JIYUKU\u3010KAN

The Future of Night Trains
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Introduction

Long distance travel

James Watt’s invention of the steam engine and its use for the railway has been one of the key elements for the industrial revolution in the 19th century. The globalised world as we see it today is aware of the environmental impact that the industrial era has caused so far. At the same time it is very complex for society to compromise on the possibility to travel and transport material on long distances. By 2030 up to 60% of the population will live in cities and the connections between these cultural and economic hubs will be more important than they already are today. The choice of transport is highly price driven which makes flights attractive on intercontinental and short distances. The evolving high speed rail network and the possibility to run trains with renewable energy offers a cleaner and more comfortable alternative to travel between hub cities in a range of 1000km in the future.
**Design opportunity**

The MA thesis will focus on a concept within the idea of night train travelling in distances between 800 to 1200 km. The aim is to create a comfortable and sustainable alternative to flights on these distances where the user is travelling without the feel of loosing time. The concept will especially address business travellers who need to be productive and responsible about their work related CO2 footprint. High speed rail networks and day trains are already an option for this target group in distances between 200-600 km. What does a high speed night train need to be interesting for longer distances?
After working at TB in the internship programme 2011 I was interested to cooperate with the company for my MA thesis. TB began full-scale production of pure-cotton knit combers (snipes), and luxury combers made from Egyptian cotton and targeting high-end customers. Recognising the opportunities in industrial materials, the company also began producing fabrics for automobiles, and began supplying base material for car seats to Toyota.

„Sakichi Toyoda’s tireless research and creative spirit gave rise to Japan’s first automatic loom and led to the birth of Toyoda Boshoku.“ Toyoda Boshoku focused on moving away from its traditional market-driven thread sales in the Izanagi boom (a period of prosperity and economic development in the late 1960s).

Recently Toyota Boshoku became a seat and interior supplier for a Japanese railroad company and is constantly looking for new business opportunities within the field of interior and furniture design.

„STRIVE TO PROVIDE CUSTOMERS WITH ENVIRONMENTALLY FRIENDLY AND ENRICHED LIFESTYLES BY BOLDLY PURSUING INROADS INTO NEW BUSINESS.“

Toyota Boshoku, Vision 2020
WE ARE AIMING TO REALISE A RECYCLING ORIENTED SOCIETY WITH NO INCREASE OF CO2 RELEASED INTO THE ATMOSPHERE THROUGH THE USE OF PLANT-DERIVED MATERIALS AND BY BOOSTING FUEL EFFICIENCY THROUGH WEIGHT AND POWER SAVINGS“

Toyota Boshoku, Research and development

What does TB stand for?

Toyota Boshoku set its sights on kenaf, an annual grass that grows quickly and has high CO2 absorption capabilities. They are continuing research into the use of this material in interior components. Currently, kenaf is being used in such parts as door trims and deck board for the cargo area.
What is the sustainable alternative for domestic flights?
What is the sustainable alternative for domestic flights?

Driving forces

SOCIETAL
- Mega Cities
- Less free time
- Social inequality

TECHNOLOGICAL
- Renewable energy
- Quiet products
- Efficient engines

POLITICAL
- Climate change
- Infrastructure
- Ressources

ECONOMICAL
- Fossil fuels
- Demand on travel
- Global competition

2030

How can business travel be more productive and less stressful?
Scenario 2030

Economic zones

Ice 1979

CLIMATE POLICY
after Copenhagen
The Role of Carbon Pricing

Appendix 1

Economy shapes decisions

1997

Kyoto protocol
Climate policies
5.2% less CO2
2005-2012

2016

Japanese carbon tax ¥ 760 per kiloliter oil

sever weather events
Japanese carbon tax ¥ 760 per kiloliter oil

Global deal on airline emissions.
Airline merge due to high competition

Voluntary action by businesses and consumers.
(CO2 responsibility bonus)

Renewable energy competes on price with fossil fuel
Trading schemes for carbon emissions rights begin to cover a critical mass of industry sectors and countries.

Double amount of flights (40% business related)
Extreme weather effects flights

Use of biofuel grows rapidly
Fossil oil price is rising slowly
Hybrid technology evolves

CO2 trading schemes remain uneffective
Business lacks direction for technology investments to improve emission management

Business as usual 2030
Lack of energy
Resource conflicts
Energy use expected to double

New Hokkaido Shinkansen

Energy use expected to double

Nuclear independence

40 M residents

Tokyo

8 M single households

4 M single households

4 M single households
Most business travel is expensive, generates greenhouse gas emissions and impacts productivity – workers are rarely productive when on the move. In the 24x7 world, compensating for lost working time spent travelling leads to longer working hours, less time spent at home, greater employee stress and lower productivity.

Meanwhile, the associated carbon dioxide emissions are often a significant proportion of an organisation’s carbon footprint. Looked at this way, who would not want to make things better?

Air travel only accounts for an estimated 5% of global carbon emissions. But that share is expected to grow as air travel becomes cheaper and more accessible. In order to combat climate change, the European Union has tried to introduce a mandatory emissions-trading scheme that would force airlines to buy carbon offsets. Politicians in emerging nations and America balked at the EU proposal. American lawmakers moved quickly to forbid American airlines from complying with the EU scheme. In November the EU announced it would postpone implementation of the plan until at least September 2013.

„WORK-RELATED TRAVEL IS A SIGNIFICANT CONTRIBUTOR TO THE CARBON DIOXIDE (CO2) EMISSIONS, AND OFTEN ACCOUNTS FOR 25% TO 75% OF AN ORGANISATION’S TOTAL EMISSIONS. “

The Economist, Jan 28th 2013, N.B. | WASHINGTON, D.C
“IF WE CAN’T GET A GLOBAL DEAL ON AIRLINE EMISSIONS, HOW LIKELY IS A GLOBAL DEAL ON CARBON EMISSIONS IN GENERAL?”.

The Economist, Jan 28th 2013, N.B. | WASHINGTON, D.C

Who is travelling

Work-related travel emissions

Transport is responsible for 13.1% of global greenhouse gas emissions. However, what proportion of “Transport” is work-related, and what proportion is “leisure” or “logistics”? In 2005, some 30% of all journeys were undertaken for business.

Interesting routes

Sapporo Tokyo reference 900 km

There are several global routes where bullet night trains could operate:

Copenhagen - Munich
Shanghai - Beijing
San Diego - San Francisco

Face to face business

Japanese business is still a face to face relationship which makes travel related emissions even more important.
Is business travel killing you? *Business travel can be bad for your health*

People who travel extensively for business are at a higher risk for a variety of health problems, including obesity and high cholesterol.

That’s the finding of two researchers at Columbia University who found that the more often a person travels for work, the less healthy they are likely to be.

The research was conducted by comparing the health data of more than 13,000 employees from a corporate wellness program. Close to 80 percent of the employees travelled at least one night per month. Nearly 1 percent were extensive travellers -- spending as many as 20 nights a month on the road.

**TRAVELLING IS STRESSFUL, AND TOO MUCH OF IT CAN REALLY DAMAGE YOUR HEALTH. “**

*The Economist, Jan 28th 2013, N.B. | WASHINGTON, D.C*
Obesity was 92 percent more common in the extensive travellers. They also had higher cholesterol and high blood pressure.

The Economist, Jan 28th 2013, N.B. | WASHINGTON, D.C

Stressful business travel

Work-related health issues

Missing out on sleep, working non-stop on the plane or train, and eating unhealthy foods are all common habits of the business traveller lifestyle.

All this can create havoc with stress levels at a time when the pressures of preparing for presentations and making meetings mean business travellers are already on edge.
Research

What if night trains would be more convenient?
Night trains

History

The sleeping car or sleeper (often waggon-lits) is a railway/railroad passenger car that can accommodate all its passengers in beds of one kind or another, primarily for the purpose of making nighttime travel more restful. The first such cars saw sporadic use on American railroads in the 1830s and could be configured for coach seating during the day.

Some of the more luxurious types have private rooms, that is to say fully and solidly enclosed rooms that are not shared with strangers. Some trains also had cars equipped with seats which attracted passengers with less income.

The open section transforms into a sleeper train. It became famous in the movie „Some like it hot“. 

Cultural impact

Each Pullman car was staffed by a uniformed porter. These were almost always African-Americans and, by convention, were often addressed as „George“ by passengers. Their union, the Brotherhood of Sleeping Car Porters, became an important source of strength for the burgeoning civil rights movement in the early 20th century.

Because they moved about the country, Pullman porters also became an important means of communication for news and cultural information of all kinds. The African-American newspaper the Chicago Defender gained a national circulation in this way. Porters also used to re-sell phonograph records bought in the great metropolitan centres, greatly adding to the distribution of jazz and blues and the popularity of the artists.
Night trains today

Sleeping cars retain a powerful ability to provide travel that is both reasonably comfortable and potentially time-saving, especially between points that are between 800 km and 1,600 km apart, distances that one can travel overnight, perhaps with dinner at the beginning of the journey or breakfast at the end. This offers efficiency in passing the time and distance by allowing travellers to do things that might be done in a hotel room during the same hours.

A sleeping car is, in essence, a moving house of lodging. A night in transit can replace a hotel stay at the destination.

„EVEN WHERE SLEEPERS ARE MORE EXPENSIVE THAN HIGH - SPEED DAY TRAINS OR OTHER MODES OF TRANSPORT, THE EXTRA COST MAY BE LESS THAN THAT OF A NIGHT AT A HOTEL!“
Wikipedia, sleeper trains 2013
The experience

Special trains

When it comes to long distance travel, people tend to think of air transportation first. However, train travel can be a nice option that should not be overlooked, even in a huge country like Canada.

Although it takes more time than air travel, train travel enables you to use your time in a more productive way. You can enjoy your time, relax and take a look through the window to admire the scenery. You can also use the Wi-Fi access and connect your laptop in case you need to work or if you simply want to spend some time on the Internet.

Cassiopeia

Cassiopeia is operated between Ueno and Sapporo. This train is the Japanese version of the Oriental Express and is the most luxurious in three luxurious overnight trains (other two are Twilight Express and Hoku-tosei) in Japan.

The Cassiopeia consists of all type „A“ accommodation, all specific to this particular train. A flat fee is charged for all rooms, regardless of starting or ending location. Currently, accommodation rates range from about ¥27,000 for a Cassiopeia Twin room to ¥51,000 for a Cassiopeia Suite.
ALL TRAINS IN JAPAN DO NOT HAVE ANY BAGGAGE CARS. YOU NEED TO CARRY YOUR LUGGAGE INTO THE CABIN SPACE. YOU MAY NOT BE ABLE TO FIND SPACE THOUGH!

Takeshi, JR rail 2010

Nobi Nobi seats

Nobi nobi seats are a thinly covered hard plank, and travellers get a thin blanket. The blanket is warm, but the sleeping platform is really hard because it is made from tatami, a traditional Japanese floor material.

There is no privacy, but there are little dividers from the window about 12-18 inches out just to divide the space. The head and shoulders are covered, but the rest of the car is wide open. If you are a tall person, you may not be able to stretch out your legs.
High speed rail

Bullet sleeper trains

Chinese Railways has begun putting a fleet of 20 high speed sleeper train sets into service on overnight journeys between Beijing, Shanghai (1069km) and Hangzhou (1516km).

Bullet trains with sleepers also started to operate between Shanghai and Chongqing as well as between Shanghai and Chengdu in 2011. It is the most advanced soft sleeper cars presently used in China. Every soft sleeper is equipped with independent video system and the luxury soft sleepers even have small meeting rooms.

From Chengdu to Shanghai the highest ticket for one advanced soft sleeper costs up to 2330 Yuan (275 Eur), as expensive as the rooms at five-star hotels.

Each train is 430 m of 16 cars, with a capacity of 618 people. There are 13 soft sleeper cars that can accommodate 496 people and second-class coach for 122 people as well as a dining car.

The whole journey takes 15 hours. The price of ticket for a second-class soft seat is 473 Yuan, for a common soft sleeper it is 980 Yuan and 1100 Yuan, and for an advanced soft sleeper the price is 1955 Yuan and 2330 Yuan.

Hu Xingdou, an expert in China-related issues at the Beijing Institute of Technology, said that transportation improvements should take into account the real needs of the general public.
THE ZEFIRO 250 - ONE OF THE WORLD’S FASTEST SLEEPER - IS NOW TRANSPORTING CHINA’S OVERNIGHT TRAVELLERS INTO NEW REALMS OF COMFORT.

Bombardier, Innotrans 2010

Social acceptance

Gu Jun, a sociologist, maintained that this is actually a “product with full of flaws” by China’s Ministry of Railways as there is no need to furnish the bullet sleeper at a five-star standard for such a short journey.

“Who wants this luxurious experience on a train? It is dark outside at night and sightseeing is almost impossible. A business person won’t spend a couple of hours on a train.” Perhaps some passengers that are afraid of traveling by air would lavish more than 2000 Yuan on such bullet sleepers,”
What characterises many of the trains operating the Shinkansen is the long noses.

Because of the mountainous terrain in Japan, the Shinkansen has to go through a lot of tunnels. When entering a narrow tunnel at high speed, air pressure is created in front of the train, and this pressure will travel in front of the train, creating a boom at the exit of the tunnel.

This problem increases with the speed of the train and a smaller diameter of the tunnel, and as Japan was a HSR pioneer, the tunnel diameters are in many cases rather small compared to newer tunnels.

The Shinkansen became an icon for Japanese engineering when it was launched just before the Olympic games in 1958.

The possibility to travel between the big Japanese business hubs increased the culture of face to face business and became an alternative to flights because it arrived in the city centre for a reasonable price.

The Shinkansen is operating with a system which stops the train in case of an earthquake. It is one of the reasons why the Shinkansen has been the safest way of transportation in the past years without any injuries.
THE SHINKANSEN WAS THE FIRST HSR IN THE WORLD, AND IS TODAY A HSR NETWORK THAT IS OPERATED BY FOUR JAPAN RAILWAYS GROUP COMPANIES."


**E6 Shinkansen**

The coaches are air-sealed to ensure comfortable tunnel passes. The E5 is built by Hitachi and Kawasaki Heavy Industries and begun its service in 2011. In addition to its 15 meter long nose, it has full bogie (wheels and framework) cover to ensure less noise and less aerodynamic drag.

Former Pininfarina designer, Ken Okuyama, supervisor of the Ferrari Enzo design, has been brought in by the Japanese manufacturer.
**Magnetic levitation**

The maglev-trains have superconducting magnetic coils, and the guide ways contain levitation coils. As the train moves, its moving magnetic fields create a current in the levitation coils because of the magnetic field induction effect. These currents create a magnetic field that interacts with the magnetic field of the superconductive coils to create a force that holds up and stabilises the train.

On 2 December 2003, a three-car train reached a maximum speed of 581 km/h (361 mph) (world speed record for railed vehicles) in a manned vehicle run.

There are plans to build several maglev lines in Japan and China. By 2035 a maglev train will most likely connect Osaka, Noagoya and Tokyo which will minimise the travel time and highly compete with flights.

The technology is not suitable for a night train concept because it covers short distances up to 290 km in a short time. It will at some point replace todays Shinkansen trains which can than be used for long distance travels at night.
THE SHINKANSEN IS COMING CLOSE TO ITS LIMITS IN TERMS OF TECHNOLOGY AND SERVICE.


MLX 01 901

The front car of the Series L0 maglev measures nearly 92 feet long – of which 49 feet forms an aerodynamic nose section – and is fitted with 24 seats.

A full 16-carriage train will be able to carry 1,000 passengers, The Telegraph reports.
900 km travel
Tokyo - Sapporo
Price / Time / CO2
2030

Waiting time
Low Comfort

Japan Airlines
¥ 6.000 / 18h / 36kg
¥ 13.000 / 3h / 60kg

Shuttle Bus
¥ 6.000 / 18h / 36kg

Capsule hotel: ¥ 2000 - ¥ 4000

Business
Function

MAGLEV - trains
¥ 15.000 / 8h / 5kg

Bullet Sleeper Train

Bullet Train

¥ 13.000 / 4h / 10kg

Night Train
¥ 6.000 - ¥ 17.000 / 16h / 17kg

Luxury Night Train
¥ 13.000 - ¥ 40.000 / 16h / 20kg

Holiday
Experience

Competition:
- Bullet Sleeper Train
- Bullet Train
- Night Train
- Luxury Night Train

Travel Costs:
- ¥ 2030
- ¥ 6.000 - ¥ 40.000
- ¥ 6.000 - ¥ 17.000
- ¥ 13.000 - ¥ 40.000

Travel Options:
- Japan Airlines
- Shuttle Bus
- Capsule Hotel

Travel Time:
- 2030
- 18h
- 3h
- 4h
- 16h
- 17kg

Travel Comfort:
- Low Comfort
- High Comfort
- Quality Time

Travel Experience:
- Holiday
- Business
Types of Accommodation

International solutions

Passengers per car / CO2

- Low Comfort
  - 30pax / 10kg
  - ¥ 6,000

- Holiday
  - 30pax / 10kg
  - 42pax / 10kg
  - ¥ 40,000

- High Comfort
  - 28pax / 10kg
  - 15pax / 20kg
  - ¥ 40,000
Field trip

Experience test in Europe
On the night train from Umeå to Stockholm / Berlin / Copenhagen

Is it possible to use night train connections for your work schedule?

On my field trip I first tried to work on a 3 bed cabin on my way from Umeå to Stockholm. The comfortable room offered a table, several sockets to charge digital devices and a sink which I mainly used to brush my teeth. I slept well and the automatic system woke me up in time so I could take a shower and prepare my self to leave the train early in the morning around 5:45 o’clock.

The next test trip continued from Stockholm to Copenhagen. I booked a reclining seat and had a hard time sleeping due to the luggage that I had to take care off. The passengers next to me did not sleep much either and used their laptops instead for entertainment.

The last test was a six birth cabin from Berlin to Copenhagen. I knew that people were complaining about this setup and had low expectations about it. I had a hard time sleeping again because of snoring neighbours and several stops in busy stations. The whole car got unlinked and switched to another train which disturbed my sleep as well.

Night train

<table>
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<th>Changes</th>
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<tr>
<td>21:23</td>
<td>+06:30</td>
<td>0</td>
<td>09:07</td>
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Seat

- Non-rebookable: 865:-
- Rebookable: 890:-
- Refundable: 946:-

Couchette/Sleeping car

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<tr>
<th>Departure</th>
<th>Arrival</th>
<th>Changes</th>
<th>Travel time</th>
<th>Price from</th>
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<tbody>
<tr>
<td>21:23</td>
<td>+06:30</td>
<td>0</td>
<td>09:07</td>
<td>957:-</td>
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1 week in advance

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<th>Arrival</th>
<th>Changes</th>
<th>Travel time</th>
<th>Price from</th>
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<tr>
<td>21:23</td>
<td>+06:30</td>
<td>0</td>
<td>09:07</td>
<td>592:-</td>
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4 weeks in advance
I USED THE NIGHT TRAINS IN SWEDEN, DENMARK AND GERMANY TO EXPERIENCE HOW IT FEELS TO TRAVEL OVER NIGHT. I CAN IMAGINE IT BEING A TIME EFFICIENT ALTERNATIVE TO FLIGHTS IF THE COMFORT LEVEL COULD BE UPGRADED TO A POINT THAT PASSENGERS FEEL RESTED AFTER THE TRIP.
User Statistics

Why do people travel?

- **Holiday** 58%
- **City trip** 9%
- **Visit friends** 20%
- **Business trip** 9%
- **Commuter** 1%

How do people travel?

- **Alone** 38%
- **Couple** 23%
- **Family** 23%
- **With friends** 15%
- **With colleagues** 0%

1,421,184 travelers in German night trains 2012 / 70% efficiency

Evolution of the rail/air market share (Madrid-Sevilla corridor)

![Graph showing the evolution of rail and air market share from 1990 to 2012.]

Source: Renfe
How do people travel in night trains?

<table>
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<th>Cabin Type</th>
<th>Percentage</th>
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<tr>
<td>Single cabin</td>
<td>32%</td>
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<tr>
<td>2 bed cabin</td>
<td>10%</td>
</tr>
<tr>
<td>6 bed cabin</td>
<td>38%</td>
</tr>
<tr>
<td>Reclining seat</td>
<td>20%</td>
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What age group is traveling?

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Percentage</th>
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<tr>
<td>Up to 29 years</td>
<td>27%</td>
</tr>
<tr>
<td>Up to 39 years</td>
<td>15%</td>
</tr>
<tr>
<td>Up to 49 years</td>
<td>16%</td>
</tr>
<tr>
<td>Up to 59 years</td>
<td>12%</td>
</tr>
<tr>
<td>Up to 69 years</td>
<td>12%</td>
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Source: Kundenzufriedenheitsbefragung City Night Line 2012 (User survey)

Do you prefer to travel fast?

68 percent of the respondents said they would accept having the entire time from door-to-door be longer to avoid the process of checking in, security and boarding.

66 percent said they would willingly add an hour or more of total travel to their trip to avoid the hassles of long lines, airport security and baggage fees.

Evolution of the rail/air/road market share (Paris-Lyon corridor)

<table>
<thead>
<tr>
<th>Year</th>
<th>Train</th>
<th>Car</th>
<th>Plane</th>
</tr>
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<tbody>
<tr>
<td>1984</td>
<td>40%</td>
<td>29%</td>
<td>31%</td>
</tr>
<tr>
<td>TGV</td>
<td>73%</td>
<td>21%</td>
<td>6%</td>
</tr>
<tr>
<td>1997</td>
<td>40%</td>
<td>29%</td>
<td>31%</td>
</tr>
</tbody>
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Mark Smith  Author and founder of seat61.com / UK

What are key issues in today's night trains?

A classic sleeper has maximum of 36 berths if every compartment is used with all 3 beds folded out. It makes one trip per day. The same length of car would have approximately 70 seats and would make umpteen round trips a day. This makes sleeper train economics very difficult. A sleeper needs to somehow cram in as many people as possible. Some older people have trouble putting luggage up in the roof space. Cooling a sleeper compartment down, after it has been sitting in sidings in the hot sun all day, is a major issue, not heating it up, that is easy.

What do passengers preferably book from your experience?

- According to Renfe, the market has polarised, into those wanting a private sleeper and those wanting cheap transportation, perhaps in a reclining seat. So small single-occupancy and dual occupancy compartments are perceived better than shared 6-berths!

- Showers often asked for - the deluxe rooms seem to sell well.

„PEOPLE THESE DAYS HAVE FORGOTTEN HOW TO TRAVEL OVERNIGHT, AND WORRY ABOUT SHARING WITH STRANGERS. THEY WILL HAPPILY SLEEP IN A SEAT WITH 400 PEOPLE ON A LONG FLIGHT, BUT A COUCHETTE IS A PROBLEM FOR THEM.“

Mark Smith, author of the book „A guide to taking the train from UK through Europe“
Sofie Holstein-Homann  
*Design Manager at Designit Copenhagen*

*What do you think about a night train concept that addresses business user?*

If Denmark would be more connected with high speed trains people would preferably use this kind of connection. I think the check in time and non efficient working time you have on a flight would be compensated by the train which is easy to access. That would be the preferred way of collaborating with the Munich office for Designit for example. Another important factor is the CO2 footprint. In the US employees get less bonus salary if they act irresponsible with their amount of business travels. A night train could provide space to work as a professional and still offer an experience that is less stressful than flying.

*What are the most important points for business night travels?*

- Minimise waiting time
- Be productive as a professional
- Convenience
- CO2 footprint
- Connect business hubs

„*WHEN YOU SHOWED ME THE MOVIE, THE INTERIOR FELT REALLY CLOSED IN. IF IT WOULD BE MORE OPEN VISUALLY, THAT WOULD BE MUCH NICER. A LOT MORE INVITING*“

*Philip Todorovski, MA Product Desinger at Designit Copenhagen*
Platform interviews Why are people travelling with the night train?

Why are you travelling and why did you choose the night train? I am travelling because I was working here. I prefer to go by train if possible but I came with a flight today. I think it is convenient. I come to Stockholm (if it is in time) earlier than if I go by plane. I find it more comfortable.

Do you have special tricks to sleep well on the night train? No, I used to go on night trains often so I am used to it. I just fall asleep... dunk...dunk...dunk... and I like it :). Some of the sleeping cars have been in a pretty bad shape though.

Why are you travelling and why did you choose the night train? I have been here in business and I am going home (near Gothenburg). And if I would go by air I would come to Stockholm and I had to stay over night there so I could as well take the night train.

Do you usually take the night train and how do you think about the comfort? This is for this occasion but I used night trains before. I used to sleep well. When I am getting older I think I sleep less well. I fall asleep and when the train stops I wake up.

„I AM GOING TO VISIT MY GIRLFRIEND. I DON’T AGREE WITH THE SWEDISH WAY OF TAKING THE AIRPLANE EVERY TIME JUST TO SAVE SOME HOURS. THERE IS AN ECOLOGICAL IMPACT. AND IT SAVES ME AROUND 800SEK“

Night train traveler, Umeå C station Sweden
Johanna Fredriksson User experience report

What was your experience traveling in a night train with your family?

I booked a 3 bed cabin to travel with my family from Umeå to Stockholm. Signe woke up and cried for twenty minutes. I became very stressed about that because I know that people are paying so much money for having this nap on the train. We put the stroller in the luggage box in the beginning of the car. That was all right. But there was trouble when we arrived because the train stops for only about 5 minutes and we had to collect everything including our stroller, bags, baby and get off the train. I don’t know how to do it if you are by yourself. You need to have at least two adults when travelling with a child.

What were the main issues on your night train trip?

- The walls are super thin so I heard the neighbours snoring.
- We oversleep a few minutes so it became very stressful to get out of the train.
- For a family if you want to go by train it is even more expensive

“WE AS A FAMILY DO NOT WANT TO TAKE THE PLANE IF IT IS NOT NECESSARY BECAUSE OF ITS ENVIRONMENTAL IMPACT. YOU ALSO DO NOT LOSE THAT MANY HOURS WHEN YOU TRAVEL AT NIGHT AND HOPEFULLY GET SOME SLEEP.”

Johanna Fredriksson, young mother from Umeå
Peter Sandstieg  SJ Night train operator / Sweden

Where are the night trains going on day time and do they have different cars per ride?

They go to a train depot in Holgerlund north from Stockholm (Luleå in the north). They get cleaned and prepared for the next trip in the evening. We try to fit the amount of cars to the booked space and needs but sometimes it is not enough. Sometimes there are empty cabins. This is why the ticket is half the price when you book months in advance. There are different seasons where we change the amount of cabins and seats. For the summer season we add more cars. (We rent them from traffic verket)

- How often do you upgrade the interior of the trains?
  Approximately every 10 to 20 years. They will not change before 2020.

What are the conditions for driver and conductors?

- Drivers have an 34h week instead of 38h. They have to press a button every 10 minutes. If they are too fast or ignore a red sign the train stops automatically. Conductors can sleep on the train. Most of the time the staff also changes in between.

„THE SWEDISH GOVERNMENT PUTS MONEY INTO THE OPERATION OF NIGHT TRAINS. WE CANNOT AFFORD THEM TO STAND STILL ON DAY TIME BECAUSE WE HAVE TO MAKE MONEY.“

Peter Sandstieg, SJ night train operator Stockholm
Katsuhiro Kunimitsu  
*Kuni Corporation Tokyo*

*From your experience in Tokyo, why do people prefer to travel by plane instead of the Shinkansen competitor?*

It is much faster than other transportation methods. 
The flight is expensive but people has to use it for one day trip to Hokkaido.

*Who is mainly travelling between Sapporo and Tokyo?*

Normal : business & Tourists = half and half  
Event = they have a famous Ice / Snow Festival at this time : more tourists  
Attractions : golf in summer, skiing in winter, good sea food famous beer and Ramen  
National University = Hokkaido Univ. (probably No.6 in Japan)  
Industry : some car makers are there and the biotech industry is big in Sapporo.

*Do business travellers also consider to go by night train? The Cassiopeia train for example?*

The night train is more for pleasure. They have good bed rooms and it is popular and difficult to reserve. I don’t think business people take it since it doesn’t save money and it is a long ride.

„SAPPORO - TOKYO FLIGHT IS NO QUESTION - NO COMPETITION.‟

*Katsuhiro Kunimitsu, Kuni Corporation Tokyo*
ROLE MODEL: Tanaka-san (32), Sapporo

- **Salary man:** Departmental manager at a large Japanese corporation.

- **Tanaka-san likes:**
  He enjoys skiing and loves to be active in the Sapporo ice festival. At that time he is a great host for his friends from Tokyo.

- **Tanaka-san does not like:**
  He has to travel at least 10 days a month due to meetings, presentations and the Japanese face to face business culture. He lives far away from the airport and is always stressed to get there in time. He is annoyed about the waiting time at the airport and would rather spend time with his family instead.

- **Family:** He is living in a house with his wife and kid which is located in the suburbs of Sapporo where he grew up with his parents. Most of his friends live in Tokyo where he was studying after high school.

- **Income:** 380,000 ¥ each month. The expenses for travels to Tokyo are also covered by his company.

  In his first year he was flying business class but the conditions changed when ticket prices were raised and carbon tax policies were introduced for airlines. His company is always looking for opportunities to

_“I WOULD PREFER TO GO TO TOKYO BY TRAIN WHEN THE HOKKAIDO SHINKANSEN LINE IS FINISHED IN 2030. IT DOES NOT MATTER FOR ME IF THE TRIP TAKES 2 MORE HOURS.”_  

Tanaka-san, Sapporo
Tanaka-san, Sapporo

“I LIKE TO COMMUTE TO WORK WITH PUBLIC TRANSPORTATION. IT IS MUCH MORE RELAXED THAN DRIVING BY CAR AND MUCH FASTER WHEN THE CITY IS CROWDED”

Nap time
Autonomous relaxation

The public transportation system is often used by Tanaka-san to take a nap before the work starts and the evening begins.

The connectivity with smart phones and laptops increased the comfort of public transportation and created a public living room where time fly by quickly.
DAILY GRIND: 3 days business trip to Tokyo, presentation

Japanese airlines Sapporo - Tokyo

850km 3 hours ¥ 10,000

Check in 5:50 pm

Flight 6:20 pm

Baggage + Scan 30 mins waiting

Delay 30 mins waiting

Orientation / departure gate

1km 10 mins

Arrival process 30 mins waiting
Tokyo airport - Tokyo centre

- Cab 9:50 pm
- 46km 40 mins ¥ 3,000

Hotel 10:50 pm ¥ 7,000

Overall Time
6h20mins

Overall Costs
¥ 21,000

Sapporo centre - Sapporo airport

- Cab 5:00 pm
- 8km 20 mins ¥ 1,000

Early wake up 4:30 pm
Goals & Wishes

Create a night train interior which
- is convenient for business travellers
- reduce noise and improve comfort

Create a sustainable layout
- for minimum 36 passengers per car
- and use eco friendly materials.
Improve the handling of luggage in terms
- of safety
- and ergonomic issues

Create an experience
- provide a shower
- think about daytime use
- create an inviting atmosphere
Inspiration & Ideation

What is the minimum size for comfort?
The hotel “9hours” in Kyoto is a new capsule hotel that offers luxury in a minimum living space. Guests first take their shoes off and lock them in a locker in the entrance hall. Slippers, toothbrush and towels are provided for guests who can then use one of the 125 sleeper pods, showers or relax in the lounge area.

Male and female levels are separated in different floors. The capsules (1.20mx1mx2m) are equipped with a light system (Panasonic) which is computer regulated to support a good sleep and wake people up nicely in the morning.

The service idea is that the guest stays 9 hours in total (shower 1 hour/ sleep 7 hours/ rest 1 hour). He can stay 17 hours maximum. The bed sheets are of the same quality as those that are used in a four-star hotel. The design is clean and puristic up to its detail and graphics.
THE 9H HOTEL IS DESIGNED BY PRODUCT DESIGNER FUMIE SHIBATA AND SHOWS THE SYMBIOSIS OF DESIGN AND ARCHITECTURE BOTH IN FUNCTION AND MANUFACTURING.

Capsule hotel

Japan’s first capsule hotel made its appearance in Osaka in 1979, and was designed by architect Kisho Kurokawa.

Originally intended for the salary man who was stranded in Tokyo due to work-related entertainment, the capsule hotels offered the basic necessities (bed, quiet, toiletries) for a cheap price.

The salary man could wake up the next day, go to the convenience store and buy a cheap pair of socks, shirt and a necktie and go to work refreshed.
Airports

Nap cabs and sleep boxes are becoming popular in Europe and Russia. They are capsule hotel units for travellers that were stranded at the airport or that have to wait several hours for their connecting flights.

Those mini hotels offer a bed, wifi, tv, a toilet and a shower in some cases. The idea is already in use in China for several years. People can work, take a nap or sleep over night.

Architects and designers experiment and try to find the balance between the basic functionality and the minimum of space that is needed to provide these functions in a comfortable way.
Capsule hotel

Japan’s first capsule hotel made its appearance in Osaka in 1979, and was designed by architect Kisho Kurokawa.

Originally intended for the salary man who was stranded in Tokyo due to work related entertainment, the capsule hotels offered the basic necessities (bed, quiet, toiletries) for a cheap price.

The salary man could wake up the next day, go to the convenience store and buy a cheap pair of socks, shirt and a necktie and go to work refreshed.

“SLEEPBOX IS INTENDED PRIMARILY TO PERFORM ONE MAIN FUNCTION - TO ENABLE A PERSON TO SLEEP PEACEFULLY. BUT IT CAN ALSO BE EQUIPPED WITH VARIOUS ADDITIONAL FUNCTIONS, DEPENDING ON THE SITUATION.”

Arch Group, www.archgroup.org/portfolio
Airports

“Airplane seating is such a challenging category of furniture design. The designer needs to create a one-size-fits-all chair that is adjustable, has on-board storage for literature and a folding table, built-in controls for A/V and/or lighting, and must be designed so that (in theory at least) it can be regularly cleaned. And it all has to fit in a very tightly-regulated footprint, for passengers who are steadily getting larger.” core77.com

Air New Zealand designed this “Spaceseat” in an effort to provide Premium Economy travellers with a more Business-Class-like experience, the middle seats are angled outwards to provide more space.

There is a trend of positioning seats in an angle to create space for additional features. Pearson Lloyed for example used this trick in their business class interior layout for Lufthansa. The space created by the angled seats is used for luggage on the back and for tables on the front side.

Entertainment systems are obligatory and the cover for the head is important when the passenger is sleeping.
AN OUTSTANDING EXAMPLE OF AIRPLANE SEATING DESIGN IS THAT OF THE NEW LUFTHANSA BUSINESS CLASS SEATING DESIGNED BY PEARSON LLOYED.

Core77, www.core77.com/blog/furniture_design

Lufthansa

Business class

Lufthansa decided to develop a fully flat business-class seat after an extensive consultation with its premium customers. The passengers’ expectations needed to be considered alongside the new design’s practical and commercial impact. Also critical to the project was the creation of an efficient, durable product that is easy to maintain and supports the flight crew’s service demands.
OPEN SPACE BECOMES MORE IMPORTANT! GLASS, COUCHES AND BEAN BAGS ARE A WAY TO CREATE A NEW ATMOSPHERE IN PUBLIC TRANSPORTATION AND GIVES THE FEEL OF A LIVING ROOM INSTEAD OF THE CLOSED EFFECT OF THE OLD DAYS.

Integrative functionality and open space feeling are two main points of latest train interior concepts.

The logistic and service design approach of the moving platforms concept by Priestmangoode shows ideas of connecting public metros and high speed rail networks directly on the go and is questioning stations as outdated elements that make trains stop.

Multifunctional designs envision seat layouts which fold into beds at night.
THE WORK BY CALATRAVA IS AN EXAMPLE FOR OPEN SPACE ARCHITECTURE. HE USES REPETITION OF ORGANIC STRUCTURES AND ITS LIGHT EFFECTS TO CREATE A UNIQUE EXPERIENCE AND ATMOSPHERE WITHIN SPACE.
Biomimicry
Before I started to create ideas for the layout of the Night Train interior, I looked at how nature is dividing space in microcosmos and was searching for inspiration in tessellated patterns. Gradients of 3D printed or milled patterns were also source of inspiration.
Sound insulation

**Soundproofing**
*Patterns*

Designed to diffuse sound, reduce acoustic glare and standing waves, these structures combine cost-effective sound control with an elegant weave pattern. Vertical and horizontal arrangements provide improved acoustics and superior aesthetics to any room.

**MIO**
*Accustic tiles*

The lightweight recycled paper modules can be installed temporarily with double stick tape or permanently with wallpaper paste which allows a custom fit to each space. Damaged parts can be replaced due to its modular system.
“VARYING THICKNESS BUILT INTO EACH PATENT-PENDING AUDIO TILE DELIVERS EXCELLENT BROADBAND SOUND ABSORPTION”.

Auralex, Shockwave
Sound cancellation

**Bose**

*Acoustic noise cancellation headphones*

“QC3 headphones feature Bose® Acoustic Noise Cancelling® technology to electronically identify, then dramatically reduce, the noise around you. Think of your noisy office, or the bustling activity in train stations and other public places. At the flip of a switch, that background noise is reduced to a whisper. You’ll hear more of your music—without having to turn up your music. And the soft-cushioned, easy-on-the-ears fit lets you listen comfortably for hours.” *Bose*

Toyotas Crown Hybrid will feature an Active Noise Cancelling system. Using a series of small microphones and speakers inside the cabin, the system is designed to remove tyre, wind and engine noise via black noise. While it won’t completely stop the noise while accelerating, once the car is in a steady-state cruise the car should be tomb-like inside. Just perfect for enjoying that premium audio system.
"The fabric wall decoration, Nunokabe, harks back to Toyota Boshoku’s roots in the textile industry and utilizes techniques gained from this business and our automobile interior business. Luxurious materials are used to create a wide assortment of rich motifs that can be arranged into a variety of patterns. An additional benefit of Nunokabe is that it helps absorb sound to keep homes quieter." *Toyota Boshoku*
Train

Measurements

The package is based on the measurements of the Japanese Shin-kansen bullet train N700 introduced in 2007. (Interior get redone every 10 to 20 years)

Its length is 26m and fits 5 passengers in one row of 3,40m width. The height of the train is 3,70m while the interior is based on the height of 1,30m. This gives passengers a total roof height of 2,40m.
Antropometry

Sit and sleep

It was important to look at the measurements of how high beds could be stacked upon each other in a comfortable way.

The height between the beds and the roof line has to be 90 cm minimum to be able to sit. The bed length is 2m and the minimum width 70cm.

Stairs to climb up to the second floor should have a height between 30cm and 35cm. The height of 1m can be reached with two 35cm steps or three 30 cm steps when the angle of the staircase is about 60°.

Straight stairs would make it hard to climb up because passengers would bump their knee into the second step.
Basic Layout

Used in the US and Canada / economy class

2500 cm

370 cm

340 cm

48 passengers

sleep & sit

Dimensions

Trolley: 50 cm

Suitcase: 30 cm

Jacket: 45 cm

100 cm

Trolley: 25 cm

Suitcase: 80 cm

36 cm
Used in Japan / economy class

60 passengers
sleep & sit

Shinkansen

Front
320cm

370cm

130cm

Top
100cm

Passenger

90cm

200cm

75cm

120cm

130cm
Initial idea

The first concept idea was based on the biomimicry inspiration of honeycombs. The layout offered 44 beds in pods with the dimensions of 100cm x 90cm x 200cm. The initial idea also offered an area to sit which could be folded to a bed at night as a separation element between the repetition of the honeycombs.
Feedback

The structure allowed to explore different asymmetric patterns which would create a more organic feel instead of the geometric repetition of the hexagon pods. The main feedback at this point was to create space that would fit both for sitting and sleeping.
The first mock up was made from stacked conventional tables with a height of 75cm. Users felt very claustrophobic in this tiny tube and were not able to sit up properly. The second mock up was build to test if users would feel comfortable in a hexagonal pod with a height of 120cm. The idea was to open up the space by positioning the angled walls to the sides.
Tape drawing

A one to one scale tape drawing was used to evaluate the overall design of the layout. This method gave the freedom to change and explore in real size which was important to fit in space for luggage and find the most efficient comfortable space.

Material

All mock ups were made from wood, paper and tape. Three frame elements were connected with 2m wood pannles to form a stable base structure that would give a real feeling of a capsule hotel space.
Workshop

Ideation

I asked class mates and students from the transportation and interaction design programme at UID to sketch on their thoughts and ideas after testing the rough mock up of the pod. The different ideas were than clustered in different layout and detail solution directions.
Feedback

Users thought that it was very comfortable space and the roof could be lower. People wanted to have their luggage locked within the capsule and were excited about a screen in the roof area. They also saw space for a small sink and a mirror which could be positioned in the front. It was easy to get in and small persons would even have enough space to change their clothes inside. It was important for users to have a defined space for their shoes.
After refining the first mock up, users liked to put their luggage from outside the capsule but still have access to it from the inside. The shoes can be put underneath the mattress and a table folds out next to the window. The created space was perceived as very comfortable and cosy. Some users could see people book two capsules and open them up to create one big sleep area for two adults and a kid for example.
Feedback

There was an issue regarding the irregular layout which gives more comfort to the bottom row pods while the top row lacks space to stretch out their legs. Passengers in the middle pods would have no chance to keep their luggage within the cabin. I kept important measurements that I learned from the mock up and explored a layout that would offer the same comfort for all passengers.
Iconic

The night train mainly operates in darkness which makes it important to think about the night time appearance of the interior. The bottom cut in the hexagon shape creates an iconic graphic when the capsule lights up from the inside.
Privacy

Passengers were asking if it would be possible to close the capsule with a door or cloth and were not convinced that climbing up to the second floor would be very business like. The last user test session was used to ask where to put details like sockets, displays, coat hanger and the table. Its size was evaluated as well to fit for a laptop, a snack in the evening and breakfast in the morning.
Nobi Nobi *(Japanese night train layout)*

The nobi nobi layout is a very efficient in its use of material and number of passengers (56) that could fit into one carriage. It's openness can be uncomfortable in terms of sound but the social aspect in this layout is very strong. Each passenger has a window, reading light, and a socket to charge mobile devices. The initial sketch shows a conference room dividing the repetitive pattern of the separation sheets.
Atmosphere

The straight corridor creates a very geometric feeling which should be avoided for the final direction. I was exploring the puristic idea of the separation sheets and tried to find a more organic way of separating the sleep areas that would also create a visual element for the exterior.
Separation sheets

The side line of the separation sheet was created so it would cover a sleeping and sitting person. In that way passengers can still have privacy without being closed in. A main difference to concept one is the perpendicular direction. Users were asking for a stabilisation element for the work position and liked to have a big window on the opposite side to enjoy the view of the landscape in the evening and morning.
Tatami mattress

The traditional Japanese tatami mattress floor was proposed as the bottom layer to use its smell absorbing quality. The refreshing smell of the tatami material was perceived as a comfortable side effect that would create a nice atmosphere. “We have tatami at home. I remember it smelling like tea. I would like to have it in a night train” Corey Chiu Taiwan
Reclining seat

The third direction are based on reclining seats that can slide down in a second shell to form a bed. It is inspired by airplane interiors and could fit 50 passengers. The initial sketch shows these multifunctional seats with separation sheets and a nobi nobi top floor.
Open space

This direction aims to create a more open feeling to the overall space. The leaf shaped separation between the seats covers the passenger while he is sleeping and can be flipped to the side to use it as a table.

Material

All mock ups were made from wood, paper and tape. Three frame elements were connected with 2m wood panels to form a stable base structure that would give a real feeling of a capsule hotel space.
User test

The mock up was perceived as comfortable especially in sleeping position. “I like the idea of the sliding part that would not effect the passengers behind!” David Cortes Spain
Static table

The table felt like a protective layer but had the disadvantage to block people from getting out of the second row.
Feedback target group

Japanese salary men could see themselves travelling in a capsule train. They would choose a small capsule to save money but would prefer to have more space when they travel for work. They pointed out that Japanese hotels can be very expensive and that they believe in the cost efficiency of the concept.
Feedback Toyota Boshoku

Christoph Ogier visited Umeå in March and was mainly curious about how to create a sound-proof solution and an efficient layout for the night train. He liked the playful direction of the honeycomb structure and could imagine it being a very Japanese way of travelling. He also pointed out that the efficient nobi nobi direction would find acceptance as well because the Japanese community aspect is much more important than the individual traveller.
Regular Layout

I used the knowledge of the first mock up to create a refined layout that would offer the same level of comfort for all passengers. The total number of passengers was reduced from 44 to 36 which is today’s standard for most night trains. Additionally the carriage could fit two bathrooms at each end.

Functions

Each passenger has its own closet which can be closed either with the staircase or a tent cover. The same cover is used to close the capsule if needed. Sliding walls offer the possibility to access the luggage and clothes from inside.

The modular walls also enable options to book several capsules in a group and open them up into one big room.
Scale model

Small 1:20 mock ups of the layout were lasercut to evaluate the expression of the overall layout. The pattern created a mix between geometric shapes and the organic flow of lines. The repetition still created a straight corridor which felt closed in and still had the feel of an animal transporter.
OLED wallpaper

The top surfaces of the inner capsule are covered with OLED fabric which enables travellers to connect with online services and mobile devices while lying down. It is also used for the entertainment program and creates light to wake up passengers in the morning.

Handle

Comfortable handles improve the secure way people climb into the second level. The stairs fold out from the lower closets.
Luxury

The capsule idea became a luxurious direction compared to the others. It felt like this way of travelling was suitable for directors and high end users which drifted away from the user group of the salary man.
**Open space**

The second chosen direction was the nobi nobi separation sheets. The layout idea splits the room into two tent colonies which is already reducing the noise level. The structure reminds on the skeleton of an airplane and uses tent covers to keep privacy for each passenger. The concept fits 48 passengers two toilets and two showers which is an improvement of 12 passengers to most of the layouts used today.

**Central luggage**

One idea was to have a central shelf for luggage and shoes in the entrance of each carriage. The blue tent covers would also prevent passengers from sliding out.

Another option was to keep luggage and clothes in between the separation sheets.

The third option was to lock the luggage within the tent cover.
Layout

Each slot is slightly angled to fit a person and luggage within one compartment. The layout of the individual space results in an arc shape which offers space for shower and toilets on both sides where it gets too narrow to sit or sleep.
Structure

The separation sheet are part of the main construction of the train carriage. It can be manufactured in a material efficient way and second layer could be used to create soundproofing and comfort.
Decission

Hideki AKYA san, director of TB Milan, born in Toyota city.
- Really feel the spirit of the capsule hotel in those proposals.
- He wanted to know if he will have the possibility to stay with his family in the train (( everybody close together )
- Reinforce the security issue ( lighting line on the ground like in planes for evacuation, alarm button in case of emergency , ( like heart attack ) His choice is in direction 1.

Futoshi san, product designer at TB Milan, born in Shikoku.
His feelings are depending on the situation, if he is travelling alone he would like to choose the 1st direction, but travelling with friends he might choose the second direction.
His choice is based on the stronger privacy aspect in direction one, but he likes the „cool“ effect of the second proposal.
Makoto HOSHINA san product designer in TB Milan, born in Tokyo.

- Direction one is stronger in the space utilisation, it looks like it has the best space optimisation.
- Direction one is also for him more interesting in term of privacy.
- Would like to know if there will be common spaces (like lobby) to have a coffee or pass a phone call...
Detailing

How to create the unique experience?
Key sketch

Additional functions

The split lines in the mattresses show where the back wrest flips up to create an armchair for the working or entertainment position. The inlay is shaped as an offset of the main curve and creates a sound proof layer which is sound dampening snoring sounds and other noise while travelling.

Final Layout

The top view shows why the final layout is created in the angled way. Each spot provides space for a person (grey area) and luggage at the end (dark area).

Stairs

One of the hardest tasks was to implement the stairs in a way so they would visually blend into the structure of the main layout. The key sketch shows how the cutout creates stairs for two passenger spaces. The luggage area was moved to the same side of the stairs to create a functional and a comfortable side in each cabin.
The main line of the interior design was refined by tape drawings to see the effect in 1 to 1 scale. The stairs were too wide and could be reduced to 15 cm on the first level and to 25 cm on the second step.
**Mock up**

**User test**

*Second floor*

The separation sheet is used as a handle to have a secure feeling when passengers climb up to the second level. The distance between the steps is 35cm and the luggage area can be used as a third step for short people.

The table could either flip from the side or rotate out of the separation sheet.
Detail Sketches
**Tent cover** *How should the space be closed?*

There are different methods to close the space for passengers. It could either slide from the bottom and lock with zippers or fold down from the top like a stroller cover. Mosquito nets, ordinary curtains and sleeping bags were also part of different closing solutions.
The first version of the inner structure was missing stability. The sketch shows how the different separation sheets get connected with the stairs to create a more stable construction.
Armchair and table

What is the most comfortable setup?

Different ideas were tested for the table setup. It could either flip from the front of the mattress, slide from the side or rotate on the side wall and flip down in an arc. The last option offered most comfort for both working and sleeping setup.
Refinement

Second floor

The stairs are connected to the front stabilisation parts and blend from the bottom into the second floor where it opens up space to keep luggage. The luggage part is also used as a step for short passengers. The tent cover will be used to secure passengers and luggage from sliding out of the compartment.
Window graphic

*Final result*

The layout is balancing the weight inside the carriage and creates a unique window graphic which is expressed in the main panorama glass part and individual windows in each passenger space.
Render tests

The final CAD model was imported into Keyshot. First 3D mannequins were used to show different functions and proportions. Back plates were important to show the feeling of travelling in the „golden hours“. The environment images were select to match the light and colour tone of the back plate image.
Main shell

The bottom part of the train was milled together with the vacuum mould for the main shell. They had an offset of 3mm to fit the right size.

The placeholders for the shower parts were milled in the same file.

Vacuum mould

Main shell

The main shell of the train was made by vacuum forming a foam mould which was covered with two component primer. It was sanded to receive a high end transparent finish in the acrylic glass material afterwards.
A 3mm acrylic sheet was used and heated up to 150°C until it was pressed on top of the mould.

**Temperature**

*150°C*

A 3mm acrylic sheet was used and heated up to 150°C until it was pressed on top of the mould.
Different printers

The main structure was printed with the zcorp printer which is building up powder and hardens it with resin. Most of the powder could be reused because of the thin wall thickness.

The front parts were printed in the objet printer to receive details and stability. Parts were sanded and primed before they got painted.
Assembly

Primer and paint were rising the height of the interior parts so the vacuum mould would not fit perfectly on top of it. It was important to sand them down to assure parts to fit together in the end.
1:20 scale

The front part of the Shinkansen was build up in clay (Styrofoam core) to explore the expression of the nose part and to get an idea of the scale.

The model was digitalised with a 3D scanner and prepared for milling.

At the same time the scanned data was used as underlay for renderings in Keyshot.

The main feature lines were explored in illustrator.
Context

Combination

After finishing and painting the interior parts it was time to merge both interior and exterior to see the concept in its full context.

Mattresses

3D print

The beds were printed in the zcorp machine and assembled with the main structure.
The scanned data was directly milled in soft foam and manually finished to save time for a highly detailed interior part.
Final Model

Exhibition

1:20 scale

The final model was assembled and later on detailed with the sound dampening inlay, rubons and textile.

A figure was added as a reference for proportion inside the interior.

The outer shell was painted white from the inside to create a high gloss finish.

Tape

The outer lines were taped on top of the acrylic shell.
The Toyota Boshoku logo and numbers for each passenger space were mounted for the final finish.
The exterior communicates high end technology and invites people to explore the inside.
44 passengers, 4 showers and two bathrooms in an open space layout.
The journey

The trip starts at 21:00 o’clock in Tokyo. Before departure the glass of the train is 100% transparent to make people aware and curious about the new way of transportation. The electrochromic glass changes light transmission properties when voltage is applied. This technology is used as a curtain at night.

Luggage is stored and locked within the passenger space and the armchair can be folded up and down with a switch on the left hand side.

The sound dampening pattern is used as decorative element and creates a cosy feeling.

Photomontage

In context

Renderings and photos of real persons were combined to show how the atmosphere would look like.
The space feels like a lounge before people decide to sleep and close their tent covers.
The journey

The interior offers an open space feeling and clearly indicates the different passenger spaces.

One could enjoy the view in the evening and morning, use their own digital devices for work or entertainment or get rested for the next day.

Digital devices can be charged at night. The socket is highlighted by the cup holder of the table which provides a pocket for valuables and glasses underneath.

Shower spots can be booked online and are available for 10min each from 5 o’clock in the morning. The trip ends round about 6:30 at the destination. Passengers feel rested and fresh to start their day in the middle of the city. They do not loose time while waiting at the airport and save money compared to additional transportation and hotel costs.

Wake up alarm

Each traveller has its own interface unit above their head. It can be used to set the wake up time in the morning. LED elements in the tent cover light up to wake up passengers without disturbing any neighbours.
Half transparent tent covers provide privacy and open space at the same time.
Users can either enjoy the panorama view or their WIFI connected devices.
Passengers arrive rested in the city center without the feel of loosing time.
Reflection

Conclusion / goals and wishes

Main challenge of the goals section was to cram in as many people as possible without losing the comfort level for business trips. The number of 36 passengers per carriage for a middle price ticket was improved to 42 and the amount of showers was doubled at the same time. The space for corridors inside today's cabins is used for additional passenger space instead.

The luggage is locked within the passenger space and is kept on the floor or on a low height of 1,20m. This improves the ergonomic situation of dealing with luggage as well as the safety issues which were observed on the research field trips. Users mentioned problems to fall asleep because they were taking care of their luggage instead.

For the final result I had to compromise on the goal to reduce noise in the interior. It was more important to fit more people inside. Active noise cancellation technology and the sound dampening foam inlay still improve the noise situation.

User evaluations showed that the open space direction was more acceptable for day time use and the lounge atmosphere was perceived as a new experience for public transportation.

The capsule hotel direction was accepted as a high class comfort solution that could be implemented in another carriage on the same train to create different price classes. For the final result it was too space consuming and far too luxurious. The amount of passengers was also too low.
Process/ learnings

By choosing a topic in scale of a train interior I put myself out of my comfort zone. From my previous experience in the interior design field I knew how important mock up testing is and decided to base the design on mock up results. In this context I learned how to explore interior spaces in 1:1 scale.

After receiving feedback at the mid review I decided to rethink the main idea of combining a capsule hotel with the train interior. When I look back it has been the most important decision in the process.

I usually explore design by sketching ideas. In this project I was forced to sketch and try different layouts in CAD very early in the process. I learned to deal with very complex CAD geometry. This complex geometry had to be waterproof to be able to print out parts for the physical model. I learned how to repair open edges with netfab and handled different scale calculations.

For the first time I scanned in a clay model and directly milled the mesh to be able to finish the front part of the train in a very quick way. The surface quality has been surprisingly good. The use of grey foam was important to implement manual changes.

It has been a great experience to cooperate and communicate ideas with Toyota Boshoku. Both offices in Nagoya and Milan were giving feedback for the mid review and final decision making. At the same time the tutor sessions in the UID have been very professional and productive. The school provided all tools that were necessary to create such a big scale project.

In communication with the tutors we decided that detailed renderings would be the best way to show the feeling of the interior space. The final model was created to have a physical reference which could have been more detailed in its finish. The exterior as well as the showers have been created as placeholders to show the whole context. Both topics could be design projects on its own. I learned how to plan a vacuum mould and created files for milling.

Overall it has been 5 months of extremely disciplined work. The amount of tasks was far too high for one person but in the end it feels like I gained knowledge on how to manage a large topic.
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References

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Thomas Degn  
UID Advanced Product Design

Anders Smith  
External Tutor

Christophe Ogier  
Toyota Boshoku Milan

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Climate policy after Copenhagen / The role of carbon pricing

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Rendering Back plates

The role of carbon pricing In 2030

Climate change is a big challenge for our generation and society.

What is this challenge?

Limiting global temperature increases to 2°C and reducing the risks associated with climate change demand large-scale reductions of carbon emissions. The reductions can only be achieved if all sectors of the economy are integrated into carbon policy. Implementation of climate policy to facilitate low-carbon development is politically challenging, because the intent is actually to change economic activity - from carbon intensive to low carbon products and services.

The prices for carbon-intensive products and services have to rise if consumer and corporate choice are to change. Most of this price increase reflects additional costs of buying carbon allowances or paying carbon taxes. The European emissions-trading scheme is evidence that it is possible to implement an ambitious policy instrument.

“AT THE UN CLIMATE CONFERENCE IN COPENHAGEN, 117 HEADS OF STATE CONCLUDED THAT LOW-EMISSIONS DEVELOPMENT IS NECESSARY IN ORDER TO COMBAT CLIMATE CHANGE.”
Business as usual Melting poles offer new resources

Over the longer term, the pace of oil demand growth is expect to ease slightly, to 1% pa during 2020-2030 from 1.2% pa in 2010-2020. Again, much of this demand growth will be led by the emerging markets, with China’s role in the world economy – overtaking the US in terms of GDP on a PPP basis after 2020 and becoming the second largest oil consumer by 2030 – meaning that demand for primary fuel sources will continue to climb.

PPP=Polluter Pays Principle is a principle in international environmental law where the polluting party pays for the damage done to the natural environment

Each round of intergovernmental talks on cutting emissions and compensating victims seems to achieve less than the one before. Meanwhile, according to a new study of 33 countries for GLOBE, a group of legislators from round the world, the number of new domestic environmental laws rose from ten a year in the early 2000s to 20 in 2012.

31 of the 33 countries now have a basic greenery law. South Korea passed legislation setting up an emissions-trading scheme in 2015. Japan introduced a carbon tax and a new law to encourage denser, more energy-efficient cities.

„IF WE CAN‘T GET A GLOBAL DEAL ON AIRLINE EMISSIONS, HOW LIKELY IS A GLOBAL DEAL ON CARBON EMISSIONS IN GENERAL?“.
The Economist, Jan 28th 2013, N.B. | WASHINGTON, D.C
Social changes  There will be more single parent households in 2030

In the European Union, average household size has been falling for some time. About 12 per cent of the population now live in one-person households, and over 4 percent are lone parents. The number of lone parent (primarily single-mother) households increased from 1.5 million in 1950 to 9.5 million in 2000.

In Japan, average household size fell from 3.22 in 1980 to 2.56 in 2005. The share of one-person households rose sharply from 19.8 to 29.5 over the same period, and that of single-parent households climbed from 5.7 percent to 8.4 percent. The average household size is set to fall from 2.56 in 2005 to 2.27 in 2030 as a result of deep-seated structural changes - one-person households up from 29.5% to 37.4%; couples with children down from 29.9% to 21.9%; single parent households up from 8.4% to 10.3%.

In European and in many other high-income countries, fertility is currently low for two reasons: first, women are delaying births to later ages, resulting in fewer births in the calendar years during which this delay happens (this is termed the "tempo effect"); second, women are not having enough births to achieve replacement level (the "quantum effect").

"The average household size is set to fall from 2.56 in 2005 to 2.27 in 2030. One person households up from 29.5% to 37.4% from 5.7 percent; single parent households up from 8.4% to 10.3%."  
Doteuchi, Sociology institute Tokyo
Singles and travel

*How to take care of your kids?*

The increasing number of single parents creates special needs for public transportation. People need help to carry strollers into the train and would be happy to find space for kids to play.

The „Deutsche Bahn“ in Germany started to offer a kids area in their ICE bullettrains.

Parents can than be sure were to find their little ones if they get lost on the train.

„DIVORCE NOW EFFECTS ONE MARRIAGE IN THREE. IN TOKYO, THE AVERAGE NUMBER OF INDIVIDUALS PER HOUSEHOLD HAS ALREADY DROPPED TO 1.99 PERSONS.“

*Doteuchi, Sociology institute Tokyo*
Online survey 20 users from 9 different countries

How often do you use night trains? Please let me know the occasion (holiday, business etc.)

- „Only once during my summer holiday. I wanted to give it a try to see what’s like on a night train."
- „Maybe once or twice a year. For holiday or when having a lot of luggage to transport."
- „Never used a night train. From my stand it feels like a night without much sleep so I would be afraid to lack energy at the next day."
- I forgot to book a plane in advance and all seats for all flights were full. I had to take a train.

Have you ever had a hard time handling luggage inside a night train?

- „I had my suitcase under my bed. It wasn’t a problem. (6 birth cabin)"
- „Yep, that’s why I pay for a 4 bed cabin by myself. (single cabin)"

„YOU HAVE TO BE QUITE STRONG TO LEVER THEM UP TO WHERE THE BAGS ARE SUPPOSED TO BE STACKED! I CAN MANAGE, BUT I THINK ABOUT ALL THE SINGLE MUMS WITH LOADS OF STUFF WITH THEM FOR THEIR KIDS."

Ting U Chen, Taiwan
How do you think about the comfort in night trains? Do you usually feel rested when you arrive at your destination?

- It shakes and woke me up several times. I felt super tired when I arrived. *(2 bed cabin)*

- Might get cold and a bit noisy but other then that it’s a good way of traveling. *(single cabin)*

- I like sleeping in moving vehicles. The „cradle“ effect from the moving carriage is very nice!

- It is what it is, it’s like the comfort of a sailboat, rocky and very much tight spaces. *(single cabin)*

- I had a hard time sleeping because I worried about my stuff. *(4 bed cabin)*

Would you prefer to travel by plane if the cost would be equal?

- Yes i would prefer the plane at night, as there is nothing to see from the train at night. And no CO2 emissions don’t mean much to me when travelling.

„THERE ARE A LOT OF HIDDEN „TIME THIEVES“ IN FLYING, SUCH AS GETTING TO THE AIRPORT, QUEING, WAITING... SO YES, FOR SHORTER TRIPS I’D PREFER THE TRAIN. ALSO EASIER TO WORK ON; AND MORE COMFY SEATING“

*Sofie Holstein Homann, Design Manager at Designit Copenhagen*
Check in interviews Why are you traveling by plane?

- Why are you traveling and why did you choose the flight? I am working here in Umeå but I am living in Gothenburg. So you live on a hotel here? Yes, I stay here three days every week.

  Have you ever considered taking the night train? Yes, I did so in the beginning but after two times with the train I started to take flights instead because the train was never in time. It was delayed by 2 to 4 hours. It is not an option.

- How come that you are traveling? I am going to Stockholm for the weekend. I will work there for one day at my previous internship. I just want to show my face there :).

  Have you ever considered taking the train or night train instead? No. It takes too much time and I guess it is as cheap as the plane anyway. So it is faster to travel by plane. I don’t think the night train would be comfortable. Have you ever tried? No!

„I AM VISITING A FRIEND WHO LIVES ABROAD FOR A WHILE. I AM WORKING SO I HAVE TO TRAVEL FAST. I COULD ONLY TAKE 2 DAYS OFF (MONDAY & FRIDAY)“

SAS passenger, Umeå airport Sweden
Henriette Stykow  User experience report

What was your experience travelling with a group in a 6 birth cabin?

We were traveling in a group of 4 people and booked spots in a 6 birth cabin. When we entered the cabin there was already one person sleeping while another guest tried to set up the bed in the middle position. It was hard to help until some people left the cabin so we had space to understand how it worked. It took us a while which disturbed the sleeping guest. First we hooked safety belts to the sealing to fix the bed in its position. But was that all? We had to push two buttons that looked like door bells simultaneously to activate the stabilisation parts of the bed. It was a stressful start.

What were the main issues on your night train trip?

- We could not find a ladder so we had to improvise to reach the top beds.
- One of the guys had glasses but there was no place to put them.
- I did not know what to expect. (We got two linen, a blanket and a pillow)

„IT WAS HARD FOR ME TO SLEEP BECAUSE YOU HEAR THE ENGINE NOISE. I WAS ALSO WORRIED THAT WE MISS THE STATION WHICH MADE ME SLEEP LESS GOOD.“
Henriette Stykow, MA Interaction Design student at Umeå Institute of Design
Initial Idea

Moving capsules  The autonomous passanger delivery system

As one of the first ideas I envisioned a concept where capsules could be moved from different stations into the train so waiting time would be reduced and delayed trains would not be noticed in night travels. From the start I was not sure whether economy and business class should be mixed or if I should focus on one of them. The final solution ended up somewhere in between business and economy class. The lounge idea is implemented into the final result as well. It is not a separated area but the whole carriage has the lounge feeling to save space and still create the experience of a living room.
Single capsule

Public lounge