KONSTFACK
University of Arts, Crafts and Design

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WORK ON TRACK!

A train interior design concept to meet contemporary work trends and needs

ABSTRACT

In a future vision for rail travel, trains will be designed as an activity-based whole space, with different areas for various activities, such as relaxing, socialising or family bonding. My degree project, in collaboration with SJ, proposes a concept carriage dedicated to work, analogous to spending a day at a mobile coworking space. By recognising the new ways of working, this carriage will cater for the needs of different individuals and various types of work and will include private digital meeting spaces, group compartments, collaborative open spaces and cocoon-like seating options in quiet areas. Unlike other modes of transportation, trains allow for passengers to navigate and experience different spaces. By enhancing the use of space and incorporating amenities that improve the user experience, I aim to transform the perception of long train journeys from tedious to exciting and allow a more seamless and efficient way of getting work done while travelling. Ultimately, this degree project encourages sustainable travel through user-centred design.

Key words: Sustainability, Long-distance train travel, Passenger experience, Future of rail, Co-working space, Travelling, Speculative design, Switch from aviation to rail, Activity-based train

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INTRODUCTION

Background

When I was calculating my individual carbon footprint last year, I thought it would be pretty low. I consider myself quite a conscious consumer, my diet is mostly plant-based, I buy almost everything second-hand, take public transport, etc. However, I am an expat in Sweden and often fly home to visit my family that lives in Portugal or Spain, as well as to travel to other places on my holidays. The fact that I go on a couple trips per year increased my footprint considerably more than any other factors.

Transportation is one of the fields where our individual choices have the highest impact. Choosing to use public transportation, cycling or walking instead of driving can significantly reduce emissions. However, air travel, though it may be used less frequently, is yet another significant source of emissions, so choosing to travel less, or choosing more sustainable forms of transportation such as trains, can help reduce the environmental impact significantly.

For different reasons, most people are not likely to compromise on traveling. Thus, it is more likely people will choose a more sustainable alternative to flying instead of cutting down on travel. This is what initially prompted my research question: How can we continue to travel while still adhering to a responsible personal carbon budget? As well as how does the future of sustainable travel look like?

After conducting the research presented in Chapter 2, I arrived at the conclusion that trains are the most sustainable alternative for long-distance travel. Consequently, my project centred on investigating strategies to encourage the adoption of trains in this context. Chapter 3 delves into the research process and outlines the approach I adopted. In Chapter 4, I shift the focus to user research and present my design proposal based on the insights gathered.

Methodolgy

I developed this project using a design thinking[1] process called the double diamond[2], which I will explain in more detail in chapter 3. I chose this methodology because it allows us to start with broad and ambiguous problems and converges until it frames a specific issue to solve. Furthermore, it is a human centered design process that starts with a deep understanding of people that the design proposal and their needs, as well as deep understanding of the entire actor network[3] around the central issue.

As shown in the graph below, I started from a broad question of sustainable travel, exploring all the possibilities and directions and from the need finding and research I converged further into the final research question.

How might travelling be more sustainable?	.....	One approach is to travel by rail instead of air
		⋮
One approach is to make the experience better for the passenger.	.....	**How might traveling long distances by train be a more widely adopted option?**
⋮		
How might the passenger experience of long distance train travel be improved?	.....	One approach is to address more specific passenger needs designing the train space by atmospheres/activities
		⋮
Choosing a persona: Narrow the scope of the project to passengers that want to work while traveling	.....	**How might the train journey be designed to cover as many different passengers' needs as possible, yet remain dynamic?**
⋮		

HOW MIGHT THE TRAIN JOURNEY BE DESIGNED TO COVER AS MANY WORKERS' NEEDS AS POSSIBLE, YET REMAIN DYNAMIC?

HOW MIGHT WORKING FROM THE TRAIN BE LIKE SPENDING THE DAY AT A COWORKING SPACE?

Table 1 Process of defining the research question

The focus of this research is on daytime long-distance train travel, excluding night trains. By long-distance, it is considered journeys of at least three hours. However, the aim is to examine train journeys where passengers spend the majority of the day on the train, or at least a whole morning or afternoon. This allows for considering the train as a complete space for movement, interaction, and activities, rather than just a temporary seating area.

Many times, a train connection between two cities that is less than five hours might still end up taking the same time as flying, or even less, when adding the extra time that is required to get to the airport, for control checks etc. The challenge comes with journeys longer than that, and leisure travellers feel they are using vacation time on transportation. For companies it becomes a significant expense if they need to pay for traveling time, or too long to ask workers to travel after working hours, or time lost during working hours. The goal of my project is to challenge the perception of traveling time as time lost, as well as spending the whole day from unthinkable and tedious to acceptable and even a little bit thrilling.

For this I have done an analogy between working from a train with spending a day at a coworking space. I considered a coworking space that follows an activity-based design, offering areas for different activities.

This research looks at how a train carriage interior can be designed to cover as many workers' needs as possible yet remain a dynamic space, which could still be used for something else when needed. Looking at the train as a pleasant space to spend time in rather than just a mean of transportation.

Framing the project and collaboration with SJ

Despite Sweden being among the pioneers in implementing a carbon tax, its greenhouse gas emissions per capita remain high, at around 9 tons annually. The majority of Swedes are concerned about climate change and recognize that aviation plays a significant role. However, they tend to fly more frequently than the worldwide average, with international air travel accounting for approximately 10% of their consumption-based emissions.[4]

The need to adopt more sustainable transportation options like trains is growing, but simply raising awareness about the issue doesn't seem to be sufficient. This project aims to explore the role that design can play at helping increase the likelihood for people to choose train travel as an alternative to flying. I have decided to collaborate with SJ, the national train company of Sweden, to explore ways to design the experience of long-distance day travel by train to be more appealing for passengers. Throughout this project I looked at the future of rail passenger experience as well as of working habits, in order to design in accordance with those visions of the future and respective needs. A good understanding of the current and future needs of passengers who wish to work while traveling is a crucial base to be able to answer them. Thus, increase passenger satisfaction and help SJ retain their customers and remain competitive, as well as compete with flying.

Making long-distance day travel more appealing also aims at increasing the use of rail connections from Sweden to the rest of Europe. The combination of day travel and night travel may open possibilities for SJ to hold longer-distance trips further into Europe.

This project aims to examine the future of train travel and consider how SJ can adapt to the evolving landscape. The focus will be on identifying the needs of train travellers and providing an overview of potential solutions (proof of concept level) without delving too deeply into finding specific solutions. Instead, the project will provide a general understanding to inspire what should be taken in account by SJ for future designs based on the findings. The project will be based on user research and will draw on insights from other fields, such as activity-based workspaces, to inform the study.

2
STARTING POINTS

Impact of aviation

It is well known that flights cause a lot of Co2 emissions and are not the most sustainable way of travelling. In total aviation is responsible for 2.5% of the global human-induced CO2 emissions, and 12% of CO2 emissions from all transports sources, compared to 74% from road transport, and 1% from rail. Transportation all together accounts for 24% of CO2 emissions of the world's total emissions.[5,]

While the impact of aviation on global pollution scale may not seem shockingly significant, it is a especially significant factor to consider when examining individual's carbon footprint. When evaluating the impact of different transportation choices on our personal carbon emissions, the narrative changes dramatically.

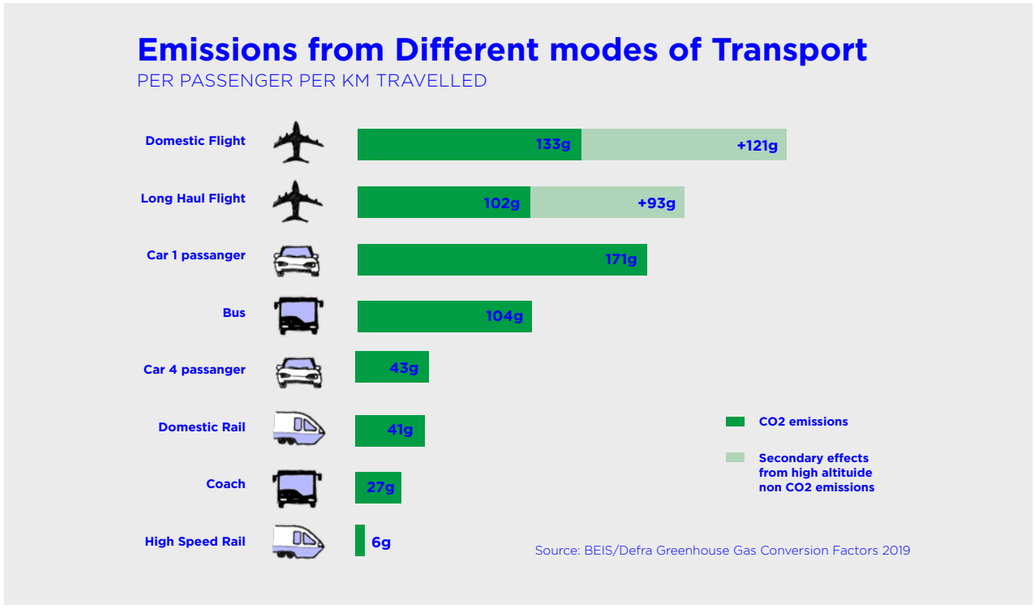


Fig.1 Emissions flying in comparison with other means of transportation[6]

We are racing to reach net-zero greenhouse gas emissions by 2050 and keep alive the goal of limiting warming to 1.5°C. If we fail to achieve such goals the impacts of climate change are projected to become significantly more severe and difficult to adapt to, as well as irreversible.

Aviation emits just under one billion tons of CO2 each year, of which 81% is for passenger travel, 19% freight[7]. If we add the emissions from processing and distributing aviation fuel, manufacturing and maintenance of aircraft, ground support vehicles and airports, the number increases significantly. The emissions are not likely to lower considerably in the next 50 years according to the global CO2 emissions from transport in the IEA's Sustainable Development Scenario to 2070[8].

Fighting climate change requires action at all levels, state, corporate, and individual. Government policies and regulations are crucial in reducing greenhouse gas emissions and promoting sustainable practices, as well as corporations who have a responsibility to reduce their own emissions and conduct sustainable business practices. It is important that all levels of society work together to address this global issue, and individuals can play a role as well in reducing their own carbon footprint through sustainable choices.

Individual carbon allowance and personal choices

It is debatable how much responsibility should be put on the individual's shoulders and if there should even be such a thing as an individual carbon allowance. To control and restrict people's carbon allowance would be a very complex and polemical process, however, to be aware of one's own footprint and what the sustainable quota per capita is, can be a good guideline for a sustainable lifestyle and responsible consumption.

The amount of CO2 emissions produced by an average person can vary depending on the country and individual lifestyle. However, according to Statistics Sweden[9] the average CO2 emissions in Sweden in 2020 is an average of 7.6 metric tons per capita.

To achieve net zero CO2 emissions by 2050, the IPCC estimates that the average global per capita CO2 emissions should be around 2.3 tones per year by 2050.[10] The global individual carbon allowance is not a widely accepted or universally agreed upon concept. The actual per capita CO2 emissions vary greatly around the world, with developed countries generally having higher emissions than developing countries. The actual per capita CO2 emissions can also vary depending on the context in which it is being measured, such as for personal consumption or for a company's emissions. However, I am referring to these statistics for general comparison. To put flying in this scale, a round-trip from Stockholm to Barcelona produces an average 0.42 tons CO2 per economy passenger, and a round-trip Stockholm-Bangkok 2.7 tons.[11] As we can see in fig1. train travel can be up to 20 times less.

Additionally, while reducing CO2 emissions is important, it's not the only way to measure the impact of transportation on the environment. Other factors such as water usage, waste, deforestation, and biodiversity loss are also important indicators of environmental impact.

Carbon tunnel vision and carbon offsetting

Carbon Tunnel Vision (CTV)[12] refers to a phenomenon where individuals and organizations focus solely on reducing their carbon footprint through emissions reduction, without considering the broader impacts of their actions on other environmental and social issues. CTV can lead to unintended consequences, such as an organization shifting to a more carbon-intensive process, or to more emissions in other areas such as water or land use, in order to offset their emissions in a particular area.

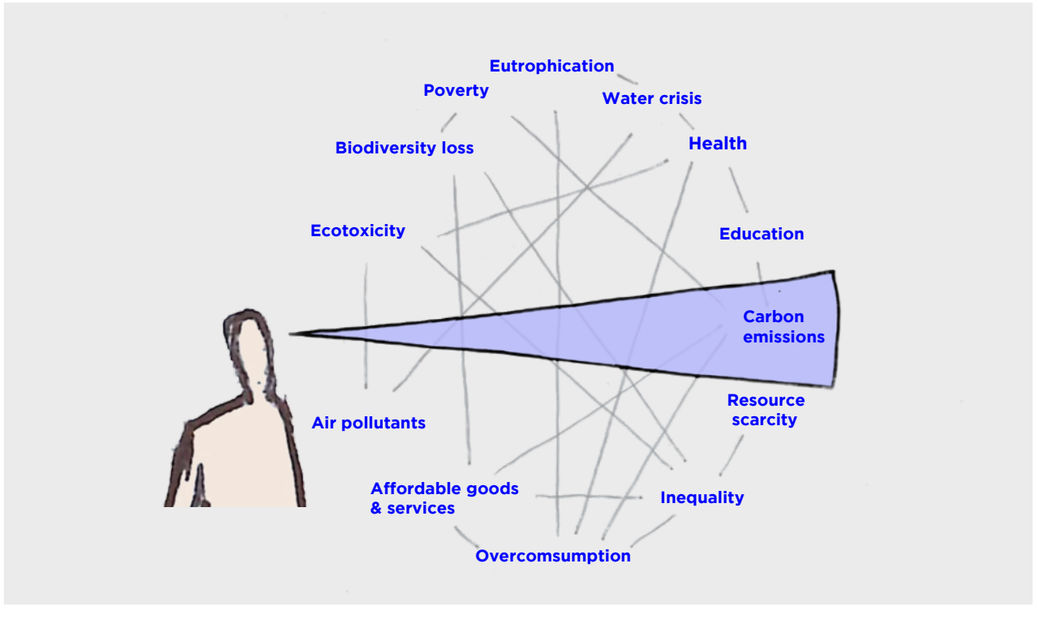


Fig.2 Illustration of carbon tunnel vision

Focusing uniquely in the CO2 emissions creates room for greenwashing[13] tactics. Oil and gas companies have begun to market their products as “clean” or “carbon neutral” by bundling them with carbon offsets. Carbon offsetting for flights' CO2 emissions is a way for individuals and organizations to compensate for their greenhouse gas emissions by funding projects that remove or reduce an equivalent amount of carbon dioxide from the atmosphere. However, carbon offsetting is not considered a long-term solution to reducing emissions from air travel, and it has several limitations and criticisms.

First, carbon offsetting projects are not always verifiable or transparent, and it can be difficult to ensure that the emissions reductions claimed by a project are real and permanent. Additionally, it is not always possible to offset the emissions from a specific flight, as the carbon offset projects may not be located near the flight’s origin or destination.[14]

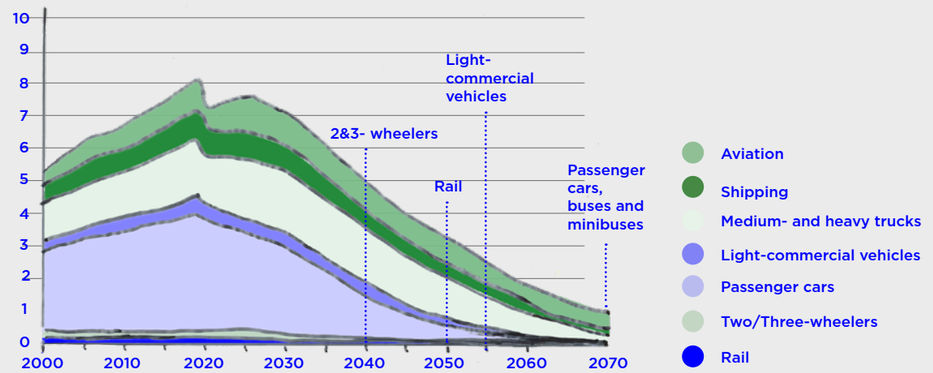
Second, carbon offsetting does not address the other environmental impacts of air travel such as noise pollution, air pollution and wildlife conservation. The emissions from aircrafts are much more potent greenhouse gases than ground vehicles and they also have other impacts like nitrogen oxides and contrails, which can have a warming effect on the planet.

Third, carbon offsetting can create a sense of complacency, where individuals and organizations believe that they have done enough to address their environmental impact by offsetting their emissions, rather than taking steps to reduce their emissions in the first place. Fossil fuel companies are using this narrative to create a distraction from the fact that we need to transition away from fossil fuels now to avoid the worst impacts of climate change.

Therefore, while carbon offsetting can be a useful tool to reduce the environmental impact of air travel, it should not be considered a substitute for reducing emissions through other means such as choosing more efficient forms of transportation, reducing unnecessary travel, or using cleaner technologies.

What’s the future of traveling?

How can we “afford” to keep on traveling? The need and desire for long-distance travel will prevail, for leisure, business and “life” reasons. Aviation is the first choice for long distances for its speed and cost advantage, however the most environmentally sustainable option today is high-speed rail. According to the IEA’s Sustainable Development Scenario to 2070 in *fig.3*, rail has promising chances to achieve net zero emissions by 2050. The IEA’s Energy Transitions for a Net-Zero Emissions vision for train travel is to provide a robust and low-carbon transport system that is accessible and affordable to all. This vision includes the deployment of electric and hydrogen trains, as well as the expansion of high-speed rail networks, which will lead to a significant reduction in emissions from the transportation sector. According to the IEA’s scenario the emissions for long-distance road freight (large trucks), aviation and shipping are particularly difficult to eliminate (*fig. 3*). The potential for hydrogen as a fuel, or battery electricity to run planes, ships and large trucks is limited by the range and power required; the size and weight of batteries or hydrogen fuel tanks would be much larger and heavier than current combustion engines.[15]



Notes: Dotted lines indicate the year which various modes have lagerly stopped consuming fossil fuels and hence no longer contribute to direct emissions of CO2 from fossil fuel comnbustion. Residual emissions in transport are compensated by negative emissions technologies, such as BECCS and DAC, in the power and other energy transformation sectors. Source IEA 2020

Fig.3 Global CO2 emissions by mode transport sustainable development scenario 2000-70 by IEA

Train traveling

Train travel has several environmental benefits beyond reducing CO2 emissions, including:
Lower air pollution: Trains emit significantly less air pollutants than cars and airplanes, which can lead to improved air quality and public health; Reduced noise pollution: Trains are generally quieter than cars and airplanes, which can lead to a reduction in noise pollution and improved quality of life for residents near transportation corridors.
Reduced land use: Trains can transport a larger number of people and goods using less land compared to cars and airplanes, which can help preserve natural habitats and farmland.
Reduced energy consumption: Trains are generally more energy-efficient than cars and airplanes, which can help reduce dependence on fossil fuels.
Improved public transportation: Trains can serve as a backbone of public transportation systems, connecting people to jobs, services, and other destinations, which can help reduce traffic congestion, air pollution and dependence on personal cars.
Reduced accident rate: Train travel is relatively safer than other forms of transportation.
Economic benefits: Train travel can also provide economic benefits, such as creating jobs, supporting local businesses, and increasing accessibility to jobs and services for people in rural and suburban areas.[16]

Travelling trends and indicators - what's happening in the industry

There is an ongoing momentum around shifting to train travel that can be identified from trends regarding train travelling and flying. These trends are manifesting in several ways:

Regulations and solutions are being developed to encourage the shift. We can see projects and investment in infrastructure to improve rail connections across Europe like the The TEN-T Core Network initiative connecting all the major cities[17]. Night train lines are also increasing across Europe. Taking as an example, the SJ night train from Stockholm to Hamburg opened in the September 2022 and the route extended soon after down to Berlin in March 2023. The Euro Night Sprinter conceptual project is a night high-speed metro between the cities of Europe.[18]

We can notice taxes and bans on aviation: Belgium introduced a new tax on private jets[19] and France banned domestic short-haul flights between cities that are connected by high-speed train.[20]

New platforms are being developed where you can see train connections across Europe and tickets can be purchased in one place such as the railway company Deutsche Bahn's app.

Environmental activism against flying like the Swedish movement *flygskam* (meaning, "flight shame") led by Greta Thunberg's mother got more than 22k signatures on a pledge to go flight-free in 2020.[21] Greenpeace's Fossil Add Ban campaign to forbid aviation advertising was approved by the city of Stockholm and become a concrete proposal in the city's budget for 2023.[22]
Business's promoting train travel as a way to lower the company's footprint.[23]
The European Commissioner for Transport Adina-Ioana Valean at InnoTrans Berlin gives her views on the future of mobility: "It looks like high-speed rails connecting all the capitals of Europe, at least, aim to double the services/volumes of merchandise moved by rail by 2030 and triple it by 2050. This is the golden age in which train is again the most attractive way for people and companies to move in Europe".[24]

Factors for choice of transport mode

The choice of mode of transport is determined for 60% of users by the speed of the alternatives[25]. Other factors that influence the choice are reliability, ease, comfort and experience. Based on my own need-finding research the main decision factor for people traveling for leisure was based on costs, very often flying is notoriously cheaper than traveling by train. However, when travelling for work the costs are not usually considered as a crucial factor of choice compared with leisure travel, as the company covers the costs.

I had a conversation with the climate and environment lead of a publicly traded Swedish company with approximately 1500 employees, where she is trying to incentivize workers to travel by train instead of flying. Some of the things she most often hears or interprets from the resistance some works pose against train travel were founded on the idea of trains often being delayed and the fear of being late for a meeting. Another main justification is the duration and the perception that train travel just means more traveling time. The "lifestyle" also plays a part in associating flying with privilege, although this notion is changing, still, many people associate flying with power and luxury. Another notion related to lifestyle is that travelling regularly used to be seen as a benefit in the consulting industry, which is also changing, and being at home has increased in value. Another factor lies in habit. Some employees say they 'just' got used to flying, they know the routine and how everything works. Taking a train sometimes means breaking their habits and routine, like when trying something new. Lastly, it often happens that employees collect points from each flight that gives them benefits over time and that may also be a motivation to choose to fly.

Design for behaviour change

Goal Framing Theory[26] helps understand what drives people to certain behaviours based one the three core goal frames: Gain - to guard and improve one's resources; Hedonic - to improve the way one feels right now; and Normative - to act appropriately for the group. These three frames can be sub categorized into seven more detailed sub-goals.

Gain	**Value for money**	To get value for money, pay a reasonable price, avoid wasting money
Gain	**Quality**	To get something of high quality and reliability, meeting one's highest expectations
Gain/Hedonic	**Safety**	To feel safe, calm and prepared for the unforeseen
Hedonic	**Stimulation**	To get something exciting, stimulating or unique, avoiding dullness
Hedonic	**Convenience**	To get something pleasant and comfortable, avoiding hassle and discomfort
Normative	**Social acceptance**	To make a good impression, identifying with peers, conforming to expectations
Normative	**Ethics**	To act according to moral principles and obligations, avoiding guilt.

Source: Barbopoulos (2012)

Table 2 Goal framing Theory

Designing with a focus on creating awareness of the problem and addressing the normative aspect may be effective in driving behaviour change. However, I choose not to include this approach in my projects and focused instead on combining the gain and hedonic frames. I focused on researching how to enhance the passenger experience and make the journey more worthwhile, thus providing value for money.

When it comes to quality and safety SJ is already reaching quite a high standard. There is a need for some improvements with punctuality and hygiene (toilets) that have implications for the holistic experience of the journey. SJ is aware that those points are top priority for improving customer satisfaction, however I did not focus my research on them

Train travel will never beat flying for convenience in terms of time, nor car driving in terms of schedule flexibility. Nevertheless, train travel has some competitive advantages such as: comfort, free time, connectivity, experience and space. I mainly focused on those aspects in relation to work. By using the travel time to simultaneously work efficiently, the perception will change from a loss of time to gaining time, and therefore train travel will be classified as high-quality time, that gives good value for money, and maybe even as an exciting break from the office routine.

Workplace design

Though out history we have seen workplaces design adapt to workers needs and evolve to promote productivity and well-being. Starting with office design in the 1950´s where employees would sit in long corridor offices, executive and managers sat in their private office all around the edges and in the middle of the office space there would be a sea of desks. This post war office layout would resemble a factory, with little privacy and a lot of noise because of the typing sounds of accounting machines. In the 1960's Herman Miller's Action Office concept was designed to be the office of the future, built around communication and movement. It aimed to provide workers with a flexible space consisting of a series of furniture designed by Robert Propst, with adjustable position to suit different tasks. Each worker had a couple of stations that including a coffee table, semi-enclosed phone booth, a bookshelf and a standing desk. This novel vision was accompanied by novel principals such as that workers would get more done when they must move around. The action office II followed as a more economical version that included three standing walls that accidentally led to the cubicle design. The cubicle layout consisted of a desk space boxed by three right corner walls. This layout was widely adopted as a cheap way to fit as many workers as possible into work areas. Instead of loud and no privacy offices people were now trapped inside a tiny space covered by giant fabric walls, which lead to the feeling of isolation and solitude leading to demotivation. By the early 2000's this was replaced by a modern open plan layout, popular in Silicon Valley, that meant to foster collaboration and disrupt the idea of hierarchy by removing all walls and divisions. But in contrast to the 1950´s open planned offices became quite quiet and the idea of talking and collaborating didn't really result as expected as the loss of privacy reared its head again.[27]
The concept of activity-based office has become recently popular, which like the action office are meant to provide workers with different zones designed for each activity, however these zones are bigger and for sharing instead of individual.

Fig.4 Cubicle individual office spaces

Fig.5 Open-plan office

Fig.6 Activity-based office

Fig.7 Biophilic design office

Activity-based workplace

Activity-based working is a strategy that allows people to work when, where and how they see fit for their task. We would naturally choose different spaces to go to for different types of activities like a comfortable coach for reading, a cafe for sending some emails and a library for concentration. An activity-based office is designed to answer all types of work scenarios. It also has some social implications. Maybe you are no longer the owner of your desk, but everyone owns the whole office where everyone works together. You can choose who you sit next to, or work in isolation. It includes spaces designed to fit the different activities but also that fit better different employees' personalities and needs, different people work better in different conditions. That's the main idea behind activity-based workplaces design, to include every type of activity and offer the maximum amount of flexibility so that workers can be productive.

Usually included are designed spaces for: private phone calls like individual booths; team meeting rooms from 2 to 6 people with whiteboards and monitors; open spaces with both sitting and standing desks, social spaces like a coffee shop environment; relaxing areas with comfortable seating; quiet small rooms with divisions or enclosed chairs.

I visited Nicole Morel, an architect at MER Architects, at their own activity-based office in Stockholm. MER specializes in office design, where activity-based workplace is one of several solutions, and my conversation with Nicole was about how office design is changing. Quiet spaces still need to be quiet, but the need for these quiet spaces today is usually not as big as before the pandemic (now that the office often is designed to function more for co-working or as a meeting hub, and focus work can happen somewhere else because of increased flexibility). Headphones with a noise-cancelling function is generally not a solution offered by the company as an alternative to a quiet space, but something that some people choose to use to be able to focus in any environment (because it suits them personally). Now defining an area for focus work is more about stating that you are not supposed to disturb or interrupt the people sitting there than necessarily making it the quietest space. However, some companies still want to offer that possibility as maybe not all the employees can work from home. In any case, usually, the quiet/focus areas and the social areas, like the kitchen, should not be next to each other.

Making spaces multifunctional that can be used for different activities according to need, is a way to optimize space and still offer areas for all activities. It is important to define what the rules are for each space and which use has priority. Offices are rarely full nowadays, so the number of desks and spaces also doesn't need to meet the total number of workers anymore, but instead an average of the people at the office per day. There is also less of a need for large meeting rooms and instead more small ones, and they should always be equipped for digital meetings, as so often some of the participants join remotely. Depending on the company there would be different divisions for different things. For instance, at MER they had an area for samples and prototypes and a library with inspirational books and cosy furniture where they would have breakfast on Fridays. This room was non-bookable and could be used for short meetings or for resting. It is also important to have meeting rooms that you can book and some you can't. There is a higher chance of getting a room when you need it when it isn't bookable, but it is also important to be able to guarantee a room. Most of the meeting rooms had glass walls but also curtains inside, which allow one to choose the level of privacy and are also sound absorbing.

Biophilic Design

Lastly, the designing of workplaces following biophilic design principles: Environmental psychology studies have shown how natural and man-made spaces affect our health, mental processes and social interactions. They have consistently suggested that the built environment supports human activity the best when it echoes the natural world. This can be achieved through scale, tone, dimension, light, layout and sound, among many other elements. Intentionally generating this type of environment can significantly curb stress and promote well-being.

Biophilia was already a trend before the pandemic, but it has accelerated since. After the lockdowns and being trapped in cities, working from small apartments, disconnection with the outside, people were able to understand the benefits of going out to parks and natural spaces, as well as the value of good work environments and atmospheres.

Hybrid working and the pandemic

The COVID-19 pandemic has accelerated the trend towards hybrid working, which combines remote work with office-based work. The pandemic has forced many organizations to quickly adapt to remote work, leading to an increased reliance on technology and digital tools for communication and collaboration. As a result, many employees have found that they can be just as productive working from home as they can be in an office. The pandemic has highlighted the need for flexible and adaptable work arrangements and has shown that hybrid work is a viable option for many organizations and employees.

Co-working spaces

Co-working spaces are usually based on the principles of activity-based workspace design and can be used by different people daily. Although many co-working places have regular users who stay for extended periods, they are also often open to individuals who just drop in to work for the day. One key aspect of coworking spaces is community building, with spaces designed for "curated collisions," where the environment encourages chance encounters and networking opportunities among users.

Are co-working spaces the future?
With the trend towards remote work and flexible work arrangements, co-working spaces provide a flexible and adaptable alternative to traditional office spaces. Co-working spaces also provide a range of amenities, such as meeting rooms, high-speed internet, and shared workstations, making them a cost-effective solution for small businesses and independent workers. With the growth of the *gig economy*[28] and digital freelance workers, demand for coworking spaces is expected to increase[29]. Furthermore, studies[30] have shown that the social and cultural benefits of coworking can lead to improved productivity and job satisfaction for members. Coworking spaces function as a hub to connect people, to facilitate collaborations and finding new business opportunities. Furthermore, the pandemic has raised question about whether companies should keep their office leases or go remote, and workers have seen the benefit of working from home to avoid daily commuting. Working from home may have its consequences as well, therefore, one possible vision for the future of work will lie in the emergence of many new coworking spaces closer to suburban areas.

On a talk with Samantha Hulls, who has been working from co-working spaces for many

years and is currently operations coordinator at OneCoworking, a company focused on creating a network of coworking spaces where individuals and teams can access coworking spaces around the world with one membership. We talked about how work habits are changing, especially after the pandemic, and what trends can be observed in how co-working spaces are being used and adapting.

One observation is that now everyone can work from their homes and will often stay in to do focus work without distractions. Therefore, silent areas become less used and instead people go to coworking spaces when they want to be social and work next to others. Towards the end of the week, there are often more people in as well.

Remote work, especially after the pandemic also means more digital meetings and calls. It is quite important for people in co-working spaces to have available spaces for private calls when needed. Small individual phone booths have become very popular. Although it was a rough estimate, Samantha thought the ratio should be to offer at least one private meeting space per each ten people.

Coworking spaces must offer high speed internet, plugs all around the room, comfortable sitting, coffee/ tea stations within reach. Having rooms for team meetings and workshops, and an area to relax is also very important. Additionally, people expect that coworking spaces will also have some playful amenities, like a ball pit, hammocks with a view or free beer on tap after working hours. Most coworking places try to have their distinctive features that makes them fun and stand out.

Samantha was part of the team designing a new coworking space and said it was also quite important to pay attention to all the little things like where to place the plugs and cables around the desks to create less hazard.

Usually, coworking spaces always have someone at the front desk that welcomes and takes new customers for a tour around on their first day. This human contact is quite important, it speeds the process of getting settled down quite quickly and gives access to all important information on how each different area works and how you're expected to behave. Giving everyone a good introduction is essential for a good functioning of that space and that everyone feels comfortable and takes maximum advantage of it.

New work habits impact on travel

The increase of remote and flexible working conditions also opens opportunities for new ways to travel, and specially to travel slower. *Digital nomads*[31] are one example of how people are using that flexibility to create a new way of living. However, in less extreme cases, we can also observe that now, when people decide to visit someplace, more often choose to stay longer as they can work remotely from the place they are visiting, instead of taking days off or just staying for the weekend. In addition, the option to work while traveling by train also opens opportunities to travel longer distances without losing time for the trip. For example, as before maybe someone would consider flying for a weekend trip somewhere on a Friday after working hours and return on Sunday night. Now, with the possibility of working remotely from a train, one could spend the day working from the train on a Friday and arrive just as the working day ends, as well as return on Monday instead of rushing back on Sunday. In this scenario spending 9 hours would actually save quality time.

3
ANALYSIS

Methodology

This project was developed using a design thinking approach, with user research as the foundation for defining needs and guiding the development of the final design proposal. The process included involving users and stakeholders in the co-creation of the solution, in order to ensure that the final proposal meets their specific needs and addresses their pain points.

The double diamond framework chosen is a design thinking process model used as a guide through the design process. This model is based on the idea that the design process is non-linear and iterative, and that should be open to exploring different ideas and possibilities before narrowing down to a final solution.

The design process and the methods employed are extensively elucidated in *Appendix 1*, which serves as a comprehensive reference for the research conducted and analysis undertaken. This appendix outlines the specific research that formed the foundation of the analysis and decision-making process throughout the design endeavor.

Experience factors insights

Through user research, in specific the need finding interviews and observations explained in *Appendix 1*, I identified and categorized various insights related to different experience factors.

Comfort:
While trains are often viewed as comfortable in terms of seating, the cleanliness and smell of the toilets is not as pleasant. They are frequently dirty and have unpleasant odours.

Free-time: Perception of time on the train
Even though individuals are aware of all the activities they can do during a train journey, they still perceive the train journey as “lost” time or not worthwhile enough to opt to take a whole day train trip over flying. They do not trust that train trips can be used effectively for work. The leisure activities available are seen as a way to pass the time rather than as high-quality activities.

Space: Use of space in the train
Space is often cited as a top benefit of train travel, but when passengers were asked how they utilize it, it was clear that it’s not fully utilized. While train seats are generally more spacious than those in planes and buses, and there is more room to move around, many passengers don’t take advantage of this. They tend only get up from their seat when they need to use the restroom or buy something from the bistro. The possibility to take a walk, stretch, and explore different compartments is there, but people don’t often do it without a specific purpose or trigger. However, people have a positive attitude towards using the available spaces more often, they just need to feel that it is expected of them to do so. This finding suggests that there is room for improvement in how space is utilized and interacted with on trains.

Connectivity:
Access to Wi-Fi and mobile networks is another significant convenience of train travel, but it is not heavily relied upon by passengers. This can be disappointing. Many passengers download all the materials they need beforehand to ensure they have it.

Experience:
Overall, the perception of train travel is positive. Passengers appreciate that train stations are in city centers, and they do not have to arrive at the station too early. They find the time on board to be enjoyable, they appreciate the sensation of movement, and enjoy looking out the windows and observing the scenery. They believe that trains generally have better service than other modes of transportation. Boarding is considered smoother than on airplanes, and passengers feel more freedom and control over their experience. All previous factors also contribute to a positive overall experience.

In-depth user interviews insights

The insights that follow were obtained from the indepth interviews explained in *Appendix 1*. People were split between being quite ruthless and taking calls if needed, remaining in their seats, or were quite disturbed by calls and preferred going somewhere else for privacy. Some people like open plans and sitting next to other people that are also working, as it helps them to concentrate comparing the experience to sitting at a café where there is a little bit of buzz, which can be inspiring. Other people like silence and some even wished they could have their private office on the train, to be able to take all meetings and calls needed in privacy. Some people mentioned the trains don’t offer enough table space, and that if all “four-seat facing”[32] with table are occupied it feels even more cramped than the individual table. It also came up a couple of times that people miss having their extra screen, not only because it facilitates work, but also because it allows for a better posture, rather than staring down into a laptop.
What caused a bad experience or a dislike for the seat is most often caused by the behaviour of other passengers, like those taking loud calls or eating.

Most interviewees said they would have to adapt their work to fit the train. Firstly, because they can’t rely on the Wi-Fi, but also that the conditions won’t make their work efficient.

On the one hand, people prefer the window seat because they don’t need to get up when the other person needs to leave their seat. On the other hand, some people prefer the aisle, so they are more independent to leave their seats whenever they like.

No one usually leaves their seat for more than to go to the toilet, although everyone liked the idea of knowing they can do so. Most people would feel uneasy about leaving their computer behind, especially the work computer, and that would be the main reason for not wanting to leave their seats. They would usually at the very least pack their computer away and leave the backpack on their seat, or in one case even take it

Areas for improvement

I mapped the areas for improvement on how a train could better adapt to fit work needs:

Connectivity – it is a maximum priority for passengers to be able to rely on a steady Wi-Fi. Having information regarding what to expect from the connection throughout the journey would help to plan work accordingly.
Ergonomics – having adapted furniture and settings for working in the right posture.
Security of belongings – being able to leave your seat without worrying about belongings.
Atmosphere – most users agreed that it creates a better feeling when you are around other people that are working too. So having a distinctive area for working would be preferable.
Sound – offering both silent areas as well as areas where you can take your phone calls at your desk and chat to the person next to you without fear of disturbing other people, all within a working atmosphere.
Working amenities – Setting arrangements - every passenger has different working preferences, and also these preferences changes according to the type of work they are doing. Places to sit alone, places to sit next to others if travelling with company, places for having private meetings. Private compartments for teams, different seating arrangements, inspiring seats, seats looking out the window for the people that get motion sickness.
Desktop – Options for more table space, room for other things besides a laptop, like a mouse.
Privacy – some passengers appreciate having their own space like a more enclosed seating arrangement.
Air quality – improving the air quality through materials.
Acoustics – improving the acoustics through materials.

4
DESIGN PROPOSAL

Future Scenario

Based on all the previous research I am setting my design proposal to be in use in 10 years from now and design for a preferred future scenario. It is not a very distant away future but it still allows room for speculation. I will be setting my project to what the preferred future will be by then, which as in Fig10. is set between the probable and possible scopes.

I'm assuming that in a probable future there are not many changes in ten years, we will still be using the trains we use today, and business will continue as usual.

A possible future is one where nobody flies anymore because of the urge for carbon emission reductions. Fossil fuels are taxed heavily, there is a huge shaming around flying and individuals must declare their carbon emissions. In this future, everyone will start travelling very long distances by train. Governments open markets for trains, and the competition increases highly. Trains become like cruises, a hotel on wheels, a coworking space, a restaurant, an entertainment hub, some may even have a spa. Although this scenario is not probable, it would most likely be possible to build in a swimming pool into a train, in ten years.

My preferred scenario stands in between these two futures, mostly in the plausible scope.

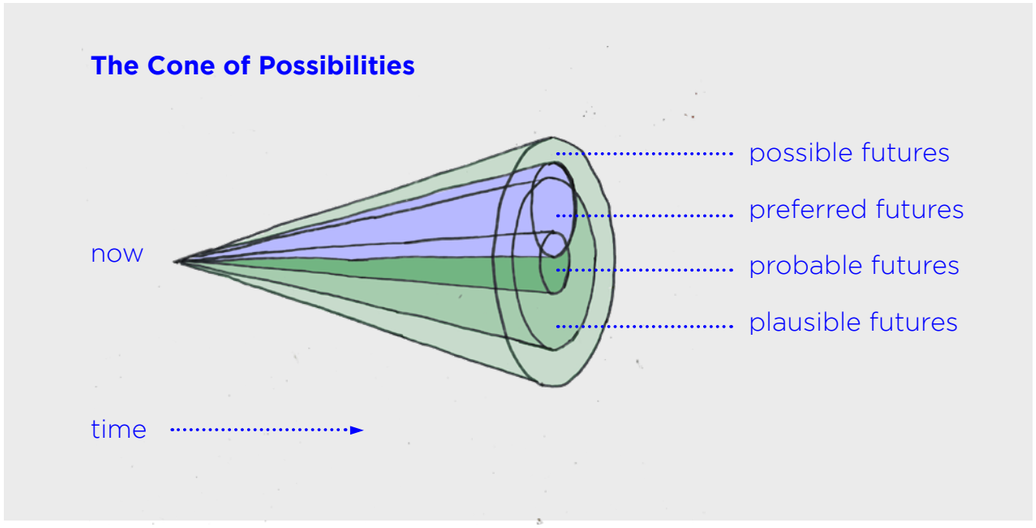


Fig.8 Speculative Design Cone of Possibilities

Activity-based train concept

Right now, high speed trains are designed to give each passenger a seat, the opportunity to store their luggage, access to toilets and a bar area. The latest model of SJ's high-speed train (renovated X2000) mapping looks like *Fig10*.

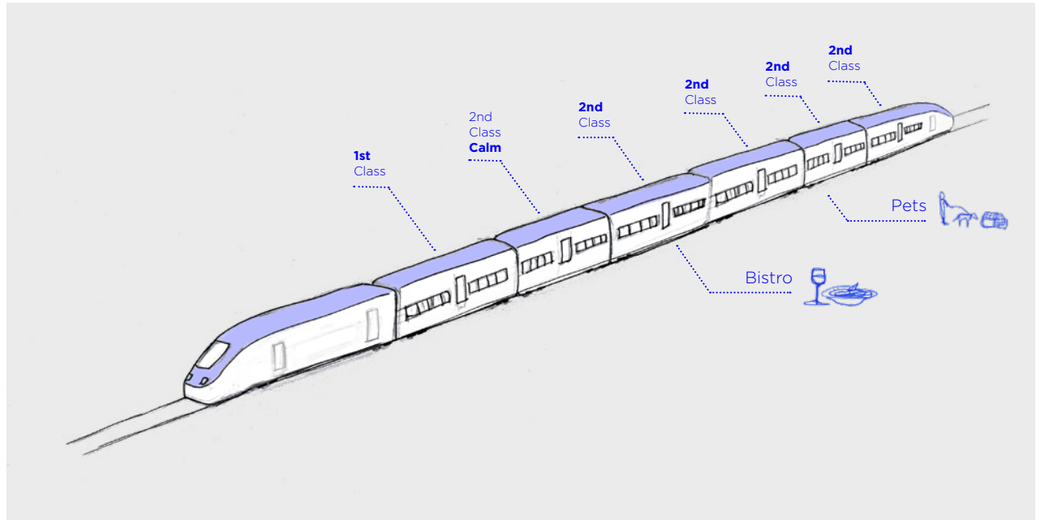


Fig.9 SJ fast train (X2000) current train mapping

In this project is set in a future vision for 2033, where trains will be used more regularly and for longer periods, as an alternative to flying. As train journeys get longer and more frequent, they will be rethought to offer a better experience, adaptable to as many passenger needs[33]. Trains will be designed to offer various areas for different activities (*Fig.11)*. Passengers can move around the entire train and utilize different areas. It will still be possible to book a specific seat, but it will also be possible to rebook it during the journey and move to another seat or area of the train. It will also be possible to book different seats for different periods of the trip in advance.

This activity-based train concept will no longer be divided by classes, instead you will find carriages designed for different activities. Fig.13 Each car will be dedicated to a specific activity and cater for a specific atmosphere. I learned from my interviews that there is a general fear of disturbing other people and there is a perception of the train travel as individual time where people appreciate silence and a calm atmosphere, however this is not at all always the case. For instance people travelling with company or with children don't desire that atmosphere yet feel they must adapt certain behaviours to not disturb others. For this exact reason I understood people would appreciate to be grouped with other people with similar motivations. I observed parents with children looking very stressed when their babies started crying because everyone else in the train would look at them.

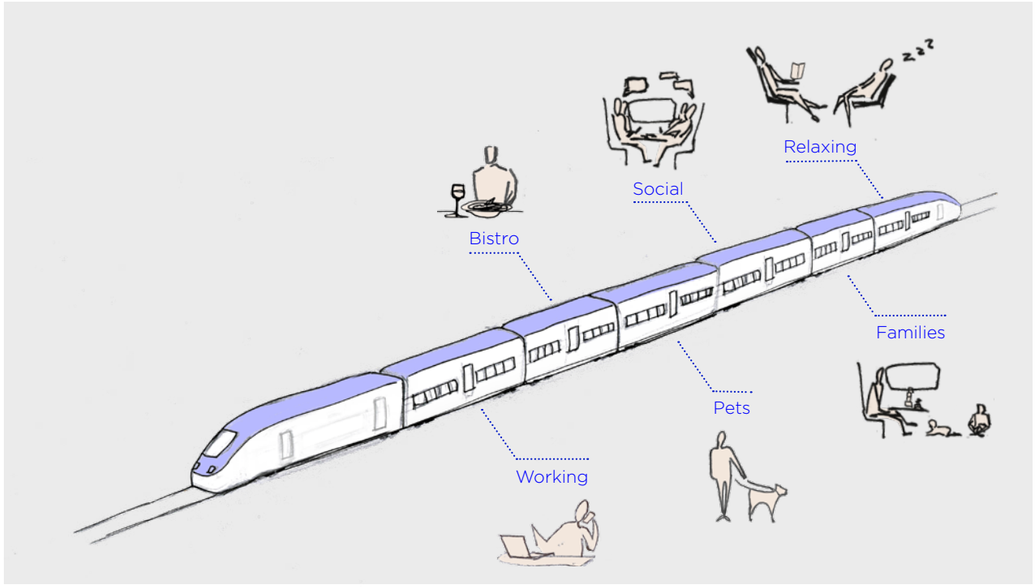


Fig.10 Activity-based train mapping

Besides the carriage for working, in this concept there would be a family carriage dedicated to families that would be designed to better fit the needs and entertainment for children and parents. A social carriage for when travelling with friends and not having to fear being too rowdy. This carriage would be designed to have an atmosphere closer to a bar and have seating arrangements to meet the needs of people travelling with company or having social motivations, and where it would be possible to meet other people. Another carriage could be dedicated to people who wish to relax, which is not only about silence, because one wouldn't relax in a silent atmosphere surrounded by people working. This carriage could instead include a library with a selection of books and magazines available to borrow, entertainment screens or massage chairs.

In ten years, SJ will have implemented the technology needed for its trains to have reliable Wi-Fi at all times. It will be possible to make unfaulty video calls, as well as to stream films.

In this scenario it will be much more accessible to travel between European countries, combining night trains with day trains. More cities will be connected by high-speed rail as new lines will keep on opening. Sj will play an important role in connecting Sweden to the rest of Europe. Complementary technologies will allow booking journeys across different countries in a simple way and optimize the best connections.

The working carriage

This project proposes the design for the work carriage within the activity-based train concept. Drawing inspiration from coworking spaces and activity-based offices, I have translated the identified user needs into a design concept that reflects how the interior of this carriage could be envisioned. The proposal takes as a reference an SJ train profile and layout, as well as the 2nd class seat proportions and pitch. In designing this train carriage, I have adopted an approach where I treat it more like an interior space rather than merely a means of transportation, focusing on careful material choices and forms. While I acknowledge the reasoning behind the current design of trains, my proposal aims to challenge those conventions and explore new possibilities.

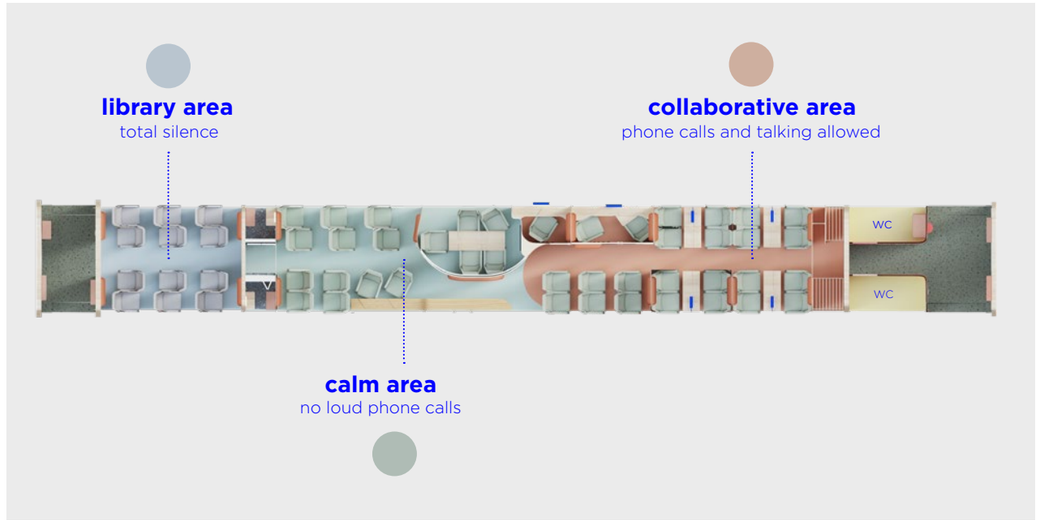
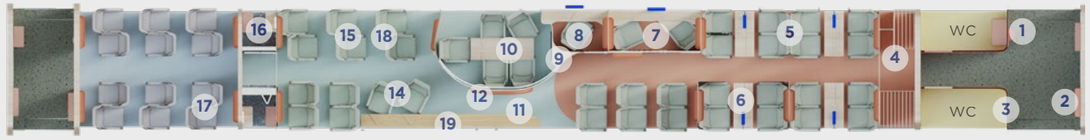
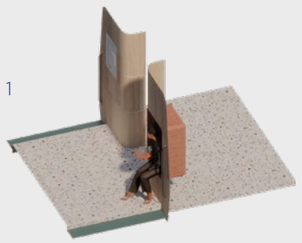


Fig.11 Work carriage areas

This carriage is divided into three areas of different sound levels, Fig. 12 and are colour coded. The collaborative area has no sound restrictions, and is the area intended for teamwork and taking calls at your seat. The library area, is intended for individual focus work and as in a library you are supposed to be in total silence. There is a door that separates this area from the rest to guarantee the silence. The calm area is something in between, it consists mostly of individual seats, it is not planned for teamwork and there you should speak quietly, however there is no door that completely separates it from the collaborative area. All areas will have information posters reminding passengers of the "rules". In all three areas you should still use your headphones for music, as for calls these should not be on loudspeaker. Warm food will be served in the bistro carriage and only cold food is allowed in the work carriage, as happens in offices.



1



sound absorving
seat for calls

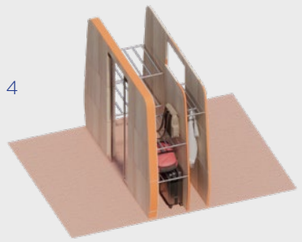
2

leaning seats

3

information panel and
booking screen

4



luggage and coats rack

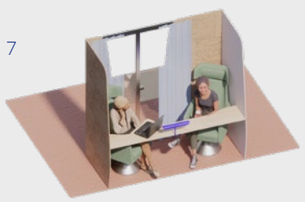
5

open plan area

6

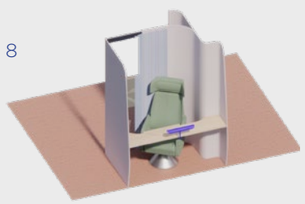
four seats with divider

7



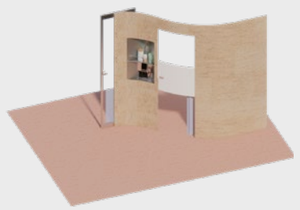
office for two people

8



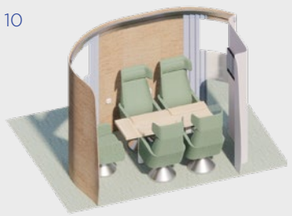
individual office

9



coffee and water
station

10

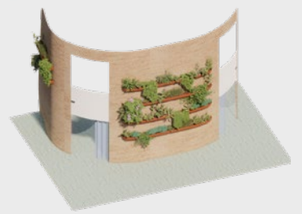


conference room

11

standing desk

12

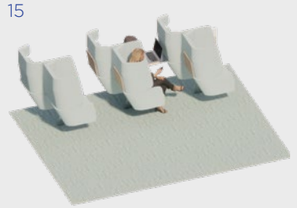


vertical garden

14

window seats

15



more privacy seats

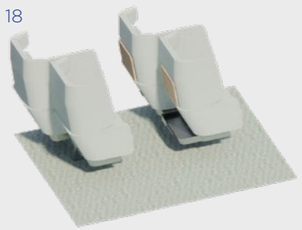
16

meeting booth

17

privacy sets with
indepent exit

18



lockers under seats

19

panoramic window

Fig.12 Work carriage areas and amenities

VESTIBULE

The vestibule area of the train serves a crucial role during boarding and disembarking, but often remains unused throughout the journey. In this proposal, I have introduced seating options in the vestibule area, providing passengers with the opportunity to make phone calls or enjoy a private break. Although this area tends to be noisier than the compartments, the ambient noise can be utilized to enhance privacy during phone calls, especially as technology advances in noise cancellation capabilities.

Fig.13 Vestibule mapping

Fig.14 Vestibule

In the vestibule there will also be a display with all the information needed about the work carriage, as well as a screen where you can book all the amenities, see the seats that are available and rebook your seat. All these options would also be available in the SJ mobile app. The seats and amenities can be booked in advance as well as during the trip.

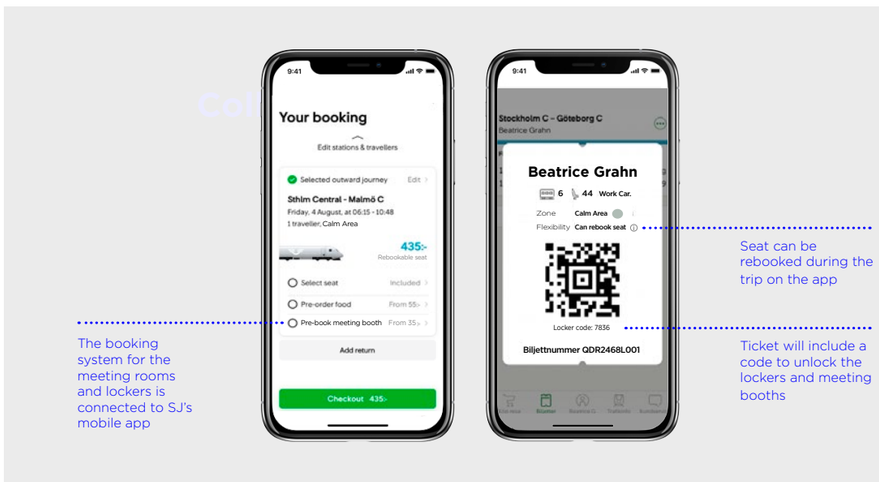


Fig.17 Booking system

STORAGE

Upon entering the train, you will find the toilets followed by the luggage racks. In this proposal, I have included a coat rack, similar to that which you would find in an office. This allows passengers to hang their coats properly, reducing clutter at their seats.

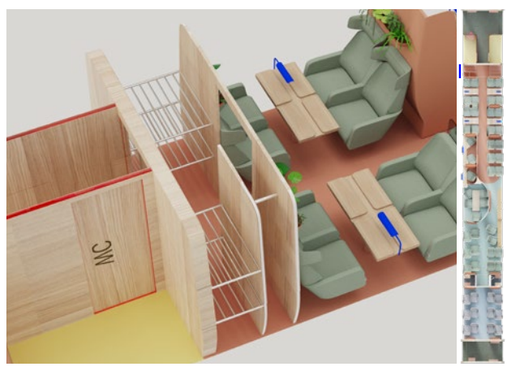


Fig.15 Luggage storage and coat rack mapping

Fig.16 Storage

COLLABORATIVE AREA

The collaborative area comprises all “four-seats facing with table” configurations, consolidated in this proposal for a teamwork-oriented, open-plan sitting area. One group offers increased enclosure with sound-absorbing dividers, providing a quieter and more private option.

This area caters to people traveling with companions or those seeking a café-like ambiance, suited for those who thrive in a lively environment and value shared workspaces. It also provides opportunities for socializing and co-working, appealing to individuals who enjoy engaging with others or prefer independent work in a collaborative setting.

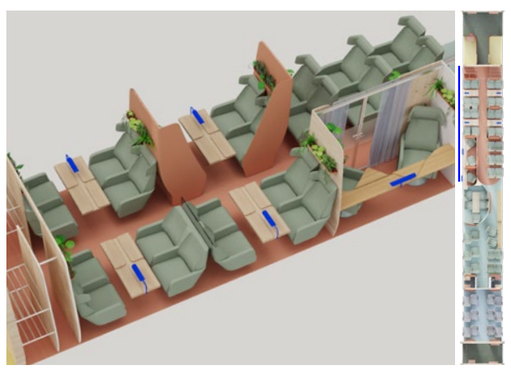


Fig.18 Collaborative area mapping

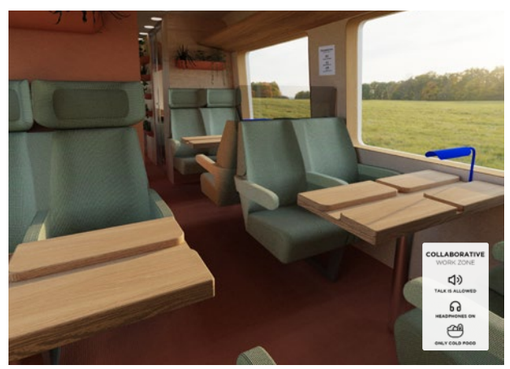


Fig.19 Collaborative area overview

COFFEE STATION

A centrally located coffee station in the carriage provides easy access to coffee, tea, and water for all passengers. For a wider range of food snacks and additional options, passengers can visit the bistro carriage. These coffee stations serve as social hubs in offices and co-working spaces, fostering interactions between people from different departments. In this proposal, the coffee station is strategically placed in the collaborative area to encourage conversation and is conveniently positioned in front of the standing desk, allowing passengers to take a break while enjoying their coffee.

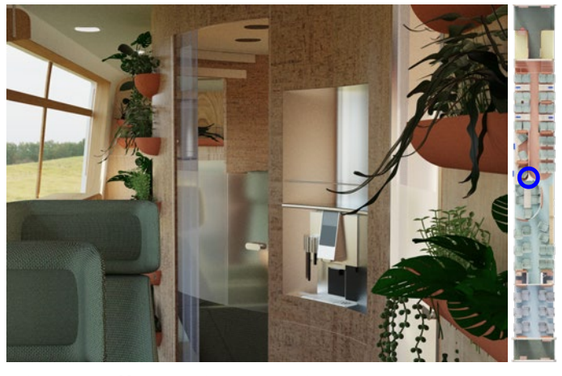


Fig.20 Coffee station mapping

PRIVATE OFFICE FOR ONE AND FOR TWO PEOPLE

You can also book an individual little office, alone or for two people. This allows you to be able to take all the calls in privacy you need. Some people's work just requires a lot of calls and meetings and so there is an option for them not to have to restrain their work. In the space for two you can also have a confidential meeting, and work together in privacy. It can also be an option for two people traveling together, like a couple or friends who just really appreciate their own space. These offices would be a premium option, which like in a co-working space would naturally have a higher price.

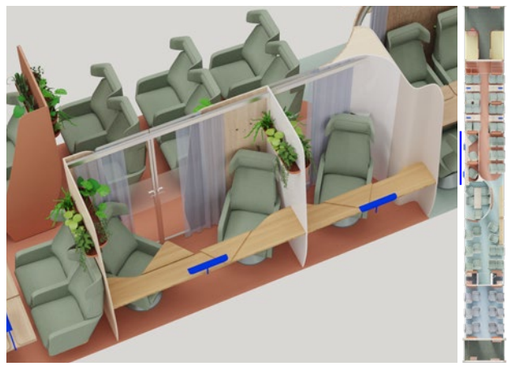


Fig.21 Private offices mapping

Fig.22 Private offices for two

CONFERENCE ROOM

To cater to teams traveling together who require privacy for work, a dedicated space with a screen is provided for video conferences and presentations. For instance, during a business trip to a conference or a fair, the train journey itself can serve as an opportune time to conduct meetings. This allows participants to make productive use of their travel time, maximizing efficiency and reducing the need for additional meeting venues. In the event that the entire room is not booked, individual seats within the space can be sold separately, and both doors can remain open, offering flexibility in utilization.

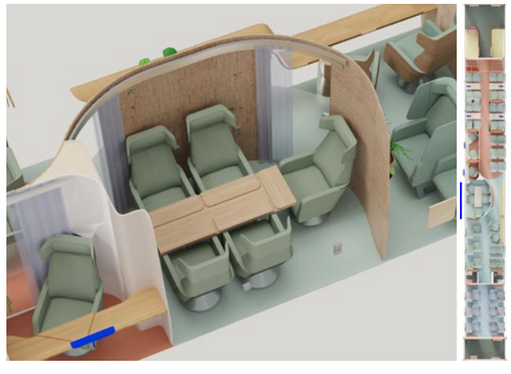


Fig.23 Conference room mapping

Fig.24 Conference room

CALM AREA

The calm area is mostly focused on individual work. There are different types of seats, facing the window, side by side and some seats with more privacy. A lot of people find it important to have the feeling of their own space and this came up very often in my interviews and workshops, people pictured adding a divider between seats to feel more separate from the person next them.

Fig.25 Calm area mapping

Fig.26 Calm area overview

The seats facing the window were designed due to the high demand from passengers who enjoy the experience of facing the window and could be branded as the inspiration seats. Additionally, they are an adequate choice for individuals who experience motion sickness, as many times looking out the window helps them alleviate the symptoms.

Fig.27 Inspiration area

Fig.28 'Vertical garden"

In order to create a memorable and enjoyable experience reminiscent of co-working spaces, a specially designed area has been incorporated into this carriage. A wall covered in cork, adorned with numerous planters forming a vertical garden, is placed in front of the standing desk, accompanied by a large panoramic window. The aim is to evoke a greenhouse ambiance, providing biophilic design elements. Located adjacent to the coffee station and positioned in the central part of the carriage, this area is easily accessible and frequently passed by. The incorporation of plants throughout the carriage, in addition to the vertical garden, not only adds a visual connection with nature but also contributes to improved air quality and balanced humidity levels. The use of cork not only enhances the biophilic aspect but also offers acoustic properties and promotes a natural aesthetic pleasing to the eye.

MEETING BOOTH

When considering the design of co-working spaces, a commonly estimated ratio is 10:1 for spaces dedicated to private calls or digital meetings in relation to the total number of workers. In this carriage, which comprises 54 seats with 46 located outside the private compartments, I have incorporated two individual meeting booths and provided additional options for making calls in the vestibules. The meeting booths are intentionally designed to be suitable for short digital meetings or phone calls, with the purpose of discouraging passengers from lingering longer than necessary. Passengers will have the convenience of booking one of these booths in advance, while the other will be designated as a "drop-in" booth for spontaneous use during the journey, for half-hour time slots, without the need for prior reservations.

Fig.29 Meeting booth mapping

Fig.30 Meeting booth

LIBRARY AREA

During the design process, I experimented with this seat layout to enhance privacy, similar to the seating arrangement in the calm area with dividers. However, I discovered that by spacing the seats slightly farther apart, passengers could easily enter and exit their seats without requiring the other person to stand up, thus promoting a sense of independence. This aspect of the design has been well-received, as it provides a level of convenience that passengers truly appreciate. This area will therefore be totally quiet, for individual focus work, and passenger won't have the need to interact with other to access their seats. You will be facing a person seating opposite to you but not the person setting next to you, and because the seats are further apart it will additionally create more leg room.

Fig.31 Library seat view and area mapping

Fig.32 Library area

LOCKERS

To address the common concern of passengers about leaving their belongings unattended while moving around the train, I have introduced the option to have a seat with a built-in locker. These lockers, located as small drawers in the seat in front, are specifically available in select seats and reserved for the person occupying the seat behind it. To ensure security, the lockers can be electronically unlocked using either a designated code or by scanning a QR code with a smartphone. This feature allows passengers to keep their most important belongings safely stored while freely exploring other areas of the train.

Fig.33 Locker drawer

Fig.34 Locker system

5
CONCLUSION

This project began with the goal of finding ways to encourage people to choose train travel for longer distances by focusing on improving the overall passenger experience. The underlying challenge that needed improvement was regarding the duration of train journeys, which often take longer compared to flying, and equate to time lost. The chosen approach aimed to shift that perception by emphasizing the value of utilizing that time effectively. The project focused on providing passengers with the means to engage in valuable activities during their travel, effectively gaining time compared to flying.

The design of the train was inspired by the concept of a cruise ship, where passengers can partake in various activities throughout the journey. The proposal aims to address passengers' needs and preferences by designing the train as a cohesive space with distinct areas tailored to different activities. Grouping passengers based on activities and providing guidelines for each space creates a sense of comfort and clarity. Furthermore, the proposal maximizes the use of space, capitalizing on one of the key advantages of trains compared to other modes of transportation and one of the qualities passengers value the most.

While people can already work from trains, there is considerable room for improvement in enhancing the overall working experience. Through my research, I identified several limitations, such as the reliance on unstable internet connections, the need to cancel meetings, and the lack of comfort and freedom from distractions. This project aimed to address these points by analysing and proposing solutions that would create a seamless working experience on trains, allowing individuals to work as they would in their own workplace, catering to the diverse work needs of passengers.

In summary, this project proposes that by creating a pleasant, reliable and efficient experience to work from a train while travelling, will encourage people to choose trains more frequently and for longer journeys. This project resulted in a visual representation of what a dedicated workspace carriage could look like, providing a tangible conceptualization of the design and layout for such a space within a train. The public's interest and response have been very positive and validating of the proposal.

If given more time, I would have dedicated individual attention to each proposed solution and seating arrangement. This would involve further exploration of space, proportion, and ergonomics to optimize the design. Additionally, I would have liked to delve deeper into the functional details of various services, such as seat rebooking and bookable meeting booths, to envision on their smooth operation.

Furthermore, with significantly more time, I would have loved to design proposals for all the other carriages, each catering to different activities and atmospheres.

Further development would also involve delving into the viability of implementing such a concept for SJ. This would require conducting in-depth research and analysis to understand the practical aspects of implementing and integrating the proposed seating arrangements within the existing infrastructure.

6
NOTES

1 *Design thinking* is a problem-solving approach and methodology that focuses on understanding human needs, generating creative ideas, and developing practical solutions. It is a human-centered and iterative process that encourages collaboration, empathy, and experimentation.

2 *The Double Diamond* method is a problem-solving and design thinking approach that follows a four-stage process represented by two diamonds. It was developed by the Design Council in the United Kingdom and is commonly used in various design disciplines. The method emphasizes exploration, ideation, and iteration to arrive at effective solutions. The four stages of the Double Diamond method are as follows: Discover, Define, Develop and Deliver. This method emphasizes both divergent thinking (generating a broad range of ideas) and convergent thinking (narrowing down and selecting the best ideas) to foster innovation and arrive at effective solutions. It encourages collaboration, empathy, and iterative design, allowing for continuous learning and improvement throughout the process.

3 *Actor-Network Theory* (ANT) is a theoretical framework developed in the field of sociology and science and technology studies by Michel Callon, Bruno Latour, and others. It is a sociological approach that seeks to understand social phenomena by focusing on the interactions and relationships between human and non-human actors within a network.

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5 Richie, Hannah. “Cars, planes, trains: where do CO2 emissions from transport come from?”. Our World Data, October 06, 2020 https://ourworldindata.org/co2-emissions-from-transport/.
Lamprinaki, Viktoria. “Why You Should Choose a Train Journey Instead of a Flight - Sustainable Conferencing Initiative.” Sustainable Conferencing Initiative. November 19, 2021. https://sustainability.biologists.com/blog/why-you-should-choose-a-train-journey-instead-of-a-flight/.

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7 Richie, Hannah. “Short-haul vs. long-haul; rich vs. poor countries: where do global CO2 emissions from aviation come from? “. Our World Data. October 23, 2020 https://ourworldindata.org/breakdown-co2-aviation

8 IEA. “Global CO2 Emissions in Transport by Mode in the Sustainable Development Scenario, 2000-2070 – Charts – Data & Statistics”. IEA. October 26, 2022. https://www.iea.org/data-and-statistics/charts/global-co2-emissions-in-transport-by-mode-in-the-sustainable-development-scenario-2000-2070

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11 Myclimate, Stiftung. “Calculate Your CO2 Emissions Now!,” n.d. https://co2.myclimate.org/en/offset_further_emissions.

12 Stockholm Environment Institute. “It’s Time to Move beyond ‘Carbon Tunnel Vision’ - SEI.” SEI, April 13, 2022. https://www.sei.org/perspectives/move-beyond-carbon-tunnel-vision/.

13 Greenwashing refers to the practice of misleadingly promoting or marketing a product, service, or company as environmentally friendly or sustainable when, in reality, it does not meet the necessary criteria or standards. It involves creating a false or exaggerated perception of environmental responsibility in order to appeal to consumers who are increasingly concerned about the environment.

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15 Cecere, D., Eugenio Giacomazzi, and Ingenito A. “A Review on Hydrogen Industrial Aerospace Applications.” International Journal of Hydrogen Energy 39, no. 20 (July 3, 2014): 10731–47. htt16ps://doi.org/10.1016/j.ijhydene.2014.04.126.

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23 “We know that businesses are becoming increasingly conscious of the impact their travel has on the environment,” Jacques Damas, CEO of Eurostar, said. “With a passenger emitting on average 15 times less carbon when travelling by Eurostar train rather than plane between London and Paris, it is clear why our corporate clients are actively choosing rail for short haul international business trips. As travel restrictions are released by governments and demand continues to rise, we will continue to add trains to our timetable offering our corporate travellers even more choice and flexibility.” Global Railway Review. “Survey Reveals Popularity of Train vs Plane for Business Travel,” April 7, 2022. https://www.globalrailwayreview.com/news/133334/survey-reveals-popularity-train-plane-business-travel/.

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26 The goal framing theory was proposed by Lindenberg and Steg in 2007. It focuses on understanding how different types of goal frames influence individuals’ decision-making and behaviour regarding sustainable actions. The theory suggests that the way goals are framed can significantly influence individuals’ motivation, attitudes, and behaviour. It explores how different goal frames, such as gain-framed (highlighting benefits) and loss-framed (emphasizing costs), impact individuals’ decision-making processes.
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27 99% Invisible “476- Reaction Offices and the Future of Work”, Spotify February 9, 2022. https://open.spotify.com/episode/0rwSMNzrscACGM7VrBL93C?si=62c0c0ace8b24d00&nd=1.

28 The Gig Economy refers to a labour market characterized by the prevalence of short-term or freelance work arrangements, often facilitated through online platforms or mobile applications. In the gig economy, individuals typically work on a temporary or project basis, taking up “gigs” or assignments as independent contractors rather than being employed by a single employer on a long-term basis. New technologies have made it easier for people to start their own businesses or rely on existing apps to connect their services to the clients who need them most.

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31 Digital nomads are individuals who use technology and the internet to work remotely while traveling and living in different locations. They leverage digital tools and communication technologies to perform their job duties, allowing them to have a location-independent lifestyle.
32 The seating arrangement where two pairs of seats are facing each other with a table in between is commonly referred to as a “four-seat facing with table” configuration.

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7
APPENDIX 1
RESEARCH METHODS AND DEVELOPMENT

Methodology

The Double Diamond framework consists of four phases:

Discover: This phase is about understanding the problem and gathering information about the user, their needs, and the context. It includes research, observation, and analysis of the design challenge.

Define: This phase is about defining the problem and the user's needs. It includes synthesizing the information gathered during the Discover phase, and creating user personas and design principles.

Develop: This phase is about developing and prototyping solutions to the problem. It includes ideation, experimentation, and testing of different design concepts.

Deliver: This phase is about delivering the final solution and evaluating its effectiveness. It includes creating detailed design specifications, defining the final product or service prototype, and testing it with users.

Observation

A visit was carried out to InnoTrans Berlin 2022, a biennial trade fair for transport technology. The fair mainly featured rail technology companies exhibits, manufacturers, and infrastructure providers. It included three pavilions for interior and comfort services, as well as a new area called mobility+ dedicated to supplementary mobility services, and the innovation hub by DB and Ideenzug with a 1:1 prototype ideas train. The fair also included a conference program with keynote speeches and panel discussions on topics related to the transportation industry.

An observation trip, was conducted as a long trip by train from Stockholm to Madrid and back. The goal was to benchmark different trains, classes, features and activities, as well as to observe users' behaviors and ask some questions.

Two observation trips to Gothenburg and Malmö to work while traveling and test the different trains and classes. During these trips I was able to observe people working, as well as I did work myself too, in order to test the experience and feel the atmosphere of the different classes.

Observation of people's behaviors at a coworking space. I spent a day at The Park coworking space in Stockholm where I got a guided tour of the facilities and had a chance to obeserve people working and using the different facilities.

Need finding interviews

The project started with general need finding, where over 10 train users were interviewed about their experiences, motivations, problems, and perceptions about train journeys. The interviews were conducted in a casual manner, with little structure. Short contextual interviews were then conducted with six respondents on Stockholm's Central Station platform for long-distance trains, focused on travellers' motivations and experiences of train journeys. In-depth semi-structured interviews were also conducted with nine individuals of diverse demographics, covering various aspects of their train travel experiences over a 30 to 60 minute conversation. One of the interviewees was Mark Smith, a travel website writer known as The Man in Seat Sixty-One.

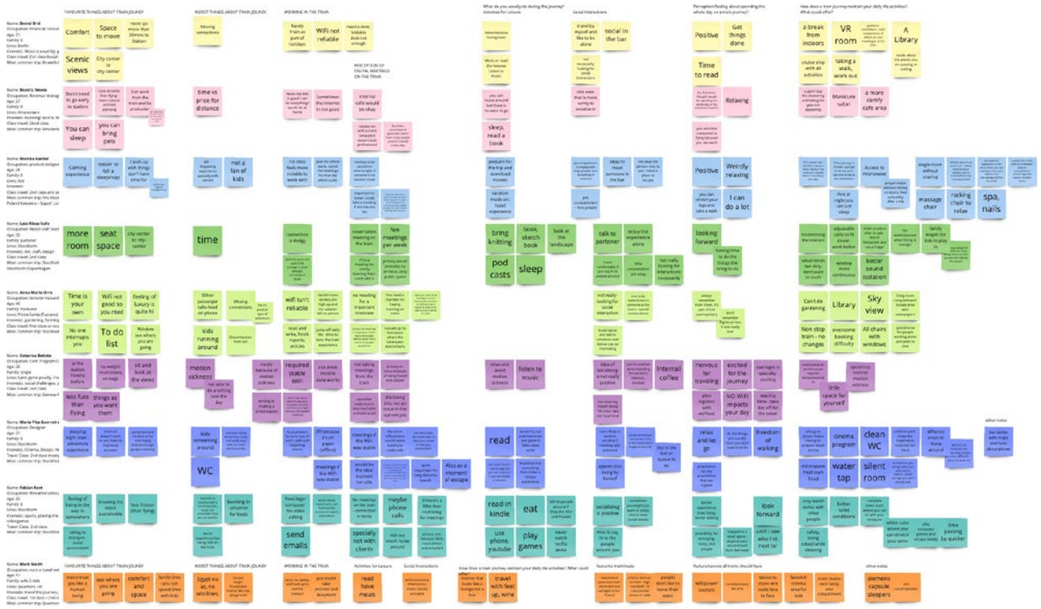

Fig. 1 User insights

Users and motivations mapping

From the first round of interviews, I understood there was many types of users and many types of activities these users want to carry out in the train journey. I mapped out as many as possible without being too specific.

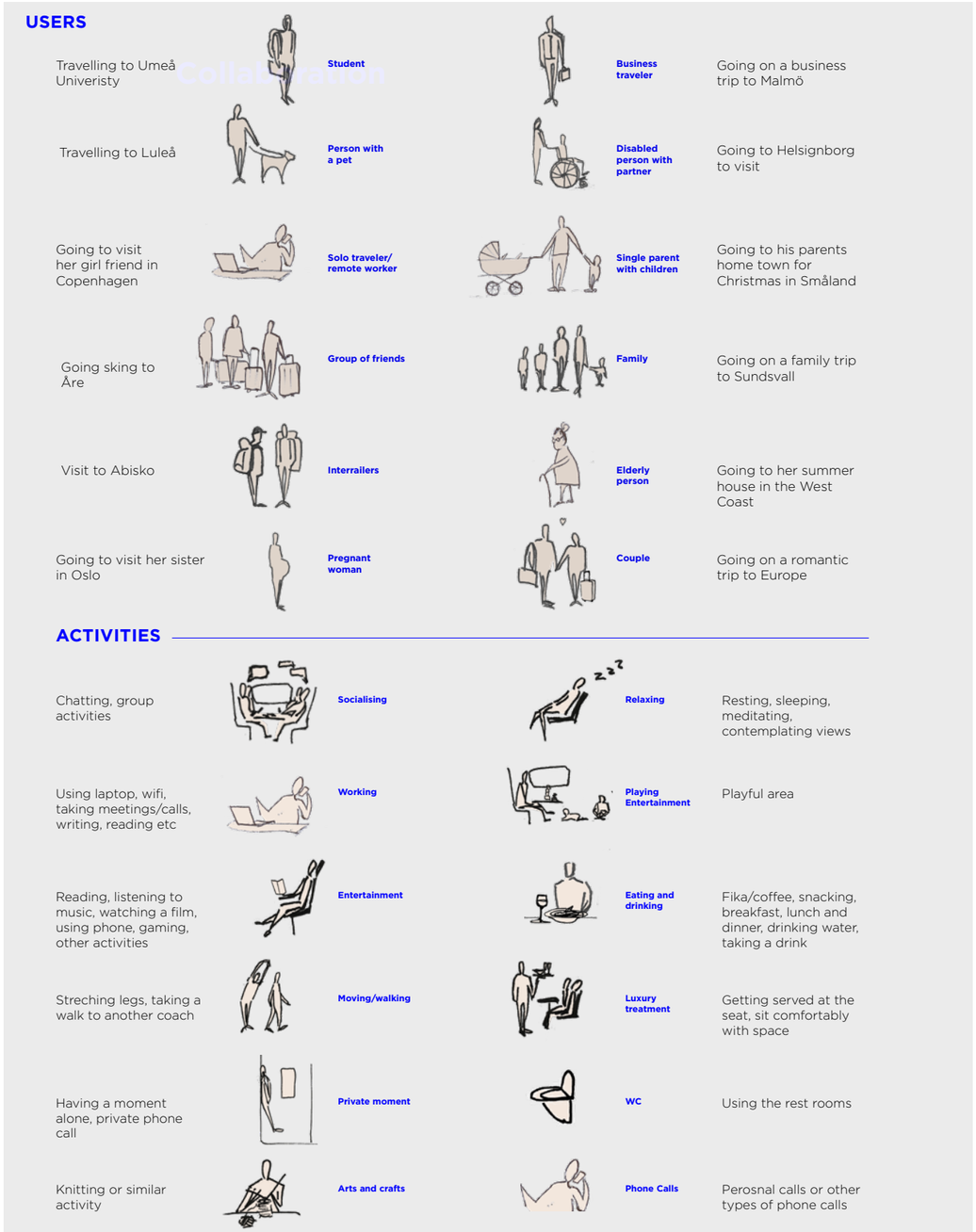

Fig. 2 Train users and activities

The needs of each person can change according to who they are, who they are travelling with but also according to what context they are traveling in and the activities they are planning for their time onboard. For instance, a passenger with a disability or traveling with a child may automatically entail specific needs. Secondly, a passenger that for example wishes to use the journey time to get work done may also have specific needs, regardless of who this person might be. Furthermore, the needs may change during the trip itself.

From the user research I also extracted some pain points of the passenger with working motivations.

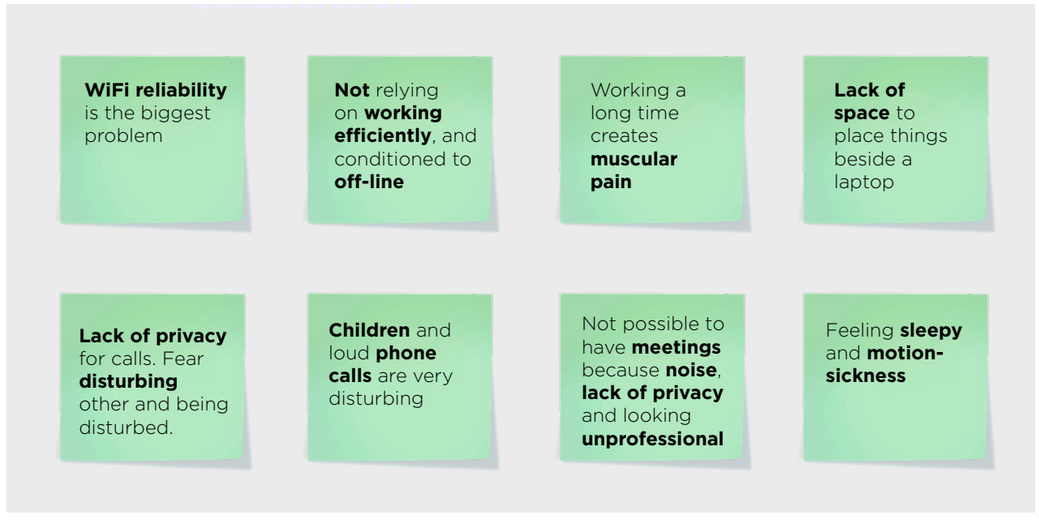

Fig. 3 User insights about workinf from the train

In-depth user interviews

From the previous insights and assumptions, I designed my in-depth round of interviews to be focused on working from the trains. I interview six people who had traveled with SJ trains in the past year, for trips longer than three hours with the goal of working during the journey, and of ranging demographics. The interviews followed a semi-structured format and took around 60mins. The outcomes matched the previous insights as well as adding many new perspectives.

Workshops

Workshops with 10 participants that were asked to design their preferred seating scenario for working from a train. Starting from a bus (where all seats are facing the same direction) sitting arrangement with chairs, participants did fast and low-fidelity cardboard additions to the seats. From this workshop I learned that the main concerns were about getting in and out of the seat without disturbing the person next to them, therefore being more independent. Also having more privacy and separation from the person next to them, by adding a division and testing how high and adjustable the divider should be. Another focus was related to ergonomics and being able to adjust the table to one's needs, as well as having enough space. Furthermore, the participants also paid a lot of attention to designing solutions that would guarantee the safety of their coffee cup thus avoiding spillage over their electronics.



Fig. 4,5,6 Workshop designing a workplace in the train

During the course of the project, two workshops were conducted in collaboration with SJ, where I had the opportunity to present my research and ideas. These workshops served as valuable platforms for engaging with individuals from various departments within SJ, fostering insightful discussions and incorporating diverse perspectives. The interactive sessions allowed for in-depth exploration of the concepts and facilitated a deeper understanding of the project from an insider's point of view.

Prototyping


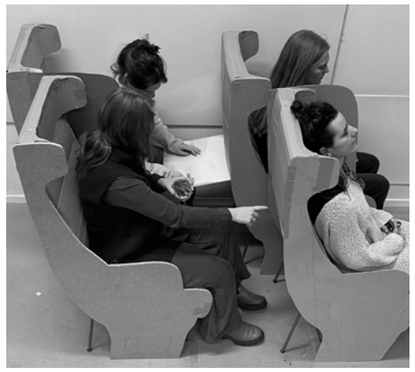


Fig. 7, 8, 9 Full scale chairs mock-ups proportions and layout testing

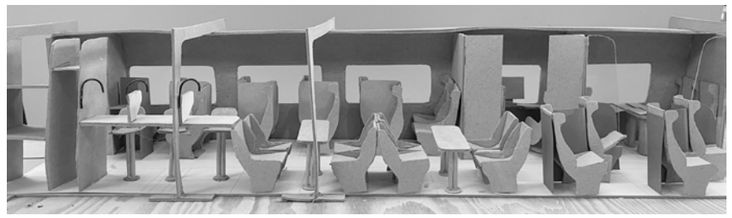

Fig. 10 Train cardboard mock-up

Personas

From the user research I created my final personas to whom I will address the design proposal.

Fig. 11 Personas

Jude, 36, Architect - The collaborative worker

The collaborative worker is used to open plan offices, collaborative work, likes to work from cafes and next to other people and even appreciates a bit of noise around to boost focus or creativity. Likes to take the opportunity to travel and work remotely, possibly from coworking places. Would enjoy travelling with colleagues and do a part of the work on the train. Openness to meeting new people. Takes several calls and meetings per day.

Robyn, 47, CEO - The solitude worker

The solitude worker, is usually a higher executive that has his own office at his workplace and wants to have his own space in the train. Neither used to much collaborative work nor to be sitting next to other people for work, and prioritizes privacy. Takes a lot of meeting and phone calls, any time any where. Wants to be left alone as much as possible. A physical business meeting could happen from the train to optimize time if traveling with a costumer/partner.

Elliot, 53 PhD Researcher - The calm worker

The calm worker is used to open plan offices, but when traveling alone tends to prefer a bit more silence and privacy. Elliot's work involves quite a lot of reading and writing, which requires a fair amount of concentration. Elliot likes a calm atmosphere, better when there are fewer people around, less movement and noise. Takes several calls and meetings per week.

All personas are aware of climate change and understand the need to adopt a more environmentally conscious lifestyle. Will adopt a more sustainable behaviour without doubt if it doesn’t complicate life/conflict with lifestyle. and especially if it’s better or more interesting.

User Journey

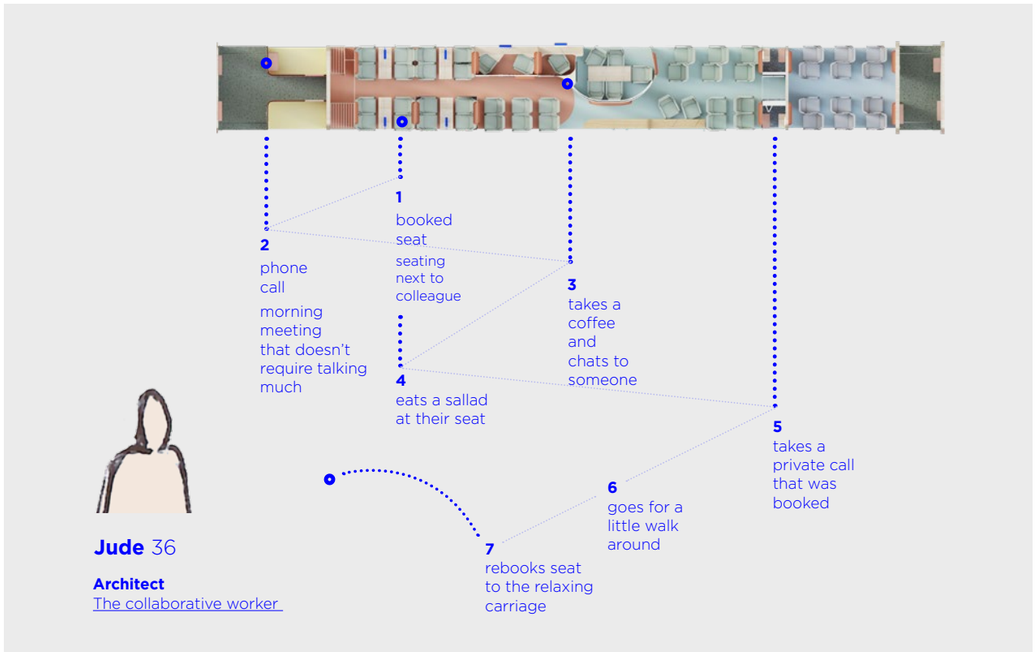

Fig. 12 User journey Persona 1 - Jude

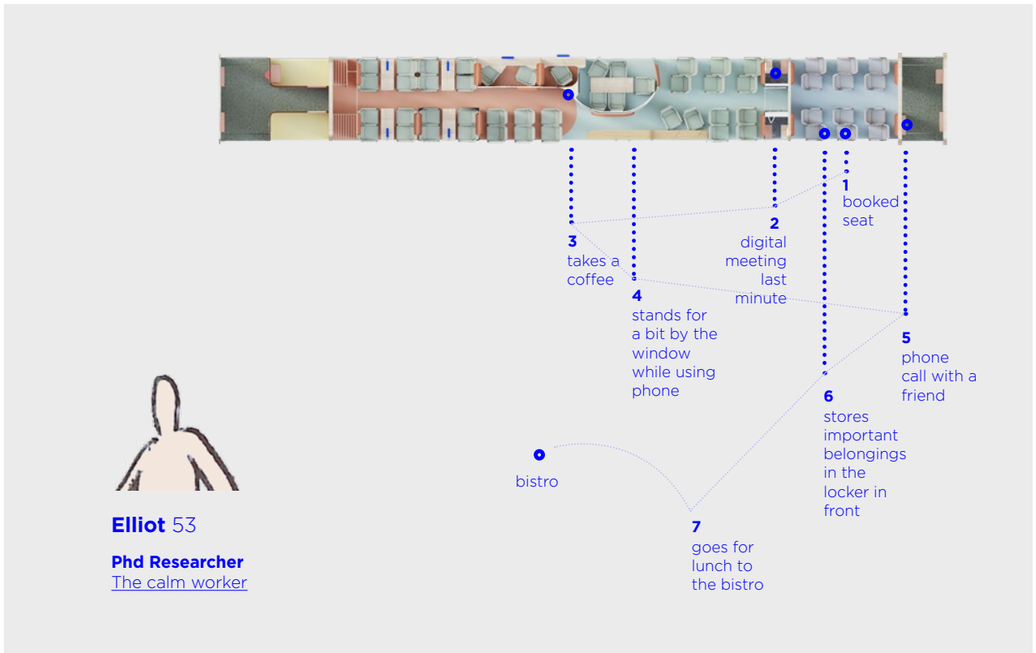

Fig. 13 User journey Persona 2 - Elliot

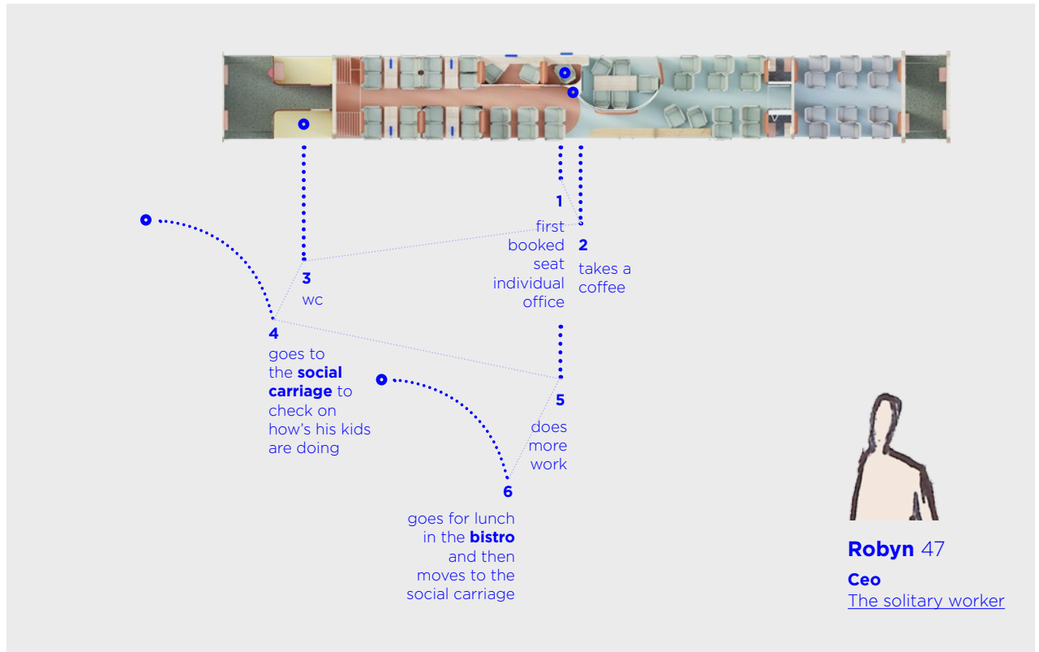

Fig. 14 User journey Persona 3 - Robyn

8
APPENDIX 2
REFLECTIONS UPON PROJECT EXHIBITION

Context and exhibition design

As part of the master program, it was a requirement to participate in a collective exhibition showcasing all the graduation projects. This annual exhibition, which has gained recognition over time, is open to the public and attracts a diverse range of visitors. It serves as a platform to present our work to a wider audience and engage in meaningful conversations about our projects.

For the exhibition of this project, I opted for a comprehensive approach. It included a crafted scale model of the train carriage (scaled at 1:20), informative posters providing detailed explanations of the model, and an immersive virtual reality experience enabling visitors to explore the interior of the carriage. The assigned location for the exhibition was a room situated in the main corridor of Konstfack, attracting a significant audience, that I shared with another exhibitor.
The scale model featured authentic materials used in the design proposal, including colors and details. To provide a realistic representation, people were positioned around the model, demonstrating how it is intended to be utilized.

To ensure a focused and uncluttered exhibition, I intentionally pursued a minimalist and clean aesthetic that would draw attention to the showcased elements. To create a distinct space for the virtual reality experience, I constructed a custom room divider. This divider served as a boundary, allowing visitors to freely navigate within the designated area without accidentally coming into contact with prototypes or obstacles. Furthermore, the wall of the divider was shaped to resemble the profile of the train, providing a sense of scale and incorporating a train-themed design element. The intention was for visitors to don the VR goggles and immerse themselves by virtually and physically “walking into the train.

I prominently displayed the phrase “What if you could take a co-working space to Copenhagen?” on the wall. My intention was to provide a concise and easily readable sentence that would instantly contextualize viewers upon entering the exhibition.
I wanted people to immediately grasp the essence of the project and establish a relatable connection. The train journey to Copenhagen is a well-known route, allowing people to easily relate to it, even though it is also a popular destination for air travel. By incorporating the words “co-working space,” the project’s objective becomes clear and readily understandable.

During the exhibition, I engaged with visitors by asking them where they would choose to sit in the train carriage. To my delight, many participants immediately understood the underlying concept of the project and began explaining how their work routines influenced their seating preferences. It was intriguing to discover that a common response was that their choice of seat depended on various factors, such as the nature of their tasks for the day and whether they were traveling alone or with others. This alignment between participants’ answers and the core objectives of the project reaffirmed my confidence in the design proposal.

Fig. 14, 15 Exhibition images

Fig. 16, 17 Exhibition images

Fig. 18, 19 Exhibition images

Fig. 20, 21 Exhibition images

People enjoyed and analyzed the model, taking pictures and showing interest in the posters. The VR experience was the highlight, with some individuals immediately gravitating towards the VR seat without prior exploration. Many were excited as it was their first-time trying VR. This strategy effectively captured their interest, as they stayed and commented on the project. Although a screen displayed the VR perspective to accommodate more viewers, it didn't provide the same immersive feeling as the VR seat, lacking the depth and bodily experience. People were pleasantly surprised by the realism and eagerly explored the interior, even attempting to gauge to gauge the comfort of the seating areas. Given more time, testing different VR mapping with physical seats would have been g for future exhibitions.

Insights from the visitors

The most commonly heard comments were along the lines of "I want to take this train." Additionally, hopes for SJ's implementation of the concept, appreciation for the inclusion of plants, and admiration for the train's vibrant color scheme that diverges from the typical somber designs.

According to a lady from Halmstad, people from her hometown who take weekend flights from Friday to Sunday appear to be commuting during the week. The assumption is that flying saves them time, but an alternative solution like the one mentioned would be perfect, eliminating any time loss completely for those trying to optimize travelling for the weekend.This comment brings to mind the policies in France where domestic flights between cities connected by rail are being banned. Implementing similar bans in Sweden would be facilitated by offering a better alternative, aligning with the concept of this project.

A common comment from many individuals was their preference for working from the train, making the concept of increased privacy in the seats highly appealing to them. Several people mentioned their frequent trips between Stockholm and other destinations for work, expressing that this solution would be ideal for business travel. They could envision themselves traveling more frequently with colleagues and reserving the compartment for five people (fig. 12 nr.10).

The library seats (referenced as Fig.12 nr 17) were highly popular among people. They likened them to love seats from the 17th century, appreciating the individual privacy they offered. When I explained the concept of being able to enter and exit the seat without disturbing or being disturbed by others, it reinforced their appreciation for those seats.

The displaced seats (referenced as Fig.12 nr 15) with dividers in the calm area were also highly popular. Many people appreciated the opportunity to have their own personal space without the need to face anyone.

All the seats facing the window, including the private offices (nr 7 and 8) as well as the seats in the calm area (nr 14), were highly popular among people. The seats in the calm area, in particular, were well-liked due to their proximity to the "vertical garden" (nr 12).

One visitor made an interesting comment about feeling more stressed about making noise in the library compartment and potentially disturbing others, rather than fully enjoying or benefiting from the silence it offers. As a result, she would likely prefer to choose a seat in the calm area or collaborative area, where she feels less pressure to maintain complete silence.

From the VR experience, it became clear that there was a bit of over-optimism regarding the available space. The corridor feels too narrow, and the conference room feels somewhat cramped. This realization suggests that adjustments may be necessary to ensure better comfort and functionality in these areas.

During the exhibition, many individuals I had previously interviewed for the project came to see the results. They were pleased to see that their specific needs had been taken into consideration, allowing them to envision themselves fitting into the design. The sustainability lead of one company even remarked, "It would be so easy to convince people to take the train if it looked like this." This positive feedback further validates the appeal and potential impact of the design in a business travel context.

The exhibition provided a fantastic opportunity to engage with people and gather their thoughts on the project. It was a successful event as the project was clearly understood by the visitors. The positive feedback received, and the genuine interest and appreciation shown by many individuals further underscored the relevance of the project. Overall, it was a rewarding experience to witness the positive reception and engagement surrounding the topic.