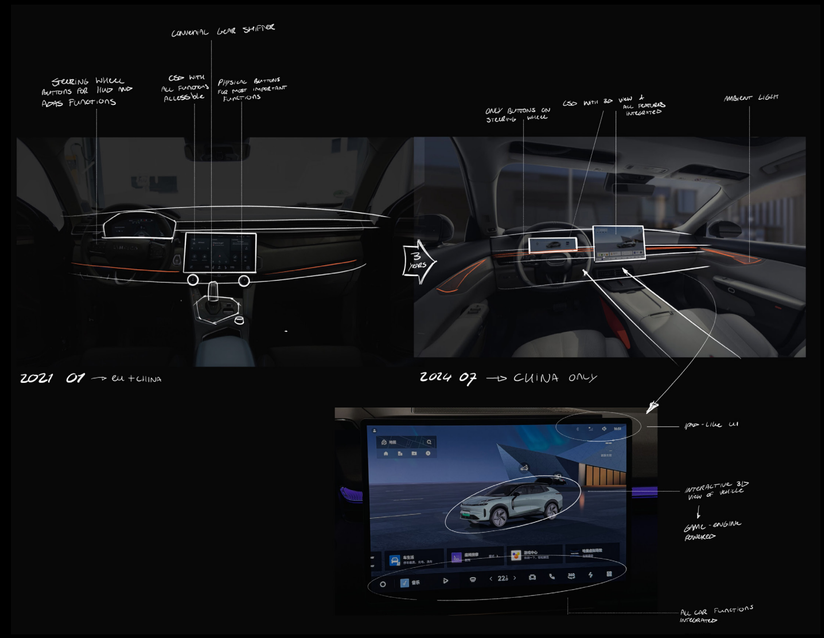
The hyperscreen layout represents the integration of multiple displays, or a large display, under a single piece of glass, aiming for a more integrated and 'futuristic' experience. Mercedes-Benz's EQS was one of the first models in Europe featuring this layout , mergin the instrument clusters, CSD and passenger display into a continuous display. The layout is used by several Chinese OEM's such as Li Xiang and Ji Yue.

6.4. The Lynk & Co HMI

The overal layout of the HMI of Lynk & Co vehicles is designed in a conventional way, in order to preserve familiarity of use. The design of what happens on the interfaces within this layout is relatively unique. Though interacting with 3D representations of the vehicle settings are changed, and with using car functions or changing settings, the 3D vehicles changes with what is happening in the physical world. Bold colors and game-like environments give the UI a unique feel, in particular when comparing it with the functional approach of digital design in HMI's in the last 20 years.

Simple lines within the interior, without any complex shapes, create a modern interior design, with the screens and steering wheel (and the few physical buttons) being the only points of interaction. In this way, an open space is created with the drivers focus on the road and the digital elements displayed on the interfaces.

↖ *Figure 58 - Lynk & Co 08 dashboard, as seen from the passengers side*



↗ *Figure 59 - Visual analysis of the Lynk & Co HMI DNA*

6.5. Latest developments in automotive HMI

Within the display-focused era that is currently taking place, Chinese automotive brands are leading the way (Jesse, 2024). They envision new ways to make their vehicles stand out and make their customers interact with them in new ways. In this subchapter, recent trends in interface technology are listed to evaluate the current HMI landscape.

NAVIGATION

Navigation systems are elevated through features like augmented reality (AR) directions and machine learning for recommendations based on driving habits over time. HUAWEI XHUD for example (figure 60), enabling AR navigation overlays projected onto the windshield, making route guidance as easy as following the cues in the line of sight.

Figure 60 - HUAWEI XHUD in the Rising Auto R7

VOICE ASSISTANTS USING AI

Voice control systems aim to give a more natural, human-like experience when interacting with the HMI. Developments in conversational AI make these rapidly more usable and relevant. Nio's NOMI is a voice assistant that includes a physical representation on top of the dashboard (figure 61).

Figure 61 - NOMI in the NIO EC6

3D

As HMI hardware gets more powerful, the possibilities increase as well. 3D rendering is one of those possibilities, visualising digital representations of vehicles and environments for a more interactive HMI experience. An example is the XPeng G9, where the signal from the ADAS sensors around the car are used to give an 3D representation of the traffic situation (figure 62).

Figure 62 - XPeng G9 3D mapping

PASSENGER COMFORT/ENTERTAINMENT

Whereas the backseat is considered the second row in Europe, Chinese manufacturers are elevating the passenger row into the place of choice. A fitting example is the Li Auto L9, featuring a large second-row entertainment display, tray tables, leg supports, and drink coolers/heaters, making the car feel like first class air travel.

Figure 63 - Li Auto L9 interior

SMARTPHONE ON WHEELS

Akio Toyoda's dream of a smartphone on wheels (Kageyama, 2011) has become reality, with HMI being complete standalone, connected devices. An example is the BYD Atto 3 (figure 64), but basically every single car being currently released could have been taken as one.

Figure 64 - BYD Atto 3 interface

NEXT GENERATION AIRPLAY

The next-generation Apple Carplay integrates all of the displays of a given vehicle, and not just the CSD. Running on a connected Iphone, Carplay is an extension of the experience one gets on their Iphone, and through Carplay OS this would be extended to all interfaces in the HMI (figure 65).

Figure 65 - Apple CarPlay OS

EXTERIOR LIGHTING

Exterior lighting is taken beyond the function of visibility and signalling. The HiPhi X for example, features a matrix of headlights that can display animation onto the road for the driver and other road users (figure 66). HiPhi imagines external lights as a way to communicate - a vision that can also be seen in other OEM's vehicles. Using displays, such as on the Zeekr X, is another way to communicate from the outside.

Figure 66 - Zeekr X external battery charging display

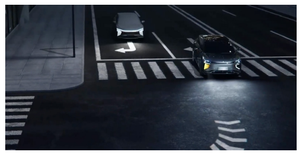


Figure 67 - HiPhi X exterior lighting

PILLAR-TO-PILLAR SCREENS

As already mentioned, full-width displays stand out as a design element, and can be considered a trend. Models like the Geely Galaxy E8 and the Jiyue 01 (figure 68) approach the interface interaction in a new way through these uninterrupted displays.

Figure 68 - Jiyue 01 pillar-to-pillar screen

07. Related areas of interest

7.1. Flow state

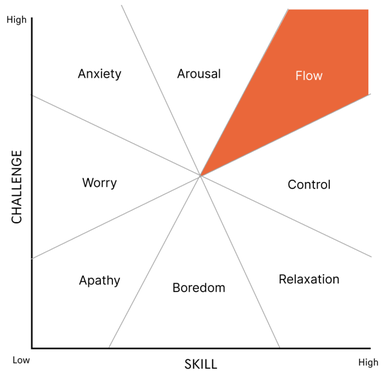
The concept of flow, often described as being 'in the zone', is a mental state in which a person is fully immersed in an activity, feeling full focus and enjoyment in doing it. The Hungarian-American Psychologist Mihaly Csikszentmihalyi was intrigued by the single-minder unique focus of painters at work, having the persistence to work despite getting tired or getting hungry. However, these artists showed little interest int he completed work once finished, as their satisfaction came from the process of doing it rather than the final result (Csikszentmihalyi, 1975).

He found out that this 'flow state' was created when people tackled challenges that they perceived to be at just the right level of difficulty for their skill sets; Just hard enough to hold interest and push one's abilities, but no so difficult to cause stress or anxiety.

As shown in figure 69, flow is experienced when high challenge meets skill. Those with a higher skill level on a specific task are more likely to experience flow than those who do not.

In the context of driving a car, a flow state can also occur. A driver can experience flow through the sense of control over the vehicle and the driving environment. Driving a long trip, being in control, while not being overwhelmed by the complexity of driving and traffic, can give a feeling of focus and rest, and with that satisfaction.

↘ *Figure 69 - Flow is experienced when high challenge meets skill*



↖ *Figure 70 - Flow state experienced during dancing and catching a wave while surfing*

7.2. Contextual design

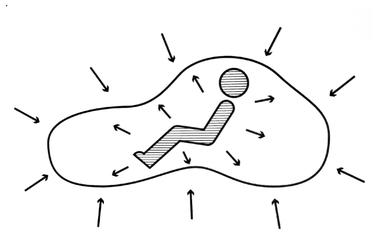
Beyer and Holtzblatt's (1999) contextual design theory emphasises the importance of understanding the environment and context in which a product will be used. The theory states that object never exist without a relation to their context, and therefore they should be designed with the context in mind. Within automotive design, it challenges the traditional view of cars as isolated objects, rather designing for the broader mobility ecosystem.

The belief of the passenger car as the epitome of freedom fueled this within automotive design. As consumers and policymakers believed in the car as the future of mobility, it allowed OEMs to design their vehicles as standalone objects, limitedly considering the context they were designing for. This belief in a one-and-only possible future leads to infrastructures that are likely to be obsolete or even limiting in a new mobility paradigm (Vermeersch & Haspeslagh, 2024).

Therefore, designing mobility needs a more contextual approach, also taking into account the (future) surroundings. Mobility should be the result of the synthesis between the user desired and the contextual needs (figure 71). By considering the user, the mobility means and the societal context, new, sense-making opportunities and new ideas can be found.

The current 'mobility realm', the one defined by the private car, led to the design of our cities, and currently leading to the question if the result of it is desired. Simultaneously, the impact on the larger environment becomes visible, in which merely optimising the energy needed to move a person is not enough to reverse the effects. Electrification and incremental improvements are simply not enough to achieve truly sustainable mobility (Smil, 2020).

A mobility context with means tailored to specific contexts and user needs could be a more purposeful way of designing mobility. Vermeersch & Haspeslagh (2024) envision "Slower urban areas where "mobile things" enhance the freedom of movement of less-mobile people, larger urban areas with 30 km/h speed limits where electric bikes merge with new types of micro EVs, air-scapes populated by small drones for cargo delivery and virtual realms where the contraction of time and space is absolute and speeds are infinite".



↖ *Figure 71 - Mobility should create a balance between contextual needs and user desires*

↖ *Figure 72 - Impression of a mobility realm with a specific means for user desires and contextual needs.*

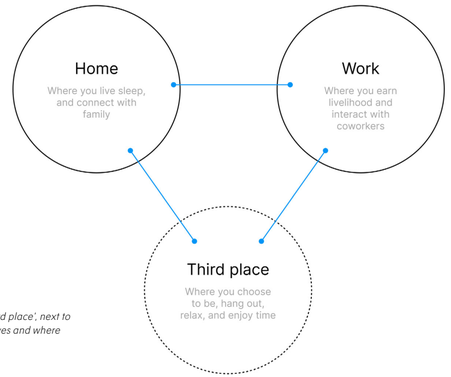
7.3. The third place

The Third Place is a term introduced by Ray Oldenburg in 1980 in his book 'The great good place' (1989). In our fast-paced and digitally driven world, the concept gained popularity as people seek ways to escape the pressure of a home and work life. Oldenburg emphasises the importance of a third primary space, next to the home and the office, or work space. He calls this place The Third Place.

The Third place is neither the home or the office. It can be all the other places. These places are the ones that people choose to be. They can gather in these places, or simply hang out there for the pleasure of good company and conversation. According to Oldernburg, "they are the heart of a community's social vitialy and the grassroots of democracy. In that Third Place, you can see the first and second place, while you are not actually in them. Therefore you can observe both place and take a moment to reflect on both.

Oldenburg identifies the following main characteristics of the Third Place;

- **Neutral ground** - In a third place people can easily join in or disengage from the conversation.
- **Leveler** - All people, regardless of class and status, are welcome and intermingle.
- **Engaging Conversation** - Talk is the main activity and provides the greatest value. The rules are simple: Don't dominate the conversation, be sensitive to others' feelings, speak on topics of general interest, and avoid trying to instruct.
- **Accessibility and accommodation** - People can wander in almost any time of day or night.
- **Regulars** - The people who frequent the place give it character, set the tone, and welcome both old timers and newcomers.
- **Low profile** - The decor is plain and unimpressive, discouraging pretension and self-consciousness.
- **Playful mood** - Displays of wit are encouraged. The congenial environment makes it feel like a home away from home.



↗ *Figure 73 - 'The third place', next to the place where one lives and where one lives*

The meaning of the car has been- and is changing rapidly over the years. Whereas it was just a way to get from one point to another, it increasingly becomes an extra place to reside in; A Third Place. When talking about a "place to reside in" in the automotive context, one might think about one of the several living room inspired concepts from automotive manufacturers presented over the years, such as the 2017 SYMBIOZ concept from Renault (figure 74). In this (and similar) concept(s), the boundaries between vehicle and living space are aimed to be blurred, by designing a living room inspired interior design. These concepts aim to give a peek into a future of complete autonomous mobility.

However, the car as a Third Place is already present in current times. With digital media having arrived in every aspect of our lives, the moments in between our destinations became the moment to wind off. The original place to lounge, inside our first space, home, has moved to the spaces we move in, our third place.

An example, familiar to many from gen x and before, is the activity of sitting in a lounge chair, listening to a vinyl album from start to finish, playing from the sound system in their living rooms (figure 75). While this practice seems to have disappeared completely from our daily lives, driving the car comes closest to it.

According to Samuel Wijk (2023), this change was catalysed by the shift from ICE to EV, especially in Chinese urban environments. Where one had to run the engine to have air conditioning cooling down the air in the vehicle, this is not needed anymore with EV's. This resulted in users having a coffee before driving, doing lunch breaks in vehicles, and consuming media before leaving the vehicle after work.

↖ *Figure 74 - Renault's SYMBIOZ concept*

↗ *Figure 75 - Audiophile vinyl listerning setup in living room*

7.4. Mode awareness

When designing for partially autonomous vehicles the different driving modes lead to several challenges in the interaction with the vehicle, including the awareness of the mode the vehicle is in; Who is responsible for the driving tasks, and how is this communicated with the driver? The definition of mode awareness, formulated by The Society of Automotive Engineers (2016) sounds: "The user's comprehension of the current operating mode of the driving automation system and its ability to transition to another mode, as well as understanding of the subtasks (or actions) that they as the driver are required to perform (if any) versus those the driving automation system is performing". The key difference between the driving modes is the required readiness and attention of the driver; In SAE level 2, the driver is responsible for driving and should be ready to act at all times, whereas in level 3 and 4, the vehicle is responsible and in control.

When the vehicle behaves differently to what the user is expecting from it, it could lead to mode confusion. With multiple levels of automation, the driver has to remember which tasks are taken care of by the vehicle and which are not. Confusion about these responsibilities can lead to critical driving situations, and should be prevented at all times. Therefore, for each mode, the vehicle (i.e. vehicle HMI) has to communicate clearly and appropriately, generating a high level of mode awareness to the driver (Feldhütter et al., 2018).

Carsten and Martens (2018) defined four factors that support providing trust to the driver;

- **Observability**- the HMI should help the human to understand what the vehicle senses and perceives when a system cannot cope with a situation, e.g. that it is not receiving required information on presence of road markings.
- **Predictability** - the HMI should allow the human to predict, when confronted with a situation, whether or not the system can cope
- **Directability** - the HMI should have the ability to influence the user and be influenced by the user to come to the best joint performance
- **Timeliness** - the information should be provided early enough so that the human can take proper action.

Currently there is no standard yet for communicating these modes, and therefore each OEM is responsible for the mode awareness of its users (figure 76). This is currently often done through icons in the HUD and DIM, 3D representations of the environment with colour coded modes, and light inside of the interior. However, when using another car than one's personal vehicle, or using a shared (Lynk & Co) vehicle, this results in high chances of mode confusion.

Figure 76 - Each OEM uses its own combination of visual and auditory elemtns to communicate driver modes, resulting in possible mode confusion when driving in new or other car.

DRIVER ATTENTION

Even during AD, it can be said that higher driver attention leads to a higher level of safety. However, hands-off driving is often perceived as implying that there is no need to monitor; hands-off leads to eyes-off (Carsten & Martens, 2018). This is especially due to the fact that humans are good at performing a task in focus, but lack the ability to remain partly focused on a non-stimulating subject. Bainbridge (1983) wrote about this topic;

"We know from many 'vigilance' studies ... that it is impossible for even a highly motivated human being to maintain effective visual attention towards a source of information on which very little happens, for more than about half an hour. This means that it is humanly impossible to carry out the basic function of monitoring for unlikely abnormalities, which, therefore, has to be done by an automatic alarm system connected to sound signals.

A more serious irony is that the automatic control system has been put in because it can do the job better than the operator, but yet the operator is being asked to monitor that it is working effectively."

The conclusion that can be drawn here is that either the driver has to be in full control to keep them in focus, make them monitor the driving task but stimulate their attention constantly (e.g. through light, sound and haptics), or take them out of the loop completely.

AD PLANNING

Hecht et al. (2020b) showed that planning of automation modes will be important for driving comfort in the near future of a partly automated driving scenario. Preparing the driver for the automation modes to come, and allowing them to make decisions based on drive duration, and automated- or uninterrupted automated driving time, result in increased mode awareness and trust in the vehicle (figure 77).

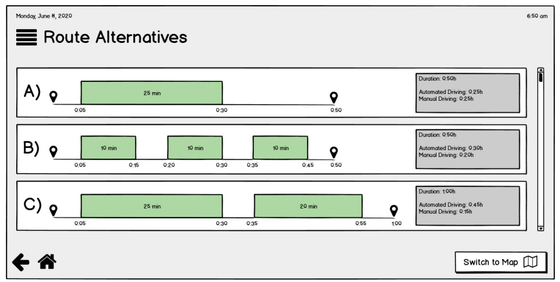


Figure 77 - Route choicemaking based on automation mode planning and user preference

PHASE B

Future framing

In this chapter, the focus is shifted from Lynk & Co and automotive interiors to a broader context, centering around the urban landscape of Lynk & Co's target markets. This part of the report dives into understanding the contextual factors that shape it, and the process of gathering them. Fourteen drivers are distilled from clustering the factors, representing the underlying themes in the domain. These are translated into a framework which holds all these forces and factors, allowing for developing future-proof concepts and positioning interactions. The aim of this phase is to understand the context of the society Lynk & Co will operate in, and design for tomorrow instead of for today/the past.

MAIN TAKEAWAYS

Final statement

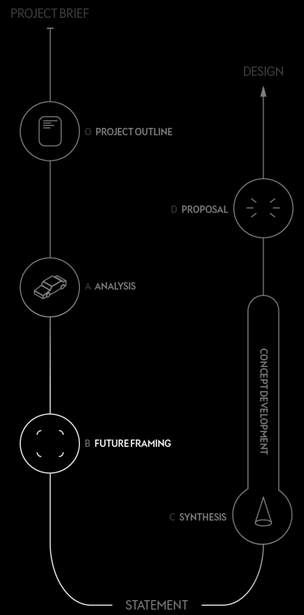
Lynk & Co and I want people to escape from and relativise modern day's hectics through a private bubble where they can disconnect, recharge, and experience the environment they are moving through.

Leisure sailing

The analogy of leisure sailing shows how a sensory experience can result in a mental flow for its passengers.

Product qualities

- Sensory enhanced flow
- Adaptable plannable
- Transparent - Open



↗ *Figure 78 - One of the six future states of automobiling; Re-engaging with the physical world*

08. The future context

After gaining understanding of the current interaction and underlying user needs, and brand-specific factors, context factors are collected to gain understanding of the future context. The early research is used to select the factors that are influential for that future, and those that are not. This chapter will describe how the factors were collected that form the foundation of the rest of the project.

8.1. Context factors

In order to create a possible future context, a set of 'context factors' was made. These concise statements serve as the building blocks of this prediction, and are the pieces of information that are most influential on the behaviour of people in the new context. Through these factors a research-based outcome can be created, as the factors are supported by sources and are aimed to give a complete overview of the set domain.

The 'types' of factors we look for within this domain, as defined by Hekkert and van Dijk (2011), are:

- **Developments**
  Phenomena that will change over time.
- **Trends**
  Changes in the behaviour, values or preferences of people or groups.
- **Principles**
  Factors that do not change over time.

In order to collect a complete set of influences, the aim is to collect factors throughout the categories Technological, Socio-cultural, Economical, Political, Environmental, Psychological, and Demographic. These categories force us to consider a broad set of influencing aspects, but do not have to be represented equally.

Example of a socio-cultural trend:
Consuming content from influencers is daily business for the majority: 87% uses Douyin (TikTok) each month. (Thomala, 2024)

Example of a psychological principle:
The ability to focus leads to increased satisfaction, happiness, and productivity. (Bellet et al., 2019)

The domain echoes the research question of this thesis, and therefore sounds:

DOMAIN

Moving and being in a 2035 Chinese urban environment, through personal transportation.

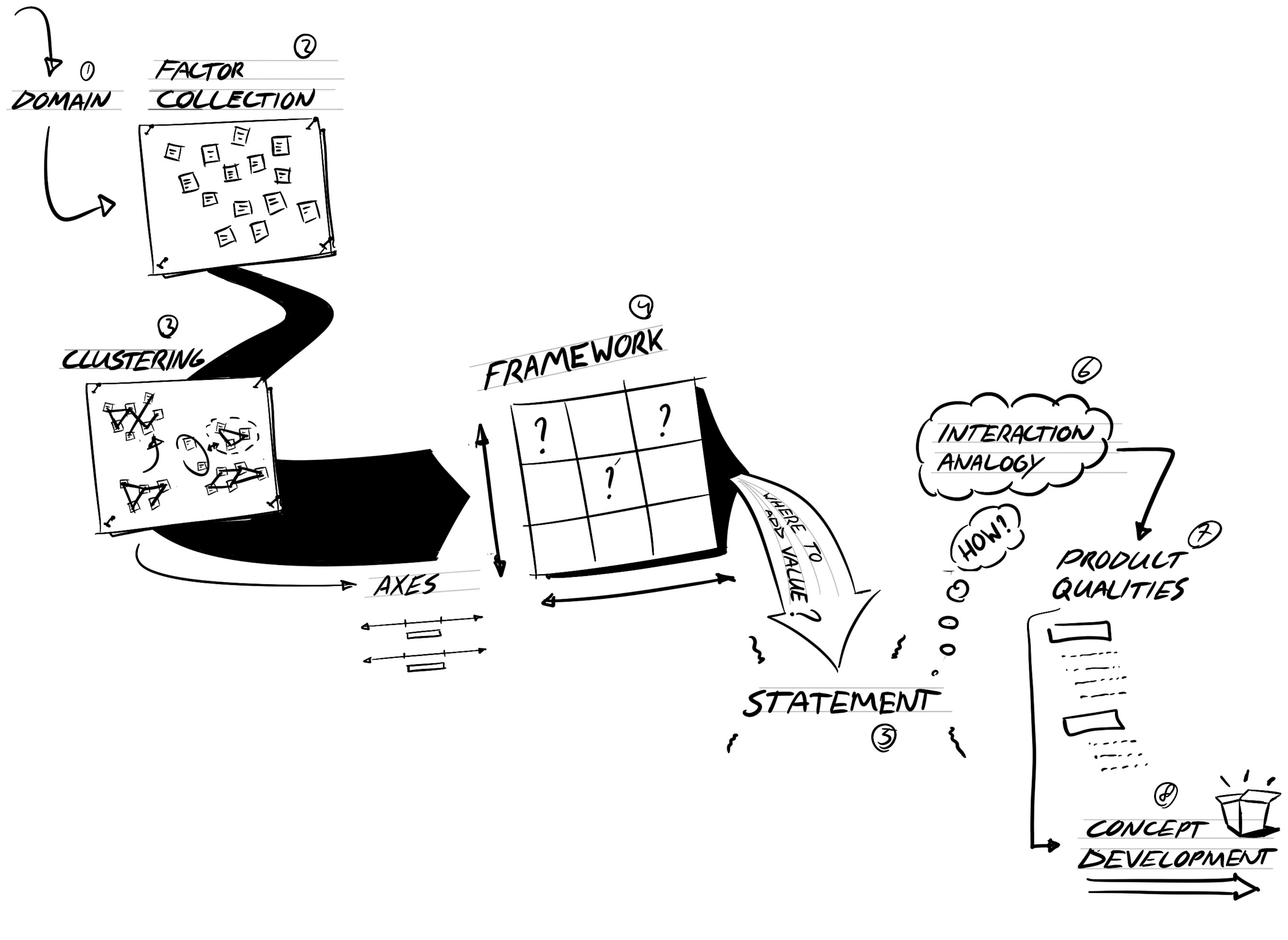


Figure 79 - Future framing process

During collection of the context factors, it is essential to consider not only the domain one is analysing, but also who you are designing for within that domain. In the case of the split identity of Lynk & Co, with each its own mix of customers, it is complex to specify this.

While choosing one target group over the other is hard, it can be stated that the market or target group that is the largest makes the most sense to consider for an approach like ViP (M. van Dijk, personal communication, 2024). This is also the way products are currently designed at Lynk & Co. Focusing on the millennials and gen Z'ers might result in less tailoring towards older generations, but many considerations also apply to them.

Besides this, in a fast-changing world, it is more relevant to prioritise a target group that will grow in the future, in this case the younger generation living in a Chinese urban environment.

The complete list of context factors can be found in appendix A.

Figure 80 - Snapshot of part of the list with context factors in appendix A

Name	Tag	Type	Cluster	Source
People become more aware about their personal 'brand' and what effect it has on their lives.	Psychological	Development	Excellence is in your own hands	(McLaughlin, 2023)
Authenticity becomes more rare and valuable, as all things converge due to digital availability of things.	Socio-cultural	Development	Excellence is in your own hands	(YANG DESIGN, 2023)
People want to belong to a social group, and consume according the that group.	Socio-cultural	Principle	Hunting common ground	(Pardede & Kovač, 2023)
Hobbies, instead of work, become the main identity driver for people, to feel part of something.	Socio-cultural	Trend	Hunting common ground	(Trinetti, 2021)
The competition for attention increases further. Focus becomes a luxury.	Socio-cultural	Development	Never not entertained	(Lorenz-Spreen et al., 2019)
Roads and cities are getting more congested. City centers become car-free and traffic jams worsen.	Demographic	Development	Louder denser busier	(García-López et al., 2021)
The development of the individual is the most important thing for gen Z and younger. Relationships are increasingly about supporting each other and personal development.	Socio-cultural	Trend	Excellence is in your own hands	(McLaughlin, 2023)
Our body is releasing rewarding hormones when talking about ourselves (online).	Psychological	Principle	Excellence is in your own hands	(Robbins, 2024)
As possibilities grow through increased wealth and connectivity, time becomes more valuable.	Socio-cultural	Development	Excellence is in your own hands	(China Britain Business Counsil, 2021)
People do not like to be told how to behave, but want to feel like being in charge instead.	Psychological	Principle	Excellence is in your own hands	(Fromm, 2023)
Gen Z and younger values experiences over products.	Psychological	Trend	Excellence is in your own hands	(Fromm, 2023)
Hypertasking slowly becomes the common way of working, as Gen Z and younger are contantly exposed to several triggers at once.	Socio-cultural	Trend	Excellence is in your own hands	(Çoklar & Tatlı, 2021)
Global trends vs local cultural expressions drives individuals to find innovative ways to showcase their cultural identities online.	Psychological	Trend	Hyper-expressive (digital) personalities	(VSR, 2024)
The rise of micro-communities and platforms catering to specific interests could allow for deeper, more specific expressions of identity.	Psychological	Trend	Hyper-expressive (digital) personalities	(VSR, 2024)
AI-generated content and virtual influencers could challenge human users to differentiate and show their uniqueness.	Psychological	Trend	Hyper-expressive (digital) personalities	(Hackl, 2023)
Growing privacy concerns may lead users to seek new ways of expressing themselves anonymously or through pseudonyms, giving them more possibilities in terms of expression.	Psychological	Trend	Hyper-expressive (digital) personalities	(Schimmelpenninck, 2023)
Advancements in AR offer new ways for users to craft and showcase their digital personalities in more immersive and customisable environments.	Technological	Trend	Hyper-expressive (digital) personalities	(Hackl, 2023)
Users are more likely to encounter content that reinforces their views, leading to echo chambers that could intensify the need for distinct personal expression.	Psychological	Development	Hyper-expressive (digital) personalities	(Schimmelpenninck, 2023)
Gen Z and younger are more conscious of their purchases (and of themselves), therefore brand values have to fit their personal brand seamlessly.	Socio-cultural	Trend	Hyper-expressive (digital) personalities	(B. Bos, personal communication, January 2024)
Trends are coming and leaving faster then ever. Jumping on a trends involves a high risk of it having passed by before you know it.	Socio-cultural	Trend	Hyper-expressive (digital) personalities	(B. Bos, personal communication, January 2024)
Social media and our digital tools give us the ability to creative a personal 'brand' / image that does not necessarily match the real world	Socio-cultural	Development	Hyper-expressive (digital) personalities	(Schimmelpenninck, 2023)
In the days we can't travel far, nature becomes a more common way to seek an escape.	Socio-cultural	Development	Poetry Near Home	(China Britain Business Counsil, 2021)
Big events and digital saturation makes people need to let go of tension and focus on the moment - Enjoy the things close to home.	Psychological	Development	Poetry Near Home	(YANG DESIGN, 2023)

8.2. User interviews

The context factors are the foundation for the framework and its outcomes, and therefore choosing the right resources is essential for relevant results. As the focus of this research is on a future Chinese urban environment, it is valuable to get information from the people being part of this context.

The user interviews mentioned in the analysis phase were used to gather context factors, in combination with the expert interviews mentioned in the project outline phase. Each of these interviews contained a moment of asking them to think outside of the automotive context, to ask what factors will change, and what factors will not, in their personal case. In this way, a varied set of context factors was gathered to create possible futures.

8.3. Literature

in addition to the interviews, other (literature) resources were used in order to collect a complete overview of the driving factors, preventing a bias through users and the selection of experts spoken throughout this project as much as possible. This process was very dynamic. During an interview a topic came up, which led to reading articles and academic work online, which led to other material, and so on. Some key works are listed in table 4. The individual sources per context factor can be found in appendix A.

8.4. Workshop

During the first weeks of the project, a workshop was organised in the Gothenburg office to gather insight for the ViP process, collect different angles on the topic from professionals, and involve colleagues in an early phase in the project. The goal was to make them step out of their daily projects and work, and come up with new perspectives while doing it.

The workshop setup consisted of a poster with a blank Lynk & Co interior, meaning only a dashboard, without any interactive elements on it, stickers with types of inputs and output, and post-its and pens.

The workshop started with dividing the group of participants into teams, and asking them what complete familiarity means in current day HMI design. After they defined this, the teams were asked to change their layout based on three different design goals. These activities were close to their daily work, and were aimed to get them involved in the workshop and used by their team.

After a short break, the teams were asked to take a step back from their daily work, and brainstorm on what factors will change over the coming 8 years, such as lifestyle changes, new technologies, politics, mobility, etcetera. These factors were taken to the final activity of the workshop, in which the team had to take the future factors, and come up with concepts based on them.

WORKSHOP STRUCTURE

- Introduction (10 minutes)
- [1] Defining familiarity (15 minutes)
- Fika break
- [2] Rethinking interactions (15 minutes)
  - Improved joy of driving.
  - Improved social interaction within the car.
  - Increased interaction with the external environment.
- [3] Envisioning 2035 (15 minutes)
- [4] Future-focused concepts (15 minutes)
- Wrap-up and sharing the best concept with the other teams

Insights from the future-focused part of the workshop were used during the collection of context factors for the ViP process, and the ideas were taken towards ideation later in the project.

#	Title	Author	Type	Topic
1	"Driving toward Modernity: Cars and the Lives of the Middle Classin Contemporary China"	Jun Zhang	Book	China becoming the biggest auto market in the world in the 21st century through a rising middle class.
2	Investigating User Needs for Non-Driving-Related Activities During Automated Driving	Bastian Pfleging et al.	Academic	Which non driving activities drivers want to perform while driving highly or fully automated.
3	"Take over!" How long does it take to get the driver back into the loop?	Christian Gold et al.	Academic	At which point in time a driver's attention must be directed back to the driving task in semi-AD.
4	mobility	society - Society Seen through the Lens of Mobilities	Matthijs van Dijk & Lowie Vermeersch et al.	Book	Examining society through various mobility lenses.
5	How can humans understand their automated cars? HMI principles, problems and solutions	Carsten, O., & Martens, M.	Academic	HMI interaction in the context of automated driving.

Table 4 - Key literature used during context factor collection

Figure 82 - Workshop impression

Figure 81 - Workshop setup

09. Framework and the six states of movement

In this chapter the main drivers shaping the future context of individual mobility in urban environments are discussed. These drivers give a notion of the future context, while not claiming to predict it in an absolute manner. Only the 14 drivers are presented; For further explanation of the drivers and the related context factors see appendix A.

9.1. Clustering factors

Through affinity diagramming (Lucero, 2015), meaning organising related information into distinct clusters, the 170 factors were translated into 14 clusters. These clusters illustrate the main drivers of the new context; What drives people in how they act in the new context? Some support each other, some contradict each other, as a context is never completely homogenous. The order of the clusters presented is at random.

The domain echoes the research question of this thesis, and therefore sounds:

Moving and being in a 2035 Chinese urban environment, through personal transportation.

Hunting common ground	Limited physical connection and an insecure future makes a feeling of belonging more important than ever.
Escaping the rush for mental well-being	With digital devices demanding our constant attention, adding up to increasing social- and economic pressure, caring for our mental health can not be ignored anymore. A break from this is necessary, but comes at a premium.
Middle class is the new normal	As the majority enters the middle class, from under 20% to over 50%, what was luxury before becomes the new standard, and a major second generation middle class is arising. Showing wealth is not enough to stand out anymore.
Louder, denser, busier	Urban space reaches its limits in terms of space, sound and infrastructure. Daily life is pushed out of the house and the way we move is transforming; the car is not always the most efficient option anymore.
Excellence is in your own hands	Constant use of social media leads to comparing ourselves to a carefully moderated version of others. Everything seems to be possible, and therefore excelling is perceived to be completely in our own hands.
Flexibility is freedom	Staying flexible in our living and working environment creates a feeling of freedom, especially when external pressure builds up. A feeling of autonomy, and with that a feeling of freedom, is the result.
Data is gold	Personal data privacy becomes a threat for every individual. As data is the new driving force behind economic growth, companies will perform (and be judged) on their way of using this data.
Craving physical connection	The world is fast and carefully curated, and the anxiety it creates is starting to be recognized. Who wants to live in a digital dystopia?
Hyper-expressive (digital) personalities	Blended trends and cultures make it more important than ever to express your unique self, and find others you resonate with. In the oversaturated digital world, expressiveness pays off.
Trusting black boxes, and the people behind them	We trust, or we do not trust. There is no inbetween. An infinite trust in black box systems, and the people behind them.
Never not entertained	Convenience addiction and instant gratification are not part of a trend; they are there to stay. What captures attention is generally known, and brands are empowered through it.
The fight for tomorrow	As climate concerns intensify, action is demanded from both companies and individuals. Those who contribute are valued, and with that idealism will be monetized.
Poetry Near Home	Staying close to home during the pandemic taught us that enhancing our close environment might result in more value than searching for it elsewhere. Nearby nature is praised and micro-adventures close to home are bringing joy to everyday life.
Time spent productive is time well spent	In society, the focus on constant optimization and measuring productivity increases, leading to both a pressure to use every second productively, and a sense of meaninglessness due to the cost of it.

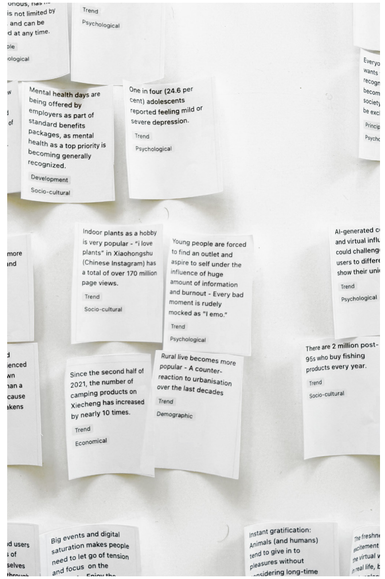


Figure 83 - Clustering of context factors

9.2. Cluster relations and the framework

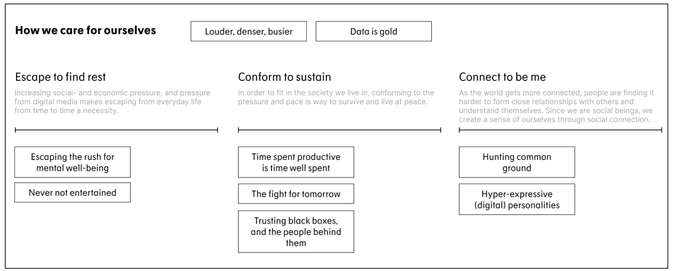
In order to gain understanding of what the main driving forces are that drive the future context, the 13 clusters are analysed and looked at from a distance. While some support each other and show an underlying relation, others contradict and show underlying conflicts. Figure 84 shows an overview of the relations and conflicts between the clusters. In order to create a framework from these relations, the relations were mapped out on a grid, in order to find a combination of dimensions that could fit all clusters.

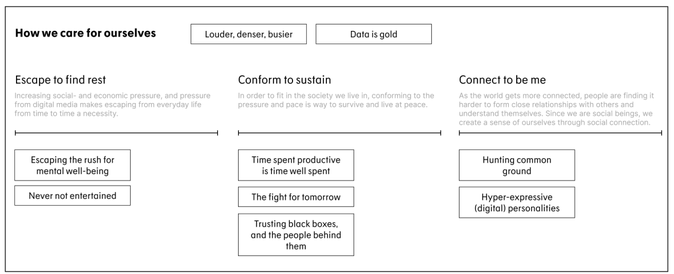
9.2.1. DIMENSION 1: ATTITUDE TOWARDS THE ENVIRONMENT

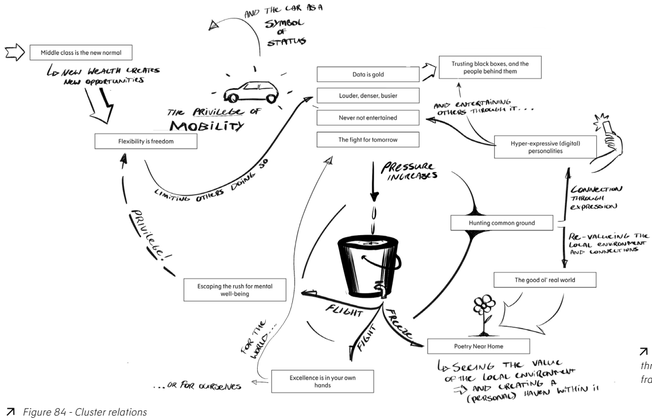
The clusters show two different attitudes towards our environment. On the one hand, a complete world at our fingertips results in a need for individuality and uniqueness, challenging us to find ourselves. On the other hand is the environment, both social and physical, essential for expressing who we are. Therefore our environment is, and is more and more important for every individual.

9.2.2. DIMENSION 2: HOW WE CARE FOR OURSELVES

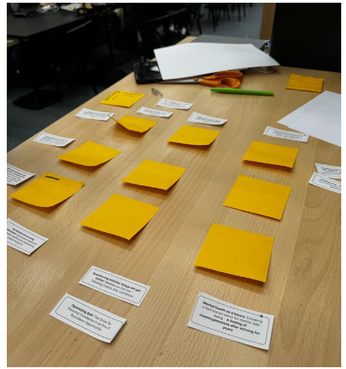
The increasing pressure from social expectations, urban density, digital (data) insecurity and other related factors result in a need for (mental) self-care. The clusters show three different ways of coping with this pressure. One way is to escape in order to forget the daily rush and be at peace. Another way is to make an effort to fit in, by conforming to the pressure and pace to survival. The third way is seeking connection with others and ourselves. Since we are social beings, we create a sense of ourselves through social connection.





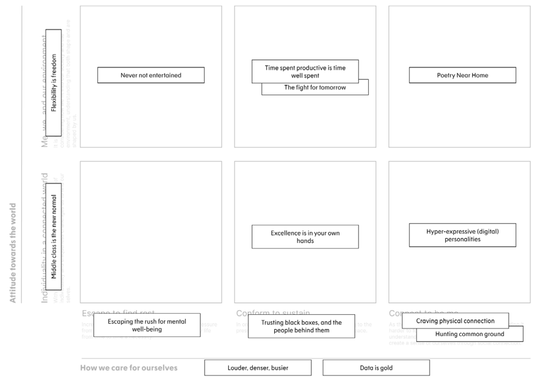


↗ *Figure 84 - Cluster relations*



↗ *Figure 85 - Creating dimensions through mapping of the clusters onto a framework*

Appendix C shows an alternative set of dimensions and its related framework. After testing both frameworks, this framework resulted to be the most fitting for a vision and concept for Lynk & Co.



↗ *Figure 86 - Positioning of clusters onto framework*

9.3. Framework

After defining the axes that represent the drivers expected to drive the future world concerning mobility in 2035, these axes are positioned so that a matrix was created. Each of the six sextants stand for a state of movement, in the context of future automobiling. In the probable future imaged through this ViP process, it is taken into account that there will be more than one behavioural state, and this framework represents the six most probable ones, resulting from the set of context factors.

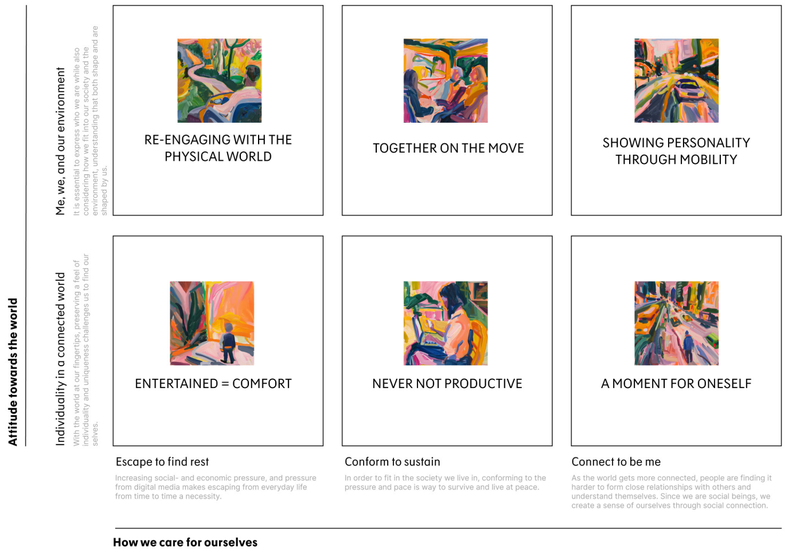
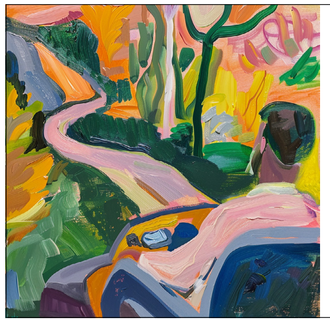


Figure 87 - Framework with the six states of urban movement in 2035

The behavioural states are all provided with a description of their underlying patterns and other relevant aspects, and the clusters matching the state.



Me, we, and our environment

It is essential to express who we are while also considering how we fit into our society and the environment, understanding that both shape and are shaped by us.

RE-ENGAGING WITH THE PHYSICAL WORLD

Finding peace away from digital overload in the tranquillity of the natural world.

In 2035, in a partly virtual world with digital personas and branded experiences, the real world emerges as a place of authenticity and peace. The contrast between the online world and the tactile, unfiltered physical world grows. Driving, especially in an AV, becomes a precious pause - A moment to gaze out the window, absorb the landscape, and to breathe in a reality unmatched by screens.

The physical world offers a rare form of satisfaction that the digital world struggles to replicate. Driving provides an opportunity to slow down, disconnect from the demands from digital media, and find escape from it in reconnection with the real world. Looking around and engaging with the environment we move through becomes an act of self-care. The simplicity of a changing environment is a welcome escape from external pressures.

Individuality in a connected world

With the world at our fingertips, preserving a feel of individuality and uniqueness challenges us to find our selves.

ENTERTAINED = COMFORT

Digital technologies make each journey a personal escape.

Digital entertainment has become the go-to method for personal relaxation and comfort while travelling. Reliance on digital devices for constant amusement became a (near) addiction, as these platforms provide a welcome escape to the demands of daily life. This constant desire for entertainment defines how we unwind and relax. Watching movies or social media, watching content from online creators or gaming are several examples of how travel time is used as a moment of personal escape.

This new norm of mind easing (or one could also refer to it as entertainment addiction) is the new norm of relaxation, and therefore will affect the car journey of 2035. Travel time becomes a moment of both solitude escape and a chance to engage through media.

Escape to find rest

Increasing social- and economic pressure, and pressure from digital media makes escaping from everyday life from time to time a necessity.

Me, we, and our environment

It is essential to express who we are while also considering how we fit into our society and the environment, understanding that both shape and are shaped by us.

TOGETHER ON THE MOVE

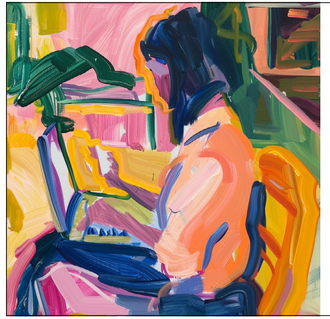
Shared drives as the moment of being together; as social space in a fast-paced world

In modern urban life, where life moves fast and personal space is limited, travelling with others is a welcome break. As cities get more crowded and anonymous, the places we travel in - cars, buses, trains, shared vehicles - become important places to connect.

During movement, whether it is on a car or a train, people come together. Travelling together turns into a time of being fully present, undisturbed from the usual external factors. They are more than just a way to get around; they give the chance to connect and share time. Friends can catch up, parents can spend time with their children, both being either physical in the same space or virtually.

Individuality in a connected world

With the world at our fingertips, preserving a feel of individuality and uniqueness challenges us to find our selves.



NEVER NOT PRODUCTIVE

Every moment counts to work on endless to-go lists, including the time on the road.

Constant productivity has taken over our daily lives, driven by the possibility of turning every moment, including time spent on the road, into an opportunity to tackle to-do's. With AD, the car becomes a mobile office, enabling work to continue uninterrupted by commute.

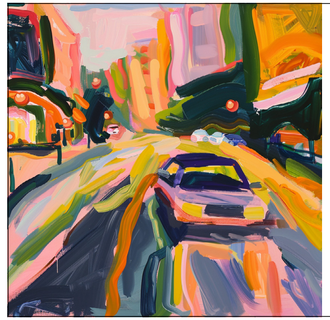
As efficiency and productivity become the benchmarks for success, in a social sense, the ability to work anywhere, including while travelling, aligns perfectly with these values. On the other side, it also provides the potential of pushing the commute into working hours. As working during AD provides advantages for many, it makes a very probable state in the future of automobility.

Conform to sustain

In order to fit in the society we live in, conforming to the pressure and pace is way to survive and live at peace.

Me, we, and our environment

It is essential to express who we are while also considering how we fit into our society and the environment, understanding that both shape and are shaped by us.



SHOWING PERSONALITY THROUGH MOBILITY

Expressing status and identity through mobility, showcasing personal wealth and taste on the roads, and showing the freedom of mobility online.

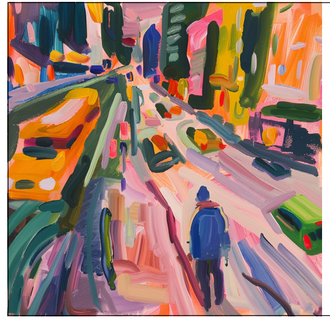
Mobility has long been a way of expressing personal identity and social status. In 2035, the way we choose to move - be it either a luxury car or public transport - continues to speak about our wealth, taste and values. Social identity becomes even more weighty, as the choice of transport not only shows personal style but also an awareness of one's place in society.

Driving a high-end car showcases wealth and sense of style, while choosing public transport options shows a commitment to environmental responsibility and personal values.

Furthermore, the expression of mobility has taken on a new dimension with digital media and remote work. Being able to move freely and work from anywhere has become a new marker of luxury. This freedom is valued highly, as many need an escape from their dense urban lives. Showing this lifestyle online has become a way to express one's freedom and success - with mobility as a key aspect for personal identity.

Individuality in a connected world

With the world at our fingertips, preserving a feel of individuality and uniqueness challenges us to find our selves.



A MOMENT FOR ONESELF

A moment to be truly alone and at rest, in a dense and connected world.

In a dense and interconnected world, a moment to be truly alone is increasingly rare and valuable. In a constant buzz of digital and social connectivity, the car is truly private space; a bubble to disconnect and recharge.

In this private bubble, one has the freedom to listen to your own music, sing along, wander or have uninterrupted conversations with friends and family. The car is truly yours, providing a unique environment that you do not have to share. In 2035, a place to be alone and to relax is essential for mental-well being in an urban world that never seems to pause.

Connect to be me

As the world gets more connected, people are finding it harder to form close relationships with others and understand themselves. Since we are social beings, we create a sense of ourselves through social connection.

Now that the states of automobiling for our future domain have been formulated, it is time to take a position. Together with Lynk & Co, we will create a vision on where and how to add value regarding a certain state. This is where insights from the analysis phase of this project get merged with the outcomes of the ViP process, creating a vision to design upon. This will be explained in the next chapter.

10. A desired future

10.1. Vision on interaction

The next step in the ViP process is the development of a vision on the interaction with the future Lynk & Co HMI. Within this step, a direction will be created for a concept; what and how to design. The aim of creating a vision is to find out what the meaning of the future product should be, and what the interaction is that will lead to that respective meaning. The vision describes what the interaction with the product will be, and how it will be experienced by its users. The meaning reflects the reason of being, and is therefore essential before creating design.

The current mission of Lynk & Co revolves around the key words personal, open, and connected. The first two are represented well in the interaction of their users with their vehicles, through bold, obvious design and a young target audience. The focus on digital connectivity inside the cars and connection with digital media through their HMI's shows their commitment to connecting their users with each other and the rest of the world.

However, when looking at the other states, coming from both the future context research and insights from users, the need for unwinding while being on the road, the wish for productivity and better connection with the driving environment, are not necessarily represented in their vehicles. The question here is if these future states are desirable.

As a result of the user's wishes and unrepresented states within the framework, it was chosen to design for both a *moment for oneself*, and the *re-engagement with the physical world.*

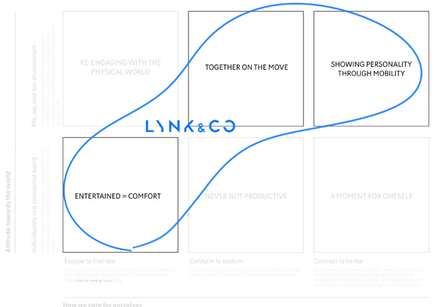


Figure 88 - Framework states where Lynk & Co performs well in

Figure 89 - Framework states with opportunities for Lynk & Co

Lynk & Co

- Counteract the direction of display-only designs; we aim to revert to a tangible, multi-sensory experience.
- Create the smoothest user experience possible, without holding on too much to current standards. Which interaction method to use for a dedicated function should be reconsidered, in order to prevent holding on to standards where they do not make sense in this new era of automobile interaction.
- Our vehicles should reflect the brand values of Lynk & Co, and be distinctive enough when placed next to the other Geely brands.
- With a development duration of 2-3 years per project (i.e. vehicle), a design vision should aim at the year 2035 at maximum.

Designer

- Smooth out the transition between a place to move in and a place to be in, using technology to provide the user with what they need to spend their time on the road, and the transition to from NDRTs and driving.
- Only use what's essentially needed - Do drivers want another device, or would they rather use the devices they are carrying? Do drivers want to change settings, or prefer automatic functioning?
- Prevent early obsolescence due to a user experience that feels outdated before the rest of the car does. Create design that is either long-lasting or that adapts to new trends and (digital) devices.
- Inspire Lynk & Co with a durable, user-centric HMI design, showing that simplicity makes sense and could be of value for the brand.

While Lynk & Co currently stands out through their brand and connected in-car experiences, other brands are doing about the same things. Competitive advantage in the oversaturated automotive market is of great importance, and therefore daring to create a distinctive in-car experience is essential.

10.2. Statement

As proposed above, it is desired to provide the driver with the optimal space for an escape from the everyday urban heat through a moment with oneself, and re-engaging with the physical world. The world around them moves fast, and they are moving with them. In the safety of their private vehicle they get the space to slow down and take in the world around them.

Based on the two states in focus, two intervention statements were created accordingly:

In the domain of personal urban mobility in 2035 ...

Emphasise the user-environment relationship by exposing them to it, and slow down their thoughts through an enhanced sensory experience.

FLOW STATE

DIGITAL DETOX

SIXT SENSE

The constant present, and attention demanding digital world forms a threat for our well-being. Restoring the connection with nature could be a way to provide a digital detox, as the sensory experience of movement has the ability of putting us into a state of flow. Humans have a natural tendency to be close to nature through an emotional connection, formed as humans had to rely on natural resources for survival throughout evolution (Chang et al., 2020).

By making users sense the environment they move through, the emphasis is put on the user-nature relationship, and less on the user-product relationship, to slow down thoughts through a state of flow.

Figure 90 - Statement I moodboard

In the domain of personal urban mobility in 2035 ...

Let people optimally be and recharge, offering a sense of privacy to the user, yet openness to the environment.

SHELTER

PERSONALISATION

OPENNESS

Moments of true solitude are rare and increasingly valuable. Personal spaces where individuals can think and recharge are therefore more important than ever. Through providing a sense of privacy, while staying transparent and open to prevent social isolation, the space offers the tranquillity needed to relax and optimally be.

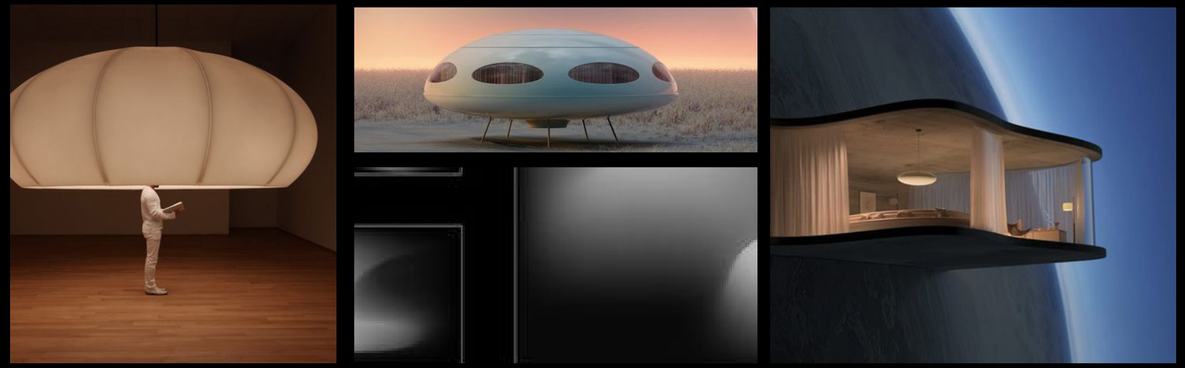


Figure 91 - Statement II moodboard

Figure 91 - The sailing analogy

10.3. Interaction analogy

"Leisure sailing - Wind as your guide, directing rather than controlling. A moment to slow down, be in the moment, and take in the environment you are moving through."

The development of a concept is guided by an interaction analogy that resonates the statement. The idea serving as an analogy for the future concept is the act of leisure sailing. When sailing, the immediate environment - the wind, sound of the water, openness of the sea - makes the passenger act in a different way than they would on land. The context captures the full attention of them, and creates a situation where its passengers relax and are more aware of what happens in the moment.

The boat indicates what the sailor needs to know, but does not force them to do anything. It allows them to take off and set course, in a functional and simplistic manner. The act of sailing enhances the journey, without overwhelming the passengers with interventions of complexity.

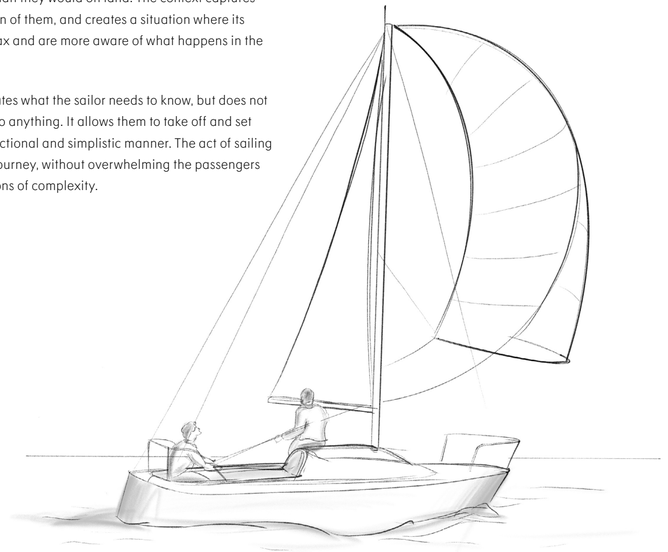


Figure 92 - Powered through wind and the sense of the natural elements; Leisure sailing as an analogy for the interaction.

Within the proposed analogy, both statements are represented and show a desirable scenario; The analogy was reviewed by both people from Lynk & Co design and the graduation team from the TU Delft, and was considered to be suitable for concept development. As this analogy represents a scenario in which both statements coëxist, the decision was made to combine both statements into a single statement, as a point of departure for ideation and creation of a vision. The final statement sounds;

"Lynk & Co and I want people to escape from and relativise modern day's hectics through a personal bubble where they can disconnect, recharge, and experience the environment they are moving through."

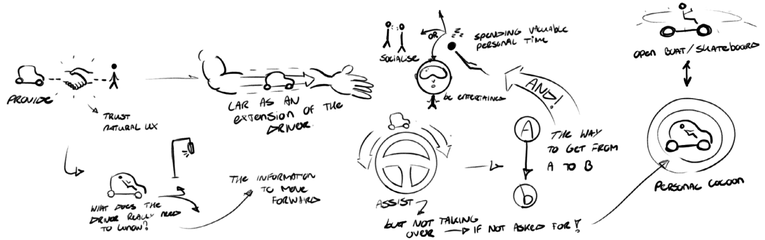
10.4. Product character

After choosing the desired interaction, an analogy reflecting this interaction, and the statement containing these, a translation is made from the interaction level to the product level. This is the final step of the ViP process before moving into ideation and concept development.

Lynk & Co and I want people to escape from and relativise modern day's hectics through a personal bubble where they can disconnect, recharge, and experience the environment they are moving through.

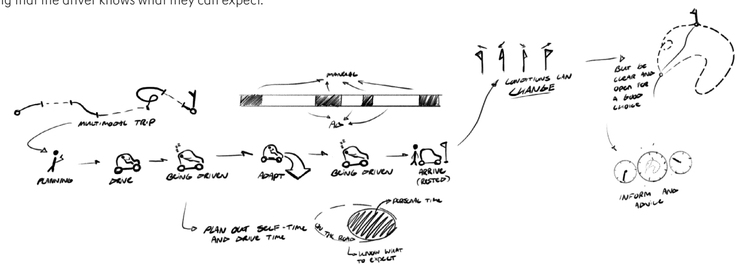
Sensory-enhanced flow

The vehicle amplifies the sensory experiences from the environment, guiding the driver into a flow. This engagement focuses on the stimuli that the driver needs, enhancing ease and joy of driving. By prioritising the essential interaction, the vehicle lets you focus on driving.



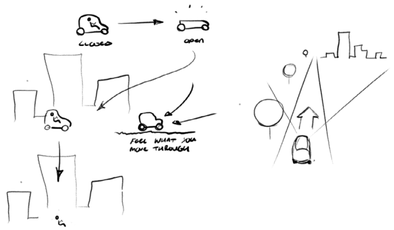
Adaptable plannable

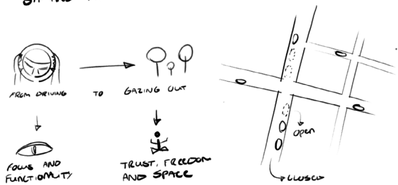
By providing the tools to plan out a drive, it makes space for personal time and a moment for oneself. The vehicle is clear about changes and adaptation needed along the journey, ensuring that the driver knows what they can expect.



Transparent - Open

Through transparency and openness towards the environment, the vehicle evokes interaction with the environment. By allowing passengers to look out, engage in conversation, or simply enjoy the serenity of their journey, a drive is transformed into a moment to recharge and process experiences before arriving at your next destination.





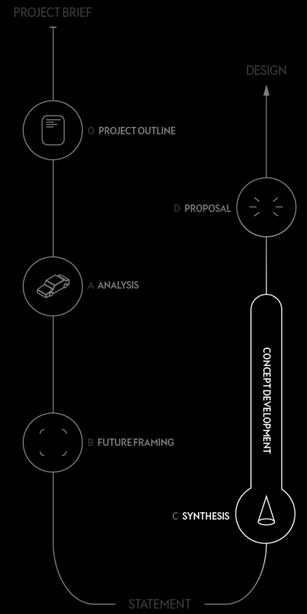
As it is not the goal to create a new interaction or brand strategy for Lynk & Co, the interaction analogy and the resulting product qualities are aimed at a desired interaction for future products. They are a result of the future context, the Lynk & Co brand values and the perspective of me as a designer, and therefore should turn into well substantiated decisions that are of value for both the user, brand and context. In the next phase, the synthesis part of the project, the outcomes of the future framing phase are merged with insights from the analysis phase into a vision for Lynk & Co, and a concept (or concepts) related to it.

PHASE C

Synthesis

In this chapter, the collaborative statement of Lynk & Co and me as a designer are combined with the findings gathered earlier in the project. This part of the report describes the road from insights and a design statement into ideas, towards a vision, and finally into concept development, to inspire and convince stakeholders to create a new meaning for the interaction with Lynk & Co vehicles in 2035.

First, the insights from the future framing, user needs, technological trends and brand identity are turned into a vision of 'tech that connects'. The unique proposition within this vision is to create a 'dark cockpit', minimising visual load to enhance the focus on the environment. These elements and consideration are turned into a concept direction, which is then turned into a final proposal in phase D.



MAIN TAKEAWAYS

Vision

Turn tech that isolates into tech that connects. Amplify the relationship between the user and the environment, through a transparent and informing HMI, which is an extension of the environment.

Unique proposition

Dark cockpit philosophy: Minimise visual load by using a 'dark cockpit' approach where lights only display when action is required, allowing the driver to focus on the environment.

Levelled interaction: Distinguish between daily controls and more in-depth settings, with daily controls easily accessible through physical buttons and simple UI, and in-depth settings managed through the driver's personal device.

Drive mode and media mode: Separate driving mode from media mode, with driving information on the steering wheel, HUD, and seat haptics, and non-driving functions on the centre display for an unobtrusive driving experience

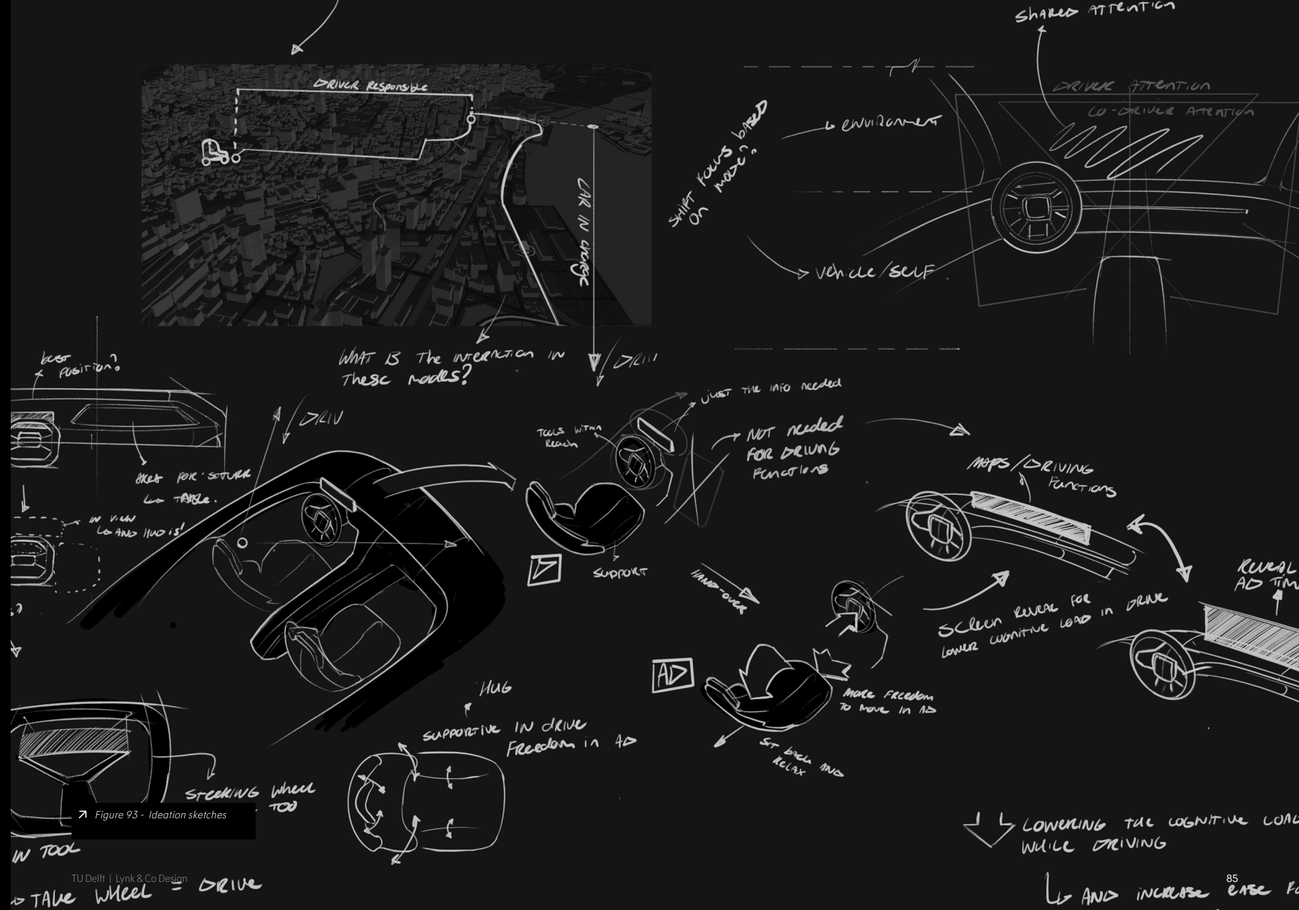


Figure 93 - Ideation sketches

11. Considerations

Ideally, the next step would be to merge all previous insights, and simply turn it into an all-encompassing solution. As this is not as simple as it seems, first an innovative vision and story need to be created that can unify all the previous findings in a convincing way (Hekkert & Van Dijk, 2011).

11.1. Proud tech vs shy tech

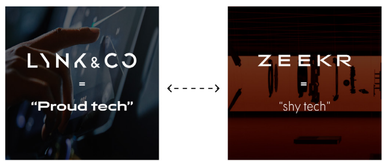
Within the Geely group, Lynk & Co and Zeekr operate in the same car segment. The differentiation between these brands is often explained using the terms 'proud tech' and 'shy tech'. In 'proud tech,' technology is prominently displayed and celebrated. In contrast, 'shy tech' aims to hide technology, focusing on simplicity, clarity, and providing only the necessary interactions for the user.

However, what does this mean in practice? As seen in Figure 95, aside from slight differences in styling and materials, the HMI experience is very much alike. Both brands feature a large display for functions graphical elements combined with a 3D vehicle and very few physical buttons to interact with.

When comparing these brands to cars in the same segment from other OEMs, similar interaction designs across many vehicles can be seen. The display is the cheapest and most versatile option for OEMs. However, this trend may lead to a lack of brand differentiation and competitive advantages through the HMI experience.

While this UI design is cost-effective and offers flexibility in updating software, it often results in a similar user experience across different brands. For instance, both Lynk & Co's 'proud tech' and Zeekr's 'shy tech' end up delivering a very similar interaction model to the user, despite their differing philosophies.

Besides that there is a potential loss of competitive advantage. When all brands in a segment offer a similar HMI experience, it becomes challenging for any single brand to stand out based on this feature alone. Consumers may find it difficult to perceive significant value differences between brands, which can impact brand loyalty and preference. While the use of large displays is practical and efficient, it also asks for innovative approaches to HMI design to truly differentiate and provide a unique user experience.



↖ *Figure 94 - Lynk & Co's proud tech vs Zeekr's shy tech ...*

↙ *Figure 95 - ... but besides styling and material differences, the 'tech'/HMI experience is comparable between the brands, and next to other OEM's as well.*

11.2. Proud tech vs software companies

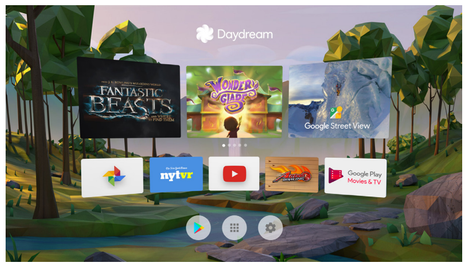
The way Lynk & Co currently aims to communicate its 'proud tech' mission is through using the possibilities of the newly gained computing power of its HMIs. This can be seen in their use of 3D environments and 3D animation on their infotainment system (Figure 96), creating an immersive digital world for driver and passenger interaction.

However, as with all new technology, initial use cases often feel outdated quickly. Consider the examples of Google Daydream and Amazon Fire Dynamic Perspective. Google launched Daydream to use the computing power of smartphones to create a virtual reality experience, but it quickly became outdated. Similarly, Amazon's Fire Phone's Dynamic Perspective gave users the ability to interact with the environment through a 3D representation on the phone, but it failed to provide practical benefits and soon felt outdated.

In this case, the increase in computing power in car infotainment systems is not unprecedented. Laptops, tablets, and phones have had this capability for years, and the technology has already matured. Following this trend of showcasing computing power seems like a dead end, as other digital products provide a clear roadmap of how quickly such features can become obsolete. Lynk & Co risks appearing outdated in the fast-paced technology landscape and therefore should rather focus on usability for competitive advantage and customer satisfaction.

↖ *Figure 96 - Visual 3D elements making use of the increase in computing power on the 2023 Lynk & Co 08*

↙ *Figure 96 - Google launched Daydream leveraged the computing power of smartphones to create a virtual reality experience, but got outdated quickly.*



↘ *Figure 97 - Amazon Dynamic Perspective created a 3D effect on the screen. Despite being a technological showcase, it failed to provide practical benefits.*

11.3. Integration or keeping control

With users, especially Europeans and Americans, value the software from major tech companies (Apple, Google), over the HMI software developed in-house by the OEM's, they start to integrate vehicle data and functions into their package. The complexity associated with developing infotainment software is high, and there is definitely room for improvement according to the experience from users. This dissatisfaction shows the necessity to improve the quality of their HMI's, or outsourcing it.

However, history shows that outsourcing critical features not only compromises a company's control over its ability to innovate, but can ultimately lead to a dependency that is difficult to reverse (Konstantopoulos, 2024). Depending on Carplay OS and Android Automotive can seem beneficial in the short term, but seems to be the wrong way on the longer term.

Quality, functionality and safety are still necessities to succeed as an automotive manufacturer, and therefore dependency on a rapidly evolving industry that has a different agenda is not strategic. Instead, leverage the products from third-parties where they flourish, for connectivity and entertainment, and keep driving functions in-house.

↙ *Figure 98 - Peugeot's inhouse HMI software in a 2024 408*

↗ *Figure 99 - Next-generation Apple Carplay in a Porsche 911*

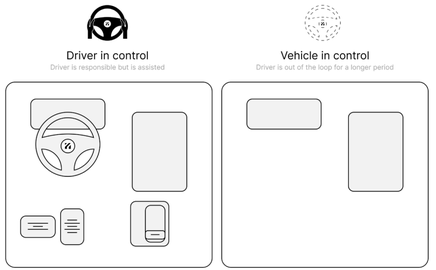
11.4. The seat is always there

The direction OEMs are currently taking is heavily focused on the car's systems. HMIs are being designed with the assumption that drivers will spend their time interacting with these systems, also when driving autonomously (Figure 101).

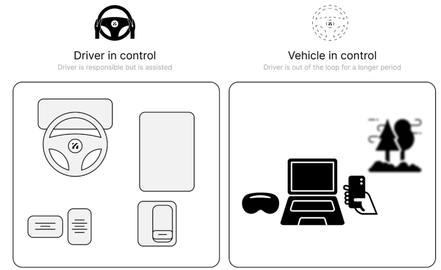
However, due to new technologies and the role personal devices are playing in our lives, it is likely that drivers will spend their time on the road using their devices (figure 100). Insights from chapter 5 show that drivers already spend more time using their phones or looking out of the window than engaging with the car's HMI when driving in AD (Figure 102).

It is crucial to consider this behaviour in designing a future concept. Notifying the user of upcoming events, alerts, or the need to take over the steering wheel should not rely purely on visual and auditory cues. The seat, which is always in contact with the driver, provides a natural and fitting way to deliver these notifications and guide the driver in the right way.

↖ *Figure 100 - New technologies will change the way we spend time on the road*



↗ *Figure 101 - Anticipated activities during driving and AD by OEM's*



↗ *Figure 102 - Expected activities during AD*

11.5. Premium vs luxury

Out of the user interviews came the Lynk & Co target audience chooses the brand for its premium status. However, they distinguish between luxury and premium. Luxury products are seen as expensive and limited, whereas premium products are characterised by durability and cost-efficiency (China Britain Business Council, 2021).

Therefore, premium design results in a design that offers maximum practical usability. Additionally, premium design must be versatile to accommodate future changes in interaction standards with our digital main devices, such as phone, laptop, or any future main digital device, as they set the standard for other products.

As the premium aspect of Lynk & Co's vehicle is a major factor of choice for customers, it is advised for Lynk & Co to follow these principles.

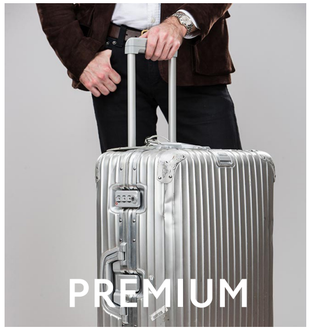


Figure 103 - The RIMOWA CLASSIC suitcase offers high practicality and durability, packed in a bold, sleek design.

Figure 104 - The Hermès Birkin bag is a symbol of ultimate luxury and exclusivity, handcrafted with the finest materials and a known symbol of status.

11.6. Persuasive design

Persuasive design was introduced by B.J. Fogg in his Behavior Model (motivation, ability, prompts) (2003). The model examines how technology can be designed to change attitudes or behaviours of users through persuasion and social influence. It distinguishes 3 types of design:

- **Informing design** - provide information to the user
- **Supportive design** - assist the user in making a decision or performing a task
- **Compelling design** - Force the user to act in a certain way, often by making alternative behaviour difficult or impossible.

In the context of automotive HMI design, Informing design is seen in how critical information is clearly visible to maintain driver awareness, like dashboards and HUDs in line of sight of the driver.

Supporting design is seen in the assistance of drivers with tasks, reducing cognitive load and enhancing safety. Features include adaptive cruise control and collision avoidance.

Compelling design enforces safe behaviours through interventions like seat belt reminders and automated braking.

ENTERTAINMENT HMI: EXTENDING PERSUASIVE DESIGN

Persuasive design principles also apply in infotainment design nowadays, compelling users to use OEM features like built-in apps and features. The layout and design of these interfaces are crafted to guide users towards specific actions, often making decisions for them. For example, prominent placement of OEM apps and seamless integration with the vehicle's systems encourage users to use built-in solutions over third-party alternatives. This design strategy can be seen as a form of compelling design, as it enforces users to learn to use the OEM's ecosystem by making alternative options less convenient or less visible.

"Consumers are looking for intuitive systems that are simple and not too distracting from the road. The challenge to OEMs and suppliers is translating those consumer expectations into design and functionality"

- Ashley Edgar, J.D. Power

11.7. Design for first use

The sharing platform of Lynk & Co serves as a major drive for European consumers to consider the brand. This incentive is likely to grow as consumers are increasingly ready for the idea of moving away from owning vehicles in favour of using them when needed (Vermeersch & Haspeslagh, 2024). However, for the majority of the consumers a significant barrier remains, namely the unfamiliarity with the shared vehicles (Mitropoulos et al., 2021). Every sharing vehicle is different, and while millennials and younger tend to adapt well to new digital interfaces, this is a challenge or even a barrier for older generations.

It is crucial to design in-car interactions that are understandable to first-time users, making sure that a learning curve is minimised. A focus on intuitive interactions is essential for the further growth of the sharing platform. Vehicles must be designed for 'first-time use', i.e. immediately understandable to new users.

One approach is to create a general standard across all sharing cars, making an interaction that is similar regardless of the specific vehicle. Although, standardisation across brands is challenging. Alternatively, the design could leverage the familiarity users have with their personal devices. By making the personal device the main interaction touchpoint, users can interact with the vehicle through a platform they already feel comfortable with, and sticking to the car's system for driving functions. An approach of making different levels of interactions could be a solution to this challenge (figure 105).

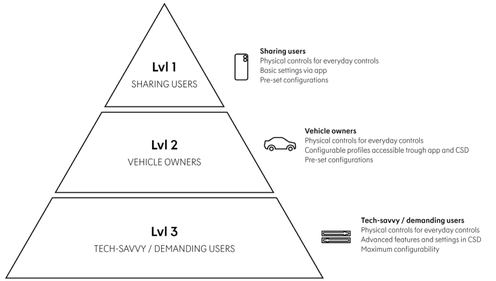


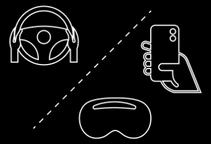
Figure 105 - Three levels of interaction for sharing users, owners, and the most demanding users

> "Just as we have traded in our collection of CDs for a monthly subscription to a streaming service, **we are increasingly ready for the idea of moving away from owning vehicles in favor of using them when needed."**
>
> Vermeersch and Haspeslagh (2024)

11.8. Considerations - takeaways

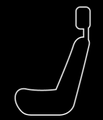
Implement the 'proud tech' identity in a physical manner

Showcasing computing power will feel outdated, as other digital product are already far ahead.



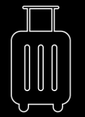
Keep driving functions and entertainment functions separate

Provide a feeling of control to the user by putting non-driving functions second, and prevent design to be compelling to them.



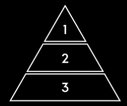
The seat is always there

Communicate through the seat, as it is always in contact with the driver, even when attention is somewhere else.



Create premium design - don't focus on status

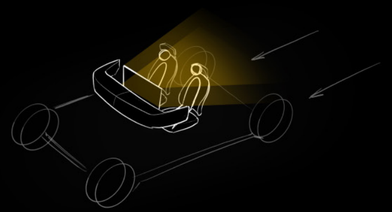
Focus on maximum practical usability, and ensure versatility for future changes in our digital main devices.



Design for first use

Provide different interaction levels for different users, making sure the design is intuitive for first-time sharing users.

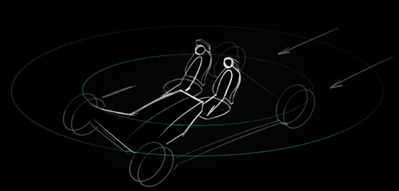
12. Conceptualisation



Tech that
Isolates

User is disconnected from the environment (interaction level)
The in-car interaction is compelling towards the digital (product level)

SUPPORTING
INSTEAD OF COMPELLING



Tech that
connects

Relationship between human and environment is amplified (interaction level)
The HMI is transparant and is informing, and is an extension of the environment (product level)

12.1. Vision

The key aspect of the future vision for Lynk & Co sounds: shift from 'tech that isolates', to 'tech that connects'. Instead of isolating users through digital media, Lynk & Co can use their technology to open up the vehicle. The goal is to transform this by creating technology that supports and enhances the connection between the user and their surroundings. This means moving from an interaction where the user is compelled towards digital engagement to one where the relationship between human and environment is amplified.

The interaction between human and machine becomes transparent and informative, acting as an extension of the environment rather than a separate entity. It creates a harmonious interaction with the environment, and contributes to mental well-being by putting its passengers in a state of flow.

LYNK & CO ALIGNMENT

This vision aligns seamlessly with the 'Proud tech' identity, and puts emphasis on their image of being a bold, and connected brand. Taking technology further than a showcase of computer power creates not only a richer driver experience, but could also create advantage over competition, as digital features are quickly imitated, while physical elements take several years to develop (R. Jones, Personal communication, 2024).

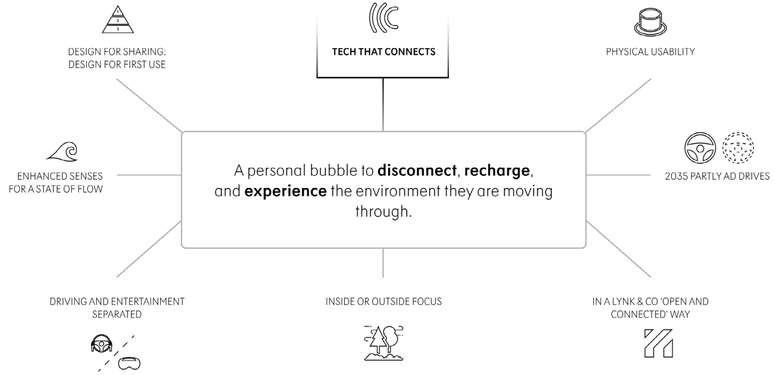
12.2. Key ideation guidelines

Having the mission statement, interaction analogy, concept considerations and vision clear, as well as the requirements of the future context, brand and user, it is time to synthesise all these factors into ideas. Insights were synthesised into a set of key guidelines that were taken into account during ideation and conceptualisation (figure 106).

12.3. Ideation

Finding a single solution out of nowhere is a challenge, and therefore the ideation process is something that not happened after, but throughout all earlier phases. The most promising and matching ideas were later merged into the final concept direction. Some of these ideas were already created before the mission, interaction analogy, and vision were not defined yet. The ideas were generated through quick sketches, discussions with Lynk & Co designers and students from the TU Delft, and collaborative brainstorm sessions. Ideation sketches can be found in appendix H.

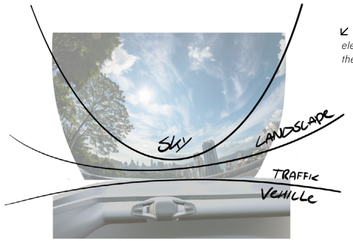
Figure 106 - The mission statement and key guidelines for concept development.



12.4. Unique proposition

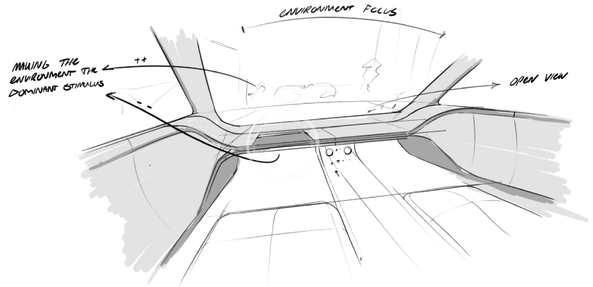
During the ideation phase, several ideas came up that focused on balancing the driver's attention between various elements within the vehicle. An approach often seen is to optimise the ratio of things of the drivers viewport (figure 107). A vehicle design featuring more glass and fewer parts in the way of it, as often seen in vehicle concepts, is a logical step towards this goal. During the sketching ideation ideas in this direction came up as well (figure 108) However, for this project, aiming to provide a feasible concept for the next generation of vehicles with a focus on HMI interaction, we assume the vehicle package as a given and focus on the interactive elements in the HMI.

The approach here is to create a 'dark cockpit'. The philosophy behind a dark cockpit is to minimise visual noise: if everything is functioning correctly, no lights are displayed, meaning that all systems are normal. If a light turns on, it gives the signal to the driver (or pilot) to take action. This philosophy implies that if the vehicle can solve a problem, there is no need to inform the driver, allowing the driver to focus on the environment.



↙ *Figure 107 - The ratio of visual elements seen through the viewport of the driver*

↙ *Figure 108 - Environment focus; the effect of an open interior design on the focus of attention*



↘ *Figure 109 - Dark cockpit interaction in an Airbus A330*

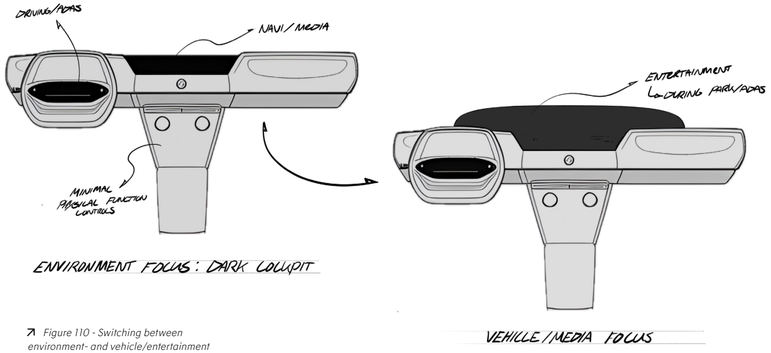
DAILY CONTROLS AND USER PROFILES

The approach of levelled interaction is expressed in two ways in the proposition made (figure 110). The first distinction is between daily controls and more in-depth settings and preferences. Daily controls, such as HVAC, driving functions, and media controls, are accessible through unobtrusive physical buttons and switches, complemented by touchscreens with simple UI designs. These controls are always reachable. User profiles, which include seat settings, UI customization, and HVAC preferences, together with more in-depth settings, are managed through the personal device of the user. In both owning and sharing scenarios, the car adapts to the profiles set in the app.

DRIVING MODE VS. MEDIA MODE

The second distinction is between driving mode and media mode. To support outward-facing interaction and make the car part of its environment rather than isolating passengers, driving mode follows the dark cockpit philosophy. When the car is in autonomous driving (AD) mode or being parked, it can switch to media/entertainment mode, enhancing the focus on the HMI without completely shutting off the environment.

In order to design for a dark cockpit interaction, auditory and visual guiding information and alerts are moved to the seat, using directional haptic feedback, slight movements, and vibrations to inform the user. This provides a natural interaction, reducing the mental load on the driver without disturbing other passengers.



↗ *Figure 110 - Switching between environment- and vehicle/entertainment focus*

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In this 'dark cockpit', elements are grouped into function clusters to make a distinction between daily controls and driving functions, and media and entertainment controls (figure 112). Driving controls and information are positioned on the steering wheel, HUD, and through haptic feedback through the seat. Non-driving functions and media controls are placed in the centre console and centre display. This allows it to function as a general information screen for both driver and passengers during driving mode, and transform into a complete entertainment device in media/entertainment mode.

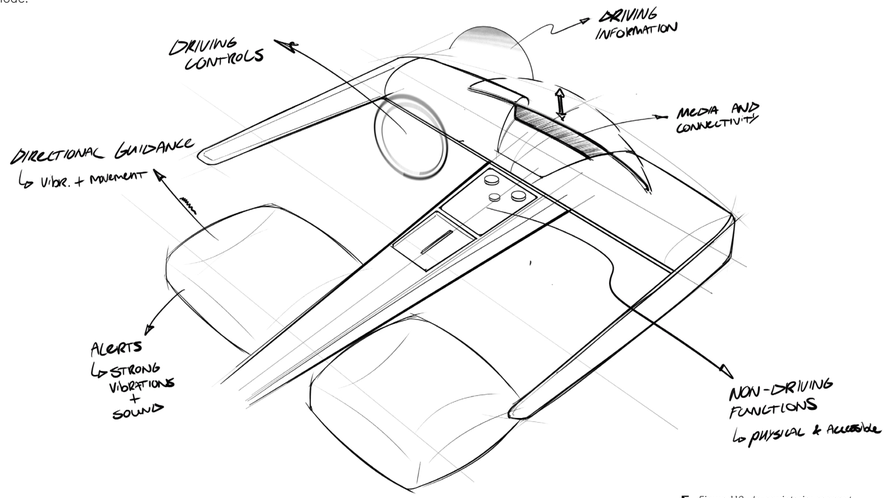


Figure 112 - In-car interior concept direction sketch

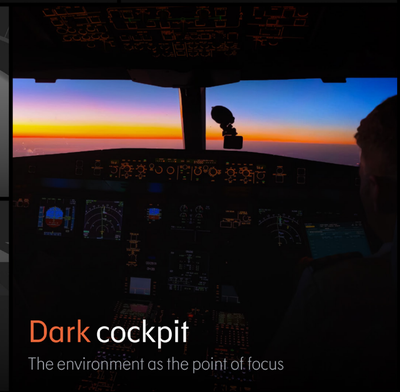
Unique proposition

Unobtrusive controls
For everyday functions

Personal device
Is the main point of interaction

Conversation
Not just automation

Simplicity of a light switch
Physical interactions to blindly interact



Guiding instead of correcting
The car as an extension of the driver

Layers of interaction
Design for first-use, design for sharing

Dark cockpit
The environment as the point of focus

Figure 113 - Takeaways unique proposition

12.5. Concept direction early impression

To give an impression of a dashboard following these principles, the sketch in figure 114 was shown to present the concept and discuss the embodiment of it. Is uses the flexibiliy of screen with the intuitive touch of a button, while reducing the need to move ones attention visually to parts inside the interior. This design direction was the starting point for moving into a more detailed CAD design, commbining the feedback and other insights to a final HMI design proposal.

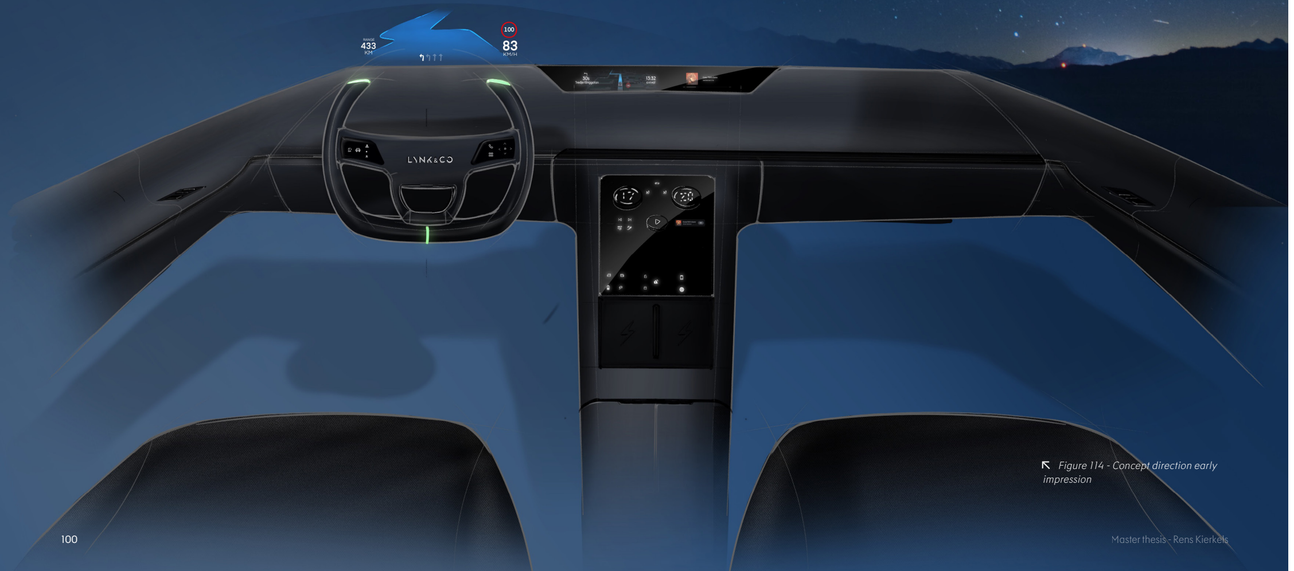


Figure 114 - Concept direction early impression

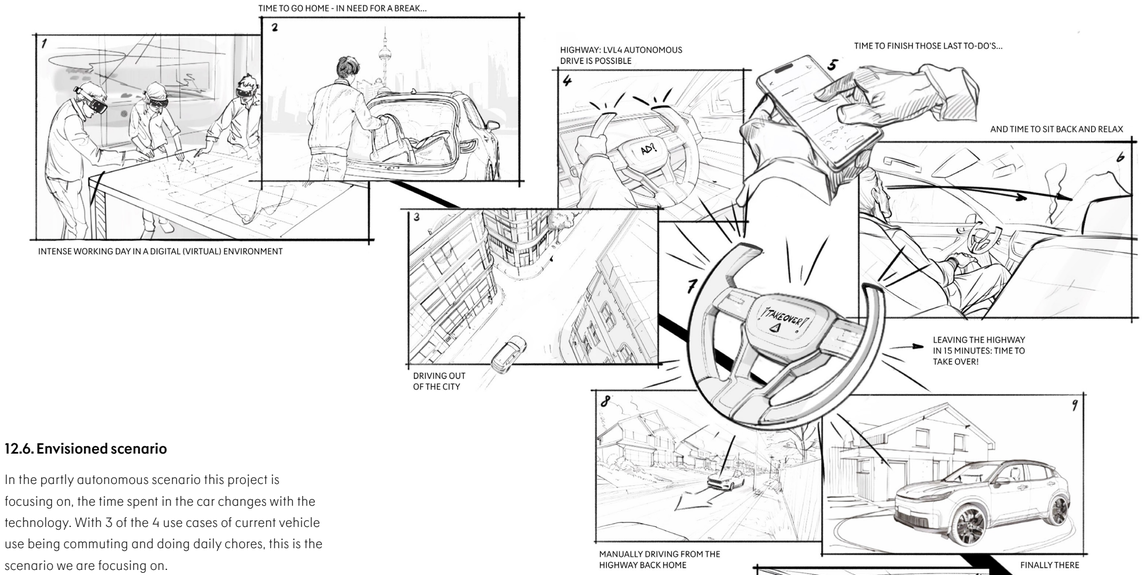


Figure 115 - Envisioned scenario sketch

12.6. Envisioned scenario

In the partly autonomous scenario this project is focusing on, the time spent in the car changes with the technology. With 3 of the 4 use cases of current vehicle use being commuting and doing daily chores, this is the scenario we are focusing on.

A typical drive starts after having had an intense work session in a digital environment. After hours of focus and digital interaction, the user heads to their car, ready to transition from a busy day to wind off at home.

The driver drives out of the busy city streets towards the highway. Entering the highway, the steering wheel and HUD indicate that AD is available, allowing the user to relax. The driver finished some last to-do's of the day on their personal device, and sits back to relax after it.

Approaching the highway exit, the system gently alerts the users through the steering wheel and seat vibration that it is time to take over control. The drivers take over and drive into the residential area where they live.

After arriving home, the driver takes another moment to sit back before going into the (busy) family house. The media mode allows the user to take a moment of entertainment before entering the home. After this, the user enters the house refreshed, ready for the evening.

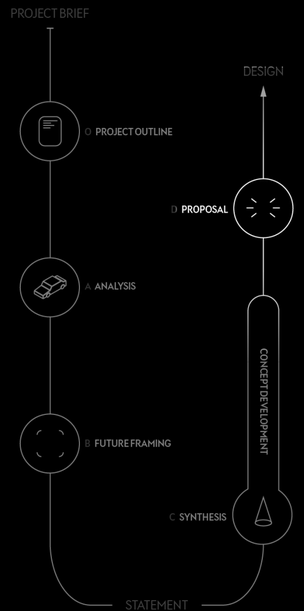
PHASE D

Proposal

In this chapter, a final design proposal is done based on the mission statement and other findings from the research done throughout the project, including the visualisations and prototype in serving as means to effectively communicate the design.

The design introduces the 'dark cockpit' philosophy, aiming to minimise visual distractions and lead focus to the environment one is driving through. A combination of physical controls for daily controls and personal devices for more advanced settings creates a tailored interaction for every scenario. Different focus modes adapt to the needs of the driver and its passengers, shifting between driving and media modes, balancing functionality and entertainment.

The design proposal aims to inspire and convince about the feasibility and advantages of the considerations, proposed interactions, and compatibility with the Lynk & Co brand.



↗ *Figure 116 - Concept direction proposal*

13. Final proposal

13.1. Dark cockpit

A dark, simple dashboard design provides the driver just with the information needed (figure 117). All driving information is presented in line of sights, putting emphasis on the context the vehicle is driving through. A central display shows general driving information on a glass panel, guiding the attention of the passengers outward during all types of interaction. Daily controls such as media, climate controls and all driving related functions are always within reach through physical switches and buttons, not requiring visual attention to be moved away from what happens outside of the vehicle. Instead of communicating information through dashboard lights and audible alerts, the driver is guided and assisted through haptic guidance where possible, in the seat, steering wheel, and pedals, and complemented through information in the line of sight of the driver on the HUD.

The central point of digital interaction is the personal device of the driver, in these visualisations assumed to be the smartphone, but could also be digital watches, glasses, or what else the future of personal devices will be. In this way, the most familiar digital interaction is leveraged to dive deeper into settings as needed, and make the automotive HMI act as an extension of it.

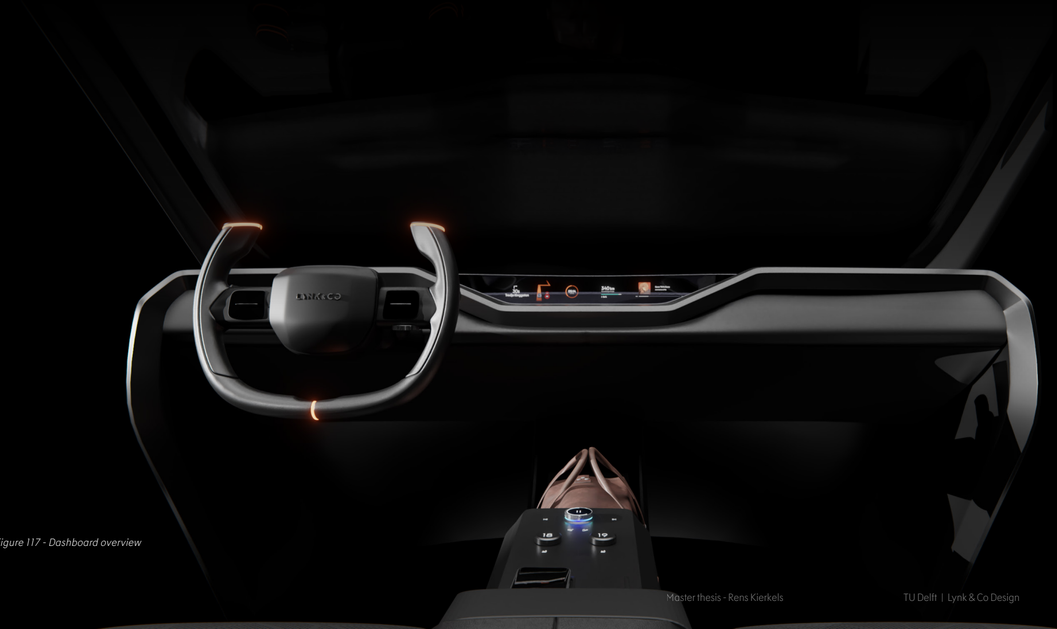


Figure 117 - Dashboard overview

The design of the different elements within the HMI follows a clustered approach, with each of these clusters having several states depending on the mode the driver wants the HMI to be in, just providing the information fitting the scenario the driver is in.

The steering wheel folds up and down to prevent it being in focus during non-driving related activitties, and always showing the current state of AD through color coded LED disks. The HUD is enabled during driving, providing driving information and AR navigation guidance projected onto the outside environment.

The CSD consists out of a glass display panel, giving a dynamic view of information valuable to the driver and the passenger at a specific time and driving mode. An navigation view is presented when for example a highway exit of intersection is coming up, and information from the personal device of the user is presented when relevant, such as notifications or music. When the vehicle is in AD mode, or is parked, the CSD can move up to create a pillar-to-pillar screen to turn the vehicle cabin into a room to enjoy content, games or other media together.

Daily controls are always within reach for both driver and co-driver, through a physical control pad in the center console. Rotaries and physical button makes it easy to adjust if any of the pre-set profiles is not according to preference.

The seat, always being in contact with the driver, provides an haptic interaction to guide, inform, and alert the driver, enabling the visual information on the dashboard to be reduced to a minimum.

Figure 118 - HMI function clusters

13.2. Focus modes

The dashboard is designed to lead the attention of its passengers to the environment they are driving through, by lowering visual stimuli inside of the car, and presenting the essential information transparently and near the line of sight of the users (figure 119). Although, as users desire richer digital experiences when not having to focus on driving or are parked, the dashboard can switch to a larger digital display, shifting the focus to the inside of the car, while preserving openness outwards (figure 120). This larger display can be used for movies, other digital content and games, again serving as an extension of the personal devices of the users (figure 121).

Figure 119 - Drive mode, environment focus

Figure 120 - Parked, vehicle focus

Figure 121 - AD, media focus

13.3. UI

The philosophy behind the design of the HMI is all about the right information at the right time. The control pad integrated in the centre console (figure 122) can be moved in and out, and features rotary buttons for the most controlled functions. LED touch buttons are integrated in the panel and are visible depending on relevancy, combining the tangible, intuitive interaction with physical controls with the flexibility of digital touchscreens. The central media rotary lets the users control media volume, and is also the physical element of interaction with the voice assistant. Holding the media rotary makes the voice assistant appear, and will most probably become the most frequent point of interaction, as the quality of these assistants will advance over time.

Figure 122 - Physical controls for everyday functions in the center console

Figure 123 - Minimal visual UI on a transparent surface

The information displayed on the CSD and HUD is dynamic, providing information about the vehicle, navigation, AD modes and media when relevant (figure 123). Through the use of a transparent display panel and a minimalistic UI the outer environment is always in line of sight, and the user is not persuaded to move their attention to the dashboard unless the information is relevant for them.

13.3. Personal device application

An application on the personal device of the user is the place where the owner(s) of the vehicle adjust the vehicle settings, set up navigation and plan out their trips, and set user profiles for different drivers (figure 124). While the standard in personal devices has been changing fast over the past 30 years, and probably will also do over the next, the smartphone is assumed here as the standard to keep the proposal feasible yet inspiring.

Through user profiles, settings about climate, seating, and UI and driving preferences are controlled through the app. In this way users are provided the familiar digital experience of their personal device while leaving advanced settings that are just relevant to some users (and some occasional moments) out of the in-car HMI, and therefore lowering complexity and visual noise. Through this approach of having the personal device as the central point of interaction, the vehicle owner is allowed to have the same product experience as the sharing user, as the vehicle adjusts based on the personal settings in the app.

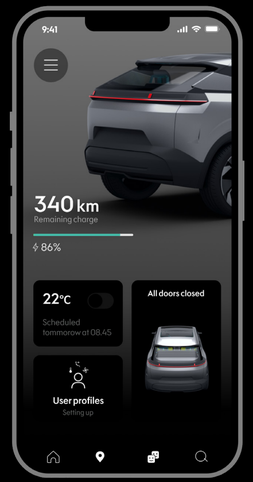


Figure 124 - Smartphone app with user profiles and vehicle settings

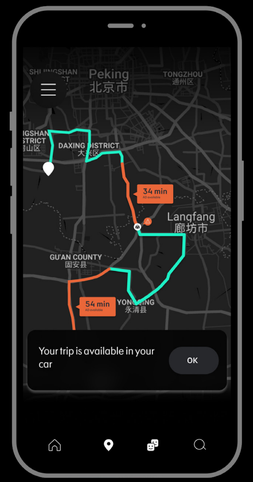


Figure 125 - In-app trip planning

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13.5. Haptic scenarios

In order to communicate this haptic HMI concept, several scenarios were created. Three of them are presented here.

13.5.1. NAVIGATION

Driving in urban areas can be a challenging task due to the complexity of the infrastructure and amount of vehicles on the road. The translation of visual information to action was mentioned by users to be a challenging task, and therefore it is a fitting scenario to improve through the guiding haptic interaction.

As visualised in figure 128, when driving manually, the seat guides in a direction when a turn or lane switch comes up. This haptic guidance continues when the turn approaches, combined with slight directional vibration in the same direction. This interaction would guide the driver to their direction, instead of requiring them to convert virtual map information to the physical world.

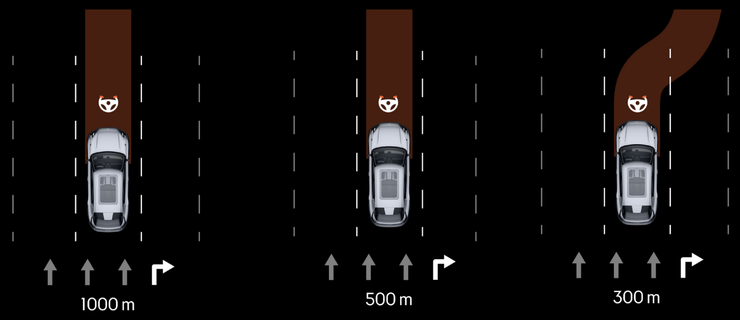
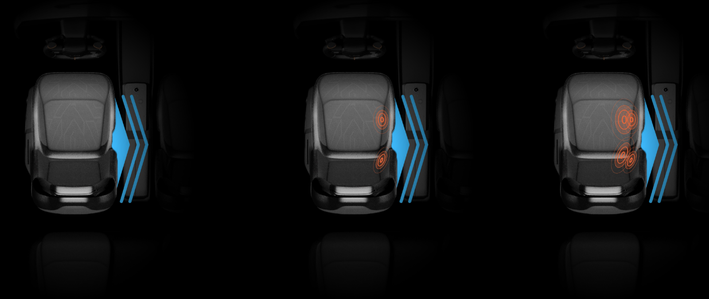


Figure 128 - Navigation guidance thorugh the haptic seat



13.5.2. HAND-OVER

With the introduction of multiple modes of driving into the car, the challenge arises to transfer the responsibility safely between vehicle and driver. This movement of transfer, the hand-over, is essential, where it is of importance that the new mode is clear to the driver, and they are aware of the environment around the car as quickly as possible.

Haptic information can support the driver in both gaining situational awareness and being informed the level of automation they are in, through directional vibration, headrest audio feedback, and stronger vibration for correction in cases of mode confusion (figure 129).

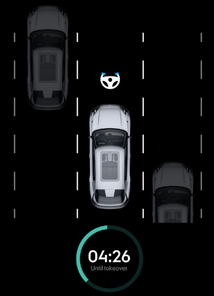


Figure 129 - Situational awareness for handover though haptic seat

13.5.3. ADAS FUNCTIONS

The interaction with ADAS functions is often considered intrusive and irritating, and leads to disabling these functions by several of the interviewed drivers, mainly due to the way the HMI informs and alerts the driver of these features. In busy traffic situations, these functions lead to a visual and auditory show that no interviewee considered helpful.

Haptic guidance allows for a more subtle interaction with these features, guiding the driver towards the right actions instead of alerting them. Lane keeping assistance is one example (figure 130) where guiding the driver to steer could create a more supportive interaction than alerting them or moving the steering wheel.

Figure 130 - Lane keeping guidance through haptic seat

13.6. A Lynk & Co interaction

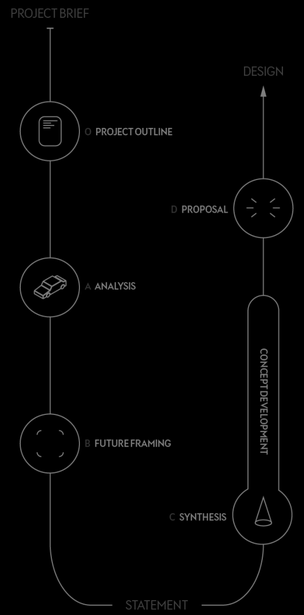
The embodiment of the design elements is designed with the Lynk & Co brand identity and target user in mind. The young, urban user is offered an HMI that is connected to other devices, and uses technology in a bold way to provide the smoothest yet novel experience possible (figure 131, 132).

Figure 131 - Dashboard HMI design impression of concept proposal

Figure 132 - Backseat view of HMI concept proposal

Discussion

This part of the thesis report discusses the final proposal. It includes recommendations for future work, an evaluation of the project's outcomes from both the perspective of the experts at Lynk & Co Design and myself, and a personal reflection on my process during this thesis project.



↗ *Figure 133 - The author in the Geely Design Centre in Gothenburg*

14. Recommendations

TECH THAT CONNECTS

Providing valuable and brand-specific features is key to creating a strong product experience. Lynk & Co's 'proud tech' identity is at this mainly expressed in a digital showcase, but this research raises the question of whether this is really what the user desires. The overt use of technological features does not necessarily seem to lead to a digital (isolating) interaction, but could also be a means of emphasising the connection with the environment through which the vehicle moves.

DIGI-PHYSICAL APPROACH

The current digi-physical approach focuses on individual features that are placed in a project after development. This approach leads to a fairly disorganised approach to in-car interaction, whereas a team that has access to both digital and physical tools actually gives the opportunity to deliver a rich experience. A clear strategy in this area will lead to more focused efforts and a better overall in-car experience.

DEPARTMENT COLLABORATION

The previous point leads to the recommendation for strong collaborations between departments, as all elements the user interacts with affect the vehicle experience. Designing a strong interaction should be done together with the interior team in need of achieving a coherent strong driving experience, as not doing so leads to creating stand-alone, sometimes gimmicky features.

ADAPT FOR AD

The introduction of autonomous driving gives a large set of design opportunities in the near future. Where brands currently have to differentiate themselves with features that are different from the competition, in a user context where much has already been done, this new paradigm creates the freedom to offer an experience that sets the tone for the industry. Introducing design elements in upcoming models, and not just applying them in concept models would prepare the brand for the near paradigm shift.

SHARING MODEL

For almost all European users, Lynk & Co's sharing platform and flexible forms of ownership was the main reason for knowing and having affinity with the brand, and even moving to purchase. It is the elements that make the brand stand out among the many other brands, and counteracts the prejudice that still exists among many about Chinese car brands. Where the focus does not seem to be on these parts of the brand because of its focus on the Chinese market, it does seem to be the way forward for a strong brand in Europe.

USER RESEARCH

The quality of the design could benefit strongly from a closer connection to the user and more intensive user research. The way the company works is currently that the design takes place in a different culture than the target group, which might result in novel design for them, but relying more on coincidence than targetedness. As mentioned earlier, like 'a puzzle changes when trying to solve it'. Providing user research insights that go beyond demographic information and use cases of the car, for example feedback on features or product interaction behaviour, can lead to better informed design and gives the tools to come up with better new ideas.

NEXT CONCEPT DEVELOPMENT STEPS

This project provides the insights, rationale and a starting point for further development of the concept. The next steps are recommended to take next (see figure 134);

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2 - The different CSD modes require testing with display technology and testing the interaction with users. A virtual reality prototype could be the next step in validating the design, after which collaboration with the interior team would lead to improving and detailing the concept.

3 - The central control pad is a feasible element that could be implemented and further developed in upcoming vehicle projects, using technology used currently. It would allow for taking elements away from the UI and take steps towards the 'dark cockpit' approach.

4 - The dashboard design guiding the focus toward the environment would be a collaborative effort between the interior- and HMI time. This overall strategy and vision would have to be discussed between teams and conceptualised upon by both teams.

5 - Mode switching through the steering wheel and moving all driving functions to it, together with the HUD, could be the next step towards a clustered approach within the HMI, and at the same time a preparation for upcoming autonomous driving modes.

Figure 134 - Recommendations for next steps of development

15. Evaluation

15.1. Lynk & Co evaluation

A week before completing this thesis, the project was presented to about 20 colleagues from the HMI and prospective team in the Lynk & Co Design office. Although it was a challenge during the project to combine the academic working method from TU Delft with the practical working method in Gothenburg (see 15.1. Personal evaluation), the research findings, vision and concept direction were very well received during this project presentation. The reactions indicated that the project gives many handles to further develop and build on, and that the values and context of the brand are cleverly incorporated in the ideas. Feedback and questions focused mainly on the embodiment of the design direction, which require detailing, prototyping and testing for verification and realisation of the concepts.

Feedback, mainly from the colleagues I worked more closely with, concurred with this, but was also that a more physical, practical approach would have helped in verifying and further developing the ideas. These steps are now presented as the next steps in further developing the ideas presented in this project. While the ideas could not have been developed without the commitment to the research area and its underpinnings, the initial request from Lynk & Co was more practical and short-term focused.

Based on the reactions to the presentation and overall feedback, the project seems to have become a valuable mix of combining an academic approach and personal ambitions, carried out in (and with feedback from) a practical industry environment. And in doing so, I am hopeful that the project will not end up on the shelf, but will inspire and be a starting point for further concept development.

PATENT APPLICATION

The concept around the interaction with the seat, developed in collaboration with colleagues in the digi-physical team, qualified for a patent application. The team will continue working on this concept in the weeks following the finalisation of this project, resulting in a patent application.

"The research findings and conclusion give us the handles to justify our future designs; It gives confirmation that we're going in the right direction."

- Christine Gall, Head of HMI & UX design Lynk & Co design

"You managed to capture the brand identity in your proposal, it's really a Lynk & Co"

- Johan Mentzer, Senior UX/UI/Sound Designer Lynk & Co Design

15.2. Personal evaluation

INDIVIDUAL FIVE-MONTH PROJECT

The main limitation of this project was the fact that it was an individual project with a duration of about five months, which led to having to make compromises due to limited time. The amount of time is not enough for a thorough analysis of the product, user and context, a thorough ViP process and the desired level of embodiment and visual quality of the results described in the project brief.

TOO BROAD SCOPE

The previous point leads to the fact that I took a too broad scope when defining the project brief. It is simply too much work to do future context research, interior future concept development, prototyping and testing physical models, while making sure to meet the TU Delft thesis requirements, achieving my personal goals and getting used to a new place to work and live as a graduate intern. The lesson here is that designing a concept vision, and embodying physical design are two very different things with different approaches; Designing a vision demands a broad, holistic research and a lot of dreaming, while embodying a physical design benefits from a more step-to-step approach, without thinking too much about the final result.

DESIGN DETAILING

A result of this too broad scope was that the different phases received less time than expected, leading to less design iterations in the concept development phase of the project. This was a natural result of the way the project was set up, but diving deeper into detailing and testing the design direction would have been valuable.

ACADEMIC/VIP VERSUS INDUSTRY/LCD

One of the major challenges of this project was the balance between the academic approach coming from the TU, and the practical approach at Lynk & Co Design. While it provides a fresh perspective to them, it has also felt like a limiting factor. The facilities and knowledge of the office in Gothenburg could have been used better when a more practical approach was taken, which would have allowed for colleagues getting more involved in the project. The long research/future framing phase kept these interactions on my project shallow for a period of time. Using and learning about the ViP approach was one of the objectives defined in my project brief, and it resulted in insights that could not have gathered without it, but it also limited on the embodiment side of things.

DESIGNING FOR A ANOTHER CULTURE

Whereas the logical decision was to make the Chinese market the target group, it happened to be harder than expected, and even felt wrong at some moments. While colleagues at LCD argue that the 'quirkiness and novelty of designs coming from the European designers' is exactly what the Chinese customer wants, it does not seem the path to good and long-lasting design. One of those colleagues mentioned at some point: 'Designing for a target group you don't know is like a puzzle that keeps on changing. In this situation it is easy to be thrown around by feedback you get, and it is better in this case to just trust on your own gut feeling.' Therefore, the limited amount of insights from Chinese customers was a limiting factor regarding this decision.

16. Personal Reflection

It was a real pleasure to get the chance to do this project within an automotive manufacturer, which has been the best learning environment I could have wished for at this point, as a young designer. It definitely was not easy, getting stuck in circles of thought several times, and having to prioritise and de-scope at multiple moments throughout the project. It led to learning more about myself, in which environment I thrive and what I would desire from the next steps in my career (/life).

PERSONAL DEVELOPMENT

Doing such an individual project, especially in a different country without knowing anyone beforehand, is challenging at times, but this definitely led to developing myself in ways that I did not expect. Whereas I expected to develop my hard skills; sketching, modelling, prototyping, the challenge for me within this project happened to be more intrinsic, and therefore the things I learned as well. Doing research and speaking with experts and colleagues made me question what I would like to contribute as a designer, and in what context and industry I would like to work.

MORAL AMBITION

These above mentioned thoughts often had a moral element in them. Whereas the first project brief from Lynk & Co was very practical in nature, I shifted this to a broader project with a ViP approach due to the desire to create valuable, long-lasting design. The way of working in Gothenburg is very fast-paced, and significantly influenced by the Chinese higher management; There is rather a focus on creating something different than the competition fast, instead of looking further ahead. This also does not provide the space to dive deeper into the target user, especially because they live on the other side of the world. This way of working did not always resonate with my beliefs, and made me question what the bigger goal of creating another car that is just the same (or a little bit different) as other cars is. I think these moral feelings are important to take seriously, but they are not always constructive in a project like this. These ideas found their way into the proposed vision, and will continue to define my next steps.

EXPECTATIONS

Whereas personal expectations (or ambition) of a project have empowered me in the past to perform well, I felt like they often worked against me throughout this project. Instead of working step-by-step towards a goal, the end result was often on top of my mind, making my own expectations of this project an unnecessary significant stakeholder. It showed me that, even when the experienced pressure is high, such as in a thesis project, a humble, sober attitude leads to a better result.

Looking back now, I am satisfied with how the process went and the experience I gained by doing it. Given the timeframe, I think I have been able to get the most out of it. There were phases that definitely felt like they could have been more efficient, such as the initial analysis phase and framing a future context, but the learnings mentioned in this chapter could not have happened without the hurdles I had to overcome.

Zooming out, I look back on some amazing years of studying at the IDE faculty at the TU Delft. I developed myself, my skill set and got to know amazing people. I now take some well-deserved time off, setting up the next step in my career.

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Figure 99
Credit: Apple

Figure 103
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Figure 109
Credit: Just planes

Thank you for reading.

Please reach out for more information about the project.

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Graduate Student - MSc Integrated Product Design

Göteborg, June 2024

Lynk&Co Design

TU Delft