UX Practice-based research – customizing the travel experience of the future

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1. Introduction

The term "tourism" refers to travel for pleasure and can be traced etymologically to the English word "tourist" (circa 1800), which in turn comes from the French "tour," meaning a round trip. People have been traveling for recreation or discovery for centuries, but it wasn't until the 18th century that tourism gained importance with the so-called Grand Tour—an educational tour of Europe by the nobility.[1]

Since then, travel has changed dramatically: What was once a privilege for a few people is now taken for granted by many. But what will tourism look like in the future? Will ecological and technological developments influence our travel behavior? And what challenges and trends will shape tourism in, say, the year 2100?

This paper addresses precisely these questions. We first take a look back at the development of tourism and analyze the factors that have shaped it. We then examine current trends: Sustainability, digitalization, and the changing needs of travelers play a major role in this. How can we travel more resource-efficiently? What technological options are available to make travel more efficient and personalized?

Today, tourism encompasses a wide variety of areas, each varying depending on the traveler's motivation and interests. Leisure and recreational travel, such as beach holidays or wellness stays, is designed for relaxation and well-being. Cultural and educational tourism allows visitors to explore cities, visit museums, or discover historical sites. Adventure and nature travel, such as mountaineering, safaris, or ecotourism, is aimed at travelers who want to experience the unknown and nature.

Sports tourism also plays an important role, whether through ski holidays, surfing trips, or attending major sporting events. Health tourism includes trips to spas and health resorts or medical treatments in specialized clinics. Business travel is another important category and includes conferences, trade fairs, or networking events.

In addition, there are pilgrimage and spiritual journeys, where believers visit places like the Camino de Santiago or religious sites. Luxury tourism, on the other hand, is aimed at travelers seeking exclusive resorts, cruises, or tailor-made travel experiences. In recent years, sustainable and alternative tourism has also gained importance, including slow travel and volunteer-based travel that emphasizes social and environmental responsibility.

This diversity shows that travel is much more than just a vacation – it is a complex and dynamic phenomenon that is constantly adapting to social, economic and technological developments.

Particular attention is paid to the challenges associated with travel – from climate change to new mobility concepts and economic developments. Through a combination of research, user analyses, and creative concepts, the project aims to explore what tourism might look like in 25 years.

[1] https://de.wikipedia.org/wiki/Tourismus

The goal of this work is to develop innovative ideas that are not only sustainable, but also practical and user-friendly. Ultimately, it's about ensuring that travel continues to be enjoyable—just adapted to the world of tomorrow.

1.1. Development of non-working days (in Germany)

The development of non-working days in Germany from the 19th century onwards was marked by significant changes:

19th century

In the 19th century, days off work were rare for most workers. The workweek was typically six days, and Sunday was often the only day off. For many workers, even this day was not guaranteed time off.[2]

Beginning of the 20th century

1903 marked an important milestone: Brewery workers were the first group of workers to secure a collective bargaining agreement granting them three days' paid vacation per year. This marked the beginning of a trend toward more days off for employees.[3]

Mid-20th century

By 1963, the Federal Republic of Germany already had a considerable number of public holidays. The legal minimum was 15, although the exact number varied depending on the federal state.[4]

Strike of 1978/1979 for 30 days of vacation

The 1978/1979 strike in the West German iron and steel industry was a groundbreaking industrial action for more vacation time. It lasted from November 28, 1978, to January 10, 1979, and began with the demand for a 35-hour week to secure jobs. Initially, 37,000 workers participated, later rising to 57,000. The result was a compromise: instead of the originally demanded reduction in working hours, a phased plan for the introduction of six weeks of vacation (30 working days) was agreed upon. In addition, a 4% wage increase and free shifts for night workers and older employees were achieved. 54.47% of union members approved this result. This strike is considered a decisive turning point in the development of vacation entitlement in Germany and laid the foundation for today's standard of six weeks of collectively agreed vacation time in many industries.[5]

Increase to 24 days

In 1994, the statutory minimum vacation entitlement in Germany was increased to 24 working days. This change came into effect on January 1, 1995, and was introduced by the Working Time Law (ArbZRG) of June 6, 1994. The increase implemented the provisions of EU Directive 93/104/EC on certain aspects of the organization of working time. However, only approximately 100,000 employees were estimated to benefit from this new regulation, as most

[2] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://d-nb.info/1096170299/34?utm_source=chatgpt.com
[3] https://www.br.de/nachrichten/wissen/erfindung-der-ferien-geschichte-einer-wunderbaren-zeit,RXbVi7U
[4] https://www.kalender-365.eu/feiertage/1963.html
[5] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://library.fes.de/gmh/main/pdf-files/gmh/1979/1979-03-137.pdf

employees already had a higher vacation entitlement through collective agreements. In 1993, the average vacation period under collective agreements was 29 working days in the old federal states and 27 working days in the new federal states.

Present

On average, employees in Germany have 28 vacation days per year – plus public holidays, which vary between 10 and 13 depending on the federal state. In some industries, even 30 days are common, although this depends heavily on the employer.

1.2. Development of tourism over time

International tourism has grown enormously since 1950. While around 25 million people traveled abroad worldwide in 1950, this number rose to almost 1.5 billion by 2019. The coronavirus pandemic led to a drastic drop in travel in 2020, but tourism is increasingly recovering. In 2023, around 1.3 billion international arrivals were recorded worldwide, almost at pre-pandemic levels.[6].

Since the 1990s, awareness of the environmental impact of travel has grown, leading to increasing interest in sustainable tourism. Although many travelers favor sustainable options, few are willing to pay more for them or travel by bus or train. Criticisms primarily concern air travel, high water consumption, and the alteration of natural landscapes. In 2018, it was determined that tourism causes around 8% of global greenhouse gas emissions. At the same time, mass tourism is leading to rising living costs and infrastructure overload in some regions.[7]

In addition to economic and ecological factors, tourism also influences social structures. While it creates jobs and promotes cultural exchange, it can also promote gentrification and the loss of traditional ways of life. Sustainable concepts such as fair trade tourism rely on both travelers and local communities to benefit.[8]

Digitalization has dramatically changed travel habits. Platforms like Airbnb and Google Maps make planning easier, social media is shaping trends, and technologies like VR and AI could further personalize the travel experience in the future. At the same time, sustainable alternatives are gaining importance – such as CO_2 offsets, emission-free mobility concepts, and slow travel.[9].

New forms of travel such as Workations Long-term travel will become more popular, while social and ethical responsibility will become more of a focus. Climate change will also impact tourism by altering or rendering destinations inaccessible.

The future of tourism lies in the balance between economic viability, ecological responsibility, and individual travel needs. Sustainable and innovative concepts are crucial to making travel environmentally friendly, socially acceptable, and engaging in the long term.

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[6] https://plant-values.de/tourismus-und-nachhaltigkeit-1-3/5342/

[7] https://www.nature.com/articles/s41558-018-0141-x

[8] https://wttc.org/research/economic-impact

[9] https://journals.sagepub.com/doi/abs/10.1509/jmr.15.0204

1.3. The future of tourism: developments and trends until 2100

The tourism industry is undergoing constant change, shaped by social, economic, and technological developments. This paper examines possible scenarios for tourism in the 2100s and highlights the most important influencing factors.

Sustainability is a key issue. In light of climate change, the travel industry will increasingly need to focus on environmentally friendly alternatives. Energy-efficient transportation, carbon offset models, and resource-efficient accommodations could become the standards of the future. At the same time, digitalization will continue to evolve and shape the travel experience – from artificial intelligence that creates personalized travel recommendations to virtual travel experiences that serve as an alternative or complement to physical travel.

In addition to ecological and technological aspects, social changes play a crucial role. Demographic shifts could lead to travel offerings being more tailored to older target groups. At the same time, new working models—such as remote work or workations—could revolutionize traditional travel behavior.

To analyze the future of tourism, this paper considers various criteria, including economic developments, geopolitical stability, cultural trends, and changing travel needs. The goal is to make informed forecasts and develop innovative concepts that meet the needs of tomorrow's travelers.

2. Project plan & problem area

2.1. Specifications

Our project aims to develop an innovative digital travel experience that harmonizes sustainability, technological advancements, and individual travel needs. We aim to promote environmentally friendly solutions and leverage digitalization as a key technology for personalized and efficient travel planning.

To implement this goal in a structured and transparent manner, we have created a specification sheet. It describes the key requirements, framework conditions, and methodological steps that we will consider throughout the project. The specification sheet serves as the basis for our conceptual, design, and research-based work and helps us clearly define the project scope, objectives, and functional and non-functional requirements. This creates the foundation for the development of sustainable tourism solutions up to the year 2100.

I. Project name and objective

- ➔ The aim is to create a scientific paper on the topic:*“Future of Tourism - Visions and Developments until 2100”*.
- ➔ Target groups: Professional audiences in the fields of tourism, research, and innovation development.
- ➔ Focus areas:
  - ◆ Future forms of travel

- Sustainable tourism
- Digitalization and AI in tourism

II. Content requirements (must-have content criteria)

- ➔ Investigation of current developments and future forecasts in tourism
- ➔ Consideration of global megatrends (e.g. climate change, demographics, technology)
- ➔ Integration of Space tourism (z. B. Elon Musk / SpaceX / Marsmissionen)
- ➔ Source-based, scientific work with primary and secondary sources
- ➔ Visual representation (e.g. infographics, diagrams)
- ➔ Outlook until Year 2100 with realistic and visionary scenarios

III. Functional requirements (What must the result achieve?)

- ➔ Structured into meaningful chapters (e.g. present, future trends, space travel, challenges)
- ➔ Presentation of opportunities and risks of future forms of tourism
- ➔ Concrete case studies (e.g. Mars trips, underwater hotels, virtual travel)
- ➔ Scientific argumentation with citation style (APA or similar)
- ➔ Conclusion with conclusion and outlook

IV. Planned steps in the project

Step	**Period**	**Description**
Topic research	KW 2–5	Collection and evaluation of sources and trends
Rough structure	KW 6	Creation of a content structure
Writing the chapters	KW 7–11	Step-by-step development of all content
Interviews/Surveys	KW 8-9	Optional: Obtain expert opinions
Design & Visualization	KW 12-13	Creation of graphics and layout
Correction phase	KW 14	Linguistic & content review
Delivery	KW 15	Finalization and submission

V. Demarcation/Non-goals

- ➔ No mere description of the current state without reference to the future
- ➔ No purely speculative theories without reference to reality
- ➔ No travel provider advertising or promotional content

2.2. Focus areas

2.2.1. Sustainable travel & alternative means of transport

Tourism contributes significantly to environmental pollution and is responsible for approximately 8% of global CO_2 emissions. Air travel, in particular, plays a key role, as it is one of the most emissions-intensive forms of transportation. To make tourism more sustainable in the long term, innovative technologies and alternative means of transportation must be developed and promoted. The greatest challenges lie in the high dependence on air travel, the ecological impact of the expansion of tourism infrastructure, the enormous water and energy consumption, and the negative social consequences of mass tourism.[10]

Air travel will be made more climate-friendly in the future through lighter materials, optimized aerodynamics, and alternative propulsion systems. According to the Lufthansa article, future aircraft could consume up to 50% less fuel, thus contributing significantly to reducing CO_2 emissions. New aircraft concepts, such as the flying wing, are intended to help further increase efficiency. These aircraft, which do not require a conventional fuselage, could transport up to 900 passengers while simultaneously reducing fuel consumption. In addition, sustainable aviation fuels (SAF) made from biomass or synthetic fuels are increasingly being researched as an alternative to fossil kerosene. Companies such as Airbus are also working on the development of hydrogen aircraft, which could be in commercial use by 2040. Despite this progress, challenges remain, including the high costs of the new technologies, limited ranges ofElectric aircraft and the need for new infrastructures for hydrogen propulsion.[11]

Rail represents an environmentally friendly alternative to air travel, especially for short and medium-distance journeys. High-speed trains enable fast and comfortable travel with a significantly better CO_2 footprint than airplanes.Rail transportTo make rail more attractive, increased investment is being made in double-decker trains to increase capacity. At the same time, efforts are being made to standardize European rail infrastructure, as 15 different train control systems and four different track gauges currently hamper seamless networking. In the long term, magnetic trains or hyperloop systems, which operate virtually emission-free, could also set new standards in sustainable transport. However, the expansion and modernization of rail infrastructure are associated with high costs, which poses a particular challenge in economically weaker regions.

Individual transport is also increasingly moving towards sustainability. Electric cars, car-sharing systems, and autonomous vehicles could make road traffic more efficient and environmentally friendly. According to studies by the German Aerospace Center (DLR), the combination of AI-controlled traffic management systems and autonomous vehicles will help optimize energy consumption in road traffic. Especially in urban areas, cities are relying on sustainable mobility concepts such as on-demand car sharing, e-scooters, and smart traffic management systems to

[10]Lenzen et al., 2018, Nature Climate Change
[11] chrome-extension://efaidnbmnnibpcajpcglclefindmkaj/https://elib.dlr.de/22475/1/Lufthansa-Artikel_Kuehne-DLR_fuer_LH20040119.pdf

reduce congestion and emissions. However, the expansion of charging infrastructure and the social acceptance of autonomous vehicles are still open questions that must be resolved in the coming decades.[12]

In addition to transportation, sustainable accommodations also play an important role in reducing the environmental impact of tourism. Forward-looking concepts focus on zero-waste hotels, energy-self-sufficient resorts, and water management systems that reduce drinking water consumption. Furthermore, "soft tourism" is increasingly being promoted to minimize the negative effects of mass tourism. Slow tourism, in particular, which consciously focuses on decelerated travel experiences, is becoming increasingly popular as a sustainable alternative. Regulations limiting visitor numbers at highly frequented destinations are also gaining importance to prevent environmental and cultural damage.[13]

The future of sustainable travel will be shaped by innovations in the transportation sector, eco-friendly accommodations, and smart mobility concepts. While aviation is becoming more environmentally friendly thanks to more efficient aircraft and alternative fuels, high-speed trains, electric mobility, and autonomous vehicles could offer sustainable alternatives for shorter distances. For this project, this means that future tourism concepts should increasingly rely on hyperloop technologies, hydrogen aircraft, and AI-powered travel assistants. Likewise, new travel incentives could be created to promote sustainable destinations and motivate tourists to adopt more climate-friendly behavior. The transition to eco-friendly travel models represents a major challenge – but also offers the opportunity to create sustainable and resource-efficient travel experiences in the long term.

2.2.2 Digital travel planning & AI-supported solutions

Digitalization has fundamentally changed tourism in recent decades. Travelers are already using platforms such as Google Maps, Booking.com or Airbnb to plan and book trips individually. Artificial intelligence (AI), big data, augmented reality (AR), and virtual reality (VR) will play an even more significant role in the future, making the entire travel process, from inspiration to return, more efficient, personalized, and sustainable.[14]

The role of AI in travel planning

Artificial intelligence enables the automation and personalization of travel planning in ways previously unimaginable. AI-powered travel assistants can carefully analyze each individual and provide tailored suggestions for destinations, transportation, and accommodations, taking into account weather data, personal interests, previous bookings, and sustainable options.[15]

According to a UNWTO study (2021), AI could help make travel decisions up to 40% more efficient by automatically comparing the best options in real time and customizing them for

[12]chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://elib.dlr.de/22475/1/Lufthansa-Artikel_Kuehne-DLR_fuer_LH20040119.pdf
[13]chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://elib.dlr.de/22475/1/Lufthansa-Artikel_Kuehne-DLR_fuer_LH20040119.pdf
[14] Buhalis & Law, 2008, Tourism Management
[15]https://www.ultralytics.com/de/blog/the-impact-of-ai-on-the-tourism-industry

each traveler. For example, platforms like Hopper and Skyscanner are already using AI to predict the best time to book flights and help travelers find the best time to book.[16]

In the future, AI-powered systems could not only offer travel suggestions but also provide interactive voice assistants such as chatbots or digital travel guides. These could accompany travelers in real time, explain sights, or suggest alternative routes to avoid overtourism.[17]

Another area is dynamic pricing, where AI creates automated price quotes based on demand, weather conditions, or personal care. This could help promote a more even distribution of tourism flows, for example, by increasing prices for popular travel times and creating incentives for less visited seasons.[18]

Augmented Reality (AR) & Virtual Reality (VR) im Tourismus

Augmented reality (AR) and virtual reality (VR) are transforming the travel experience by enabling new dimensions. Some museums and historical sites are already using AR applications to reveal past eras or hidden details. In the future, AR glasses could guide travelers through cities and provide historical facts or translations in real time.[19] [20]

Virtual reality (VR) goes a step further, allowing travelers to explore destinations virtually in advance. This could help travelers make more sustainable decisions by providing a realistic impression of a place before booking. Companies like Expedia and Marriott already offer VR-enabled hotel tours to give guests an immersive preview of their accommodations.[21]

For people who cannot travel due to physical limitations or financial hurdles, VR travel could offer an alternative. For example, one could experience a safari in Africa or a hike up Kilimanjaro from the comfort of one's own home. By 2050, such virtual experiences could even offer haptic feedback and multisensory impressions to enhance theTravel feeling to make it even more authentic.[22]

Big Data & Predictive Analytics in the Travel Industry

The use of big data is revolutionizing the travel industry by analyzing travel behavior and predicting future trends. Predictive analytics enables companies to create personalized experiences based on historical data and real-time information.

Airlines and hotel chains are already using dynamic algorithms to analyze customer profiles and provide customized offers. For example, future booking platforms could automatically detect whether a user prefers sustainable travel options and specifically suggest environmentally friendly hotels or carbon-neutral transportation options.[23]

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[16]https://mize.tech/blog/6-examples-of-how-ai-is-used-in-the-travel-industry/
[17]https://www.ultralytics.com/de/blog/the-impact-of-ai-on-the-tourism-industry
[18]chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://elib.dlr.de/22475/1/Lufthansa-Artikel_Kuehne-DLR_fuer_LH20040119.pdf
[19]https://www.resourcespace.com/blog/augmented-reality-in-museums
[20]https://innoarea.com/en/noticias/fitur-2025/
[21]https://www.traveldailynews.com/hotels-lodging/marriott-international-is-leading-the-virtual-reality-race-for-the-meetings-events-sector/
[22] https://www.linkedin.com/pulse/future-virtual-reality-tourism-2025-moneyadviceofficial-81t1f
[23] https://www.smartvel.com/resources/blog/big-data-for-analyzing-travel-trends

The combination of big data and IoT (Internet of Things) could also contribute to more efficient management of tourist flows. Intelligent traffic control systems could use sensors and real-time data to reduce congestion at tourist attractions by suggesting alternative routes or time slots.[24]

One example of data-driven tourism management is Smart City Barcelona, which uses AI and real-time data to regulate visitor flows in the city. In the future, such concepts could be used worldwide to minimize the negative impacts of mass tourism.[25]

Automation & Robotics in Tourism

Automation and the use of robotics in tourism have increased significantly in recent years and are expected to continue to play an important role in the coming years. By 2025, 96 percent of airports worldwide plan to offer self-service check-in counters, and over 60 percent are aiming for automated border controls. AI programs are already being used in the hotel industry to improve customer service and simplify booking processes.[26]

A notable example of the use of robotics in tourism is the Hilton Group's "Connie" pilot project, in which a robot uses speech recognition and AI to provide tourist information services and serve as a contact person for hotel guests.[27]Other hotels have also installed interactive robots that perform tasks at the reception or even serve food and drinks.[28]

The use of robots in the tourism industry goes beyond the novelty factor. They are increasingly being used for practical applications, such as baggage handling at airports or as autonomous security robots. In restaurants, robots may potentially play a role in food preparation and food service.[29]

The use of robots has increased in response to the COVID-19 pandemic due to their potential to reduce direct human-to-human contact. This demonstrates how technology can be used not only to increase efficiency but also to adapt to new challenges in the industry.

Despite the increasing use of robots and AI in tourism, it is important to note that these technologies are not intended to completely replace the human factor, but rather to complement it. They aim to take over routine tasks and free up staff time for personal interactions and enhancing the guest experience.[30]

While specific predictions for autonomous drone taxis or driverless shuttle services in tourism are not directly mentioned in the given sources, general trends in robotics and automation suggest that such developments are quite possible in the near future, especially in the context of smart cities.[31]

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[24] https://thinkz.ai/ai-iot-smart-tourism-project-thinkz-libelium/
[25] https://urbact.eu/articles/how-use-data-analysis-making-tourism-more-sustainable-cities-and-communities-solutions
[26] https://de.statista.com/themen/10581/trends-im-tourismus/
[27] https://de.statista.com/themen/10581/trends-im-tourismus/
[28] https://www.revfine.com/de/tourismus-trends/
[29] https://www.revfine.com/de/tourismus-trends/
[30] https://www.revfine.com/de/technologie-trends-reisebranche/
[31] https://www.hessen.tourismusnetzwerk.info/2025/01/28/eine-prognose-der-tourismus-trends-2025/

3. Research

To analyze the future of tourism and develop innovative solutions, we conduct comprehensive research. We combine qualitative and quantitative methods to identify both existing challenges and future developments. Competitive analysis helps us understand current market trends, evaluate existing digital solutions, and identify gaps that can be filled with new concepts.

3.1. Competitive analysis

This project combines various research methods to provide a comprehensive and holistic analysis. The research is based on a mix of primary and secondary data to identify both current and future trends in the tourism sector.

3.1.1 Qualitative research

Qualitative methods enable a deeper understanding of the needs, expectations, and challenges of various stakeholders in the tourism sector. These include:

➔ **Expert interviews**: Discussions with experts from the fields of tourism, sustainability, UX design, and technology are intended to help better assess future developments. Experts from tour operators, the hotel industry, aviation companies, or innovative start-ups in the field of sustainable tourism can be consulted.

➔ **User research**: In-depth interviews and ethnographic studies with travelers of different age groups and social classes are intended to provide information about changing travel habits and future expectations.

3.1.2. Expert interviews

In our research on the future of tourism, we found that qualitative methods are crucial for gaining a deeper understanding of the needs and expectations of the various stakeholders in the tourism sector. To illuminate these perspectives, we draw on both our own surveys and existing expert interviews.

Expert interviews with professionals in the fields of tourism, sustainability, UX design, and technology provide valuable insights into future developments and trends. These discussions with experts from tour operators, the hotel industry, aviation companies, and innovative start-ups in the field of sustainable tourism help us better understand the challenges and opportunities facing the industry. For example, we analyze interviews like the one with Catharina Fischer.(*https://utopiegestalten.de/2024/11/27/zukunfte-von-tourism-and-events-interview-with-catharina-fischer-about-narrative-future-values-and-the-h*

uman-factor/), in which she discusses narratives, future values, and the human factor in tourism of the future. Such sources allow us to benefit from the insights and experiences of leading minds and enrich our own research.

I. Catharina Fischer – Future of Tourism

This interview with Catharina Fischer, an expert in sustainability and tourism, highlights key aspects for the future of the industry. Fischer emphasizes that the tourism industry needs a new narrative and vision to emerge stronger from crises. A key point here is the role of employees as a key pillar shaping sustainability, value creation, and digital connectivity.

Digitalization offers enormous opportunities to make tourism more sustainable, efficient, and experience-oriented. However, technology should always be understood as a tool that complements and supports human interaction.
Fischer expands the focus to include the future value of events and tourism as a whole. This "legacy" concept implies that tourism activities should create and leave something positive for the future. One example of this is the "Copenpay" campaign in Copenhagen, in which tourists and locals collect trash and receive discounts in return.

Ultimately, we can change the narrative of the entire industry by focusing on the positive contribution of tourists and event attendees. It's about broadening the perspective in the sustainability discussion and trying to create something positive through events and travel.

Fischer emphasizes the importance of the "human factor" and the potential of each individual to help shape the future. She concludes with a quote from the Dalai Lama: "Your future is what you want it to be. And the future is about wanting."[32]

II. Dr. Martin Linne – Challenges and Potentials

This interview with Dr. Martin Linne, tourism expert and managing director of Tourismus-Lotsen UG, explores the challenges and potential of the tourism industry, especially for small and medium-sized enterprises. Linne came to tourism through his business studies and a stint on Heligoland, where he was fascinated by the combination of theory and practice.

Tourism Pilots see themselves as sparring partners for destinations, hotels, and maritime companies, combining practical solutions with strategic thinking. Clients include SMEs and municipalities facing challenges such as change management, generational change, and market analysis.

Linne sees labor shortages, customer focus, service quality, and the still underutilized digitalization as the biggest challenges. Dynamic data analytics offer opportunities to increase efficiency, but the necessary know-how is often lacking. He recommends that companies get creative and differentiate themselves from standardized offerings with customized concepts.

[32]https://utopiegestalten.de/2024/11/27/zukunfte-von-tourismus-und-events-interview-mit-catharina-fischer-uber-narrative-zukunftswerte-und-den-faktor-mensch/

Linne predicts profound changes for the future. A solid financial plan and business planning will be essential. Niche markets such as boutique hotels and innovative restaurants offer great potential. Tourism should become more personal again, with the guest at the center. He cites IKEA as inspiration, which stages people in their living environments—a concept that could be applied to the hotel industry.

Linne values his work's collaboration with people and the analytical side of deriving strategies from data. His new book, "Tourism," offers a concise introduction for beginners and professionals alike.[33]

III. Stefan Gössling – Sustainable Tourism

Stefan Gössling, a well-known researcher in the field of tourism and mobility, is critical of the tourism industry's efforts to become more sustainable. He is skeptical whether companies are truly committed to improving their environmental performance. Gössling considers many initiatives superficial and calls for a fundamental change in the industry's thinking and actions.

Air traffic is a key problem because it contributes significantly to climate change. Gössling believes that there will be no technical solutions to solve this problem in the foreseeable future. Instead, he advocates for a societal discussion about how much air traffic is still acceptable and how CO2 emissions can be reduced.
Although there are positive examples, Gössling warns that these should not lead to the industry as a whole continuing to operate as it has done so far. He calls for a redesign of the system to make vacations and recreation sustainable for as many people as possible. Gössling suggests that destinations should consider how to attract guests with lower emissions and how to extend the length of stay. In addition, tour operators should better promote environmentally friendly travel and critically examine long-distance travel.

Gössling emphasizes the need for innovation and new thinking in the industry to make tourism truly more sustainable.[34]

IV. Prof. Dr. Harald Zeiss – Sustainability as an imperative

In this interview, Professor Harald Zeiss of the Harz University of Applied Sciences sheds light on the complex aspects of sustainability in tourism. For Zeiss, sustainability means managing resources in a way that ensures future generations can also benefit from them. This includes the careful use of fossil energy, water, and land, as well as fair working conditions and behavior that respects human rights.

Despite the necessity, Zeiss continues to view sustainable tourism offerings as niche products. He attributes this to the discrepancy between the desire for sustainability and actual consumer behavior—the so-called "attitude-behavior gap." Many people are interested in sustainable travel but fail to put it into practice, for example, because more sustainable options are more expensive.

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[33]https://www.ihk.de/schleswig-holstein/ihk-magazin/tourismus-gastronomie/tourismus-lotsen-interview-martinlinne-6431736
[34] https://www.wirsindanderswo.de/artikel/keine-nachhaltigkeit-in-sicht-interview

Zeiss emphasizes that cooperation between consumers, companies, and policymakers is needed to advance sustainability. Policymakers must create uniform framework conditions, for example, regarding CO2 offsetting, so that individual providers are not disadvantaged when they factor higher offsetting costs into their prices. He advocates for a transparent presentation of the actual costs incurred by CO2 emissions.

Zeiss also sees movement among large companies, particularly due to reporting requirements and growing investor interest in sustainability strategies. However, he does not expect any short-term changes, as demand for sustainable offerings is not yet strong enough.

According to Zeiss, climate change will lead to a restructuring of the tourism market. He predicts that destinations in the Mediterranean region will become less attractive due to rising temperatures, while destinations such as the North and Baltic Seas, Scandinavia, and Eastern European countries will become more popular. However, the appropriate infrastructure must first be created.

In conclusion, Zeiss emphasizes that almost everything in tourism has two sides and that it's all about finding the right balance between positive and negative effects. He hopes his students will act more responsibly and implement their knowledge in their jobs and companies.[35]

V. Dirk Reiser – Sustainable travel after the pandemic

Dirk Reiser, Professor of Sustainable Tourism Management, discusses the importance of sustainable travel and how we can change our behavior. He sees the coronavirus pandemic as an opportunity to rethink tourism and make it more sustainable. But climate change is a much bigger problem that should influence our travel behavior in the long term.

For Reiser, sustainable tourism is a goal we must achieve together. This includes not only ecological aspects, but also social and economic ones. He advises travelers to book certified accommodations, avoid air travel, and use public transportation instead. Animal shows should be avoided, and souvenirs should be purchased from local vendors.

Reiser acknowledges that offsetting air travel isn't perfect, but it's better than nothing. However, he criticizes the fact that many people want to travel more sustainably but rarely actually act accordingly.

To encourage more people to adopt more sustainable travel behavior, customers, companies, and policymakers need to work together. Travelers need to change their habits, companies should offer more sustainable options, and policymakers need to create a framework that makes sustainable travel easier.

Finally, Reiser offers ten tips on what to avoid when traveling—from unnecessary flights to avoiding animal shows. His goal is to encourage people to travel more consciously and leave the world a little better.[36]

[35] https://www.wirsindanderswo.de/artikel/keine-nachhaltigkeit-in-sicht-interview
[36] https://www.travelbook.de/natur/umwelt/wie-sieht-eine-nachhaltige-reise-aus-interview

In summary, tourism faces major challenges, particularly with regard to sustainability and climate change. Experts emphasize the need for fundamental change to make tourism sustainable. This requires interaction between consumers, businesses, and policymakers, as well as new approaches to reconcile ecological sustainability with economic interests and the needs of travelers.

3.1.3. User research

To gain a comprehensive picture of the future of travel, we conducted a series of telephone interviews with people of different ages and backgrounds. We wanted to find out how respondents imagine travel in 2100, what is currently important to them when traveling, and how they currently travel. We also asked about other relevant aspects that they believe could influence travel in the future.

The following five interviews provide insight into the diverse perspectives and expectations regarding the future of travel. Respondents answered the following questions, among others:

- ➔ How do you imagine traveling in the year 2100?
- ➔ What is currently important to you when you travel?
- ➔ How are you currently traveling?
- ➔ What other aspects do you consider relevant for the future of travel?

The responses reveal a wide range of ideas and priorities, from technological innovations to sustainability and cultural exchange. Here are the results of our survey:

I. Sophia Freiperger, 35, engineer

"I imagine that in 2100, we will travel much more sustainably. Perhaps there will be airplanes powered by hydrogen or other renewable energy. Currently, I'm very careful about my ecological footprint and try to avoid air travel. I often travel by train or use car sharing for short distances. I think the balance between the joy of travel and environmental protection will become even more important in the future."

II. Fred Popowski, 28, IT-Spezialist

"2100? I see us traveling in autonomous transport capsules that move seamlessly between different modes of transport. That sounds really exciting! Maybe there will be truly autonomous gondolas that take us directly from home to the airport. Today, it's important to me that everything works digitally and seamlessly. I book almost everything through apps and often use ridesharing services. That makes travel planning so much easier.

The integration of AI into travel planning will certainly play a major role in the future. AI-powered travel planners already exist that offer personalized suggestions and even use

real-time data to find the best deals. By 2100, these systems will surely be much smarter and able to create perfectly tailored trips for us.

I can imagine that we will then have travel apps that not only know our preferences, but also take into account the weather, local events and even social trends to plan our travel plans in real time.to adapt. Thewill make traveling so much more flexible and exciting!"

III. Elise Becker, 62, pensioner

"Oh, the year 2100? That's so far away, I probably won't be around then. But I hope that traveling will be easier for older people then. Maybe there will be more help with carrying luggage or getting on and off the plane. It's already important to me that everything is comfortable and the service is good. I like traveling on cruise ships or booking all-inclusive vacations; I don't have to worry about anything. I'm not a big fan of these modern things like virtual travel. I want to see and experience the places properly while I still can. But who knows, maybe young people will think differently about it in the future."

IV. Liam Kupfer, 19, Student

"2100? That sounds incredibly far away! But I think we'll be totally into authentic experiences then. Maybe there will be accommodations that completely blend in with nature—that would be really cool. Right now, it's important to me to get to know new cultures without spending too much money. I often use Couchsurfing or hostels; it's super cheap and you meet people right away. In the future, it will probably be about how we can travel without ruining the places we visit. Maybe there will also be more opportunities for volunteer trips where you can do something good. And hopefully, by then, we'll have better technology to get from A to B quickly and in an environmentally friendly way. It would be cool to be on the other side of the world in a few hours!"

V. Hannah Rybarczyck, 45, businesswoman

"In 2100, travel for business people and families will likely be much easier and faster. Maybe will there be vehicles that function like mobile offices, allowing you to work while driving? For longer distances, new modes of transport such as hyperloops or even space travel could be an alternative.

By then, space tourism could potentially also be accessible for family vacations, enabling entirely new experiences. The travel experience could also change everyday life, with convenient and fast ways to get from home to the airport.

For families, it might be interesting to be able to train at home before a trip to space to prepare for the experience. The ability to better combine work and leisure could allow business travelers to spend more time with their families. Overall, I think travel in 2100 will

probably be easier, faster, and more accessible for everyone. But perhaps also not. I don't know."

conclusion

The five interviews provide fascinating insight into the diverse ideas and expectations of different people about the future of travel in 2100. The responses reveal a wide range of priorities: from sustainability and technological innovations to convenience and authentic experiences. Common to all is the expectation that travel will be easier, faster, and more accessible in the future, albeit in different ways.

3.1.4 The future of travel in 2100

One fascinating aspect that emerged in our interviews and is confirmed by current developments is the idea of space tourism. Companies like Virgin Galactic and SpaceX are already actively working on realizing this concept, which until recently sounded like science fiction.

Virgin Galactic conducted its first commercial flight with the VSS Unity spaceplane on June 29, 2023. The company plans to offer monthly flights for tourists, offering a view of Earth from space, starting in August 2023. A ticket for this unique experience currently costs $450,000.[37]

For our UX design work, it's crucial to consider the entire customer journey of a space vacation. This begins with information research and booking, and extends to preparation and the actual experience. Virgin Galactic, for example, offers a readiness program to prepare passengers for space travel.[38]

When designing a booking platform for space travel, we must keep in mind that potential customers need detailed information about the flight itinerary. With Virgin Galactic, the entire flight lasts approximately 90 minutes, with approximately five minutes of weightlessness.[39]

Passenger preparation is a critical aspect. Virgin Galactic offers a "Future Astronaut Community," which is likely part of the preparation process. Digital tools could be used here to support training sessions and disseminate information.[40]

Safety is another crucial factor. The Federal Aviation Administration investigated deviations from the planned flight path during a test flight in July 2021. This underscores the need for robust safety systems and clear communication with passengers.

Despite the high price and risks, interest in space tourism appears to be high. Virgin Galactic has already sold about 800 tickets. The estimated revenue potential of total space tourism for 2030 is between three and twelve billion dollars.[41]

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[37] https://www.tagesschau.de/wirtschaft/unternehmen/virgin-galactic-weltraumtourismus-100.html
[38] https://flypix.ai/de/blog/commercial-space-exploration/
[39] https://de.wikipedia.org/wiki/Virgin_Galactic
[40] https://flypix.ai/de/blog/commercial-space-exploration/
[41] https://www.tagesschau.de/wirtschaft/unternehmen/virgin-galactic-weltraumtourismus-100.html

Based on our research on the development of tourism through 2100, we can make the following estimates. These are a series of logical steps aimed at establishing space stations. These steps will involve technological innovations and ambitious missions, but will also require compromises from the first visitors, who will face spatial challenges such as the proximity or distance of planets and atmospheric conditions.

First phase: Preparation and orbital infrastructure (2025–2040)

- ➔ **Commercialization of the ISS:**Private missions such as Axiom-4 (2025) to test the reception of tourists and research in microgravity[42].
- ➔ **Lunar Exploration:**Use of robotic stations on the Moon to exploit resources (ice in the regolith) and to prepare permanent habitats[43].
- ➔ **Hotel test phase:**Test phase for the installation of hotels[44].
- ➔ **New drive technologies:**Demonstrations of fuel transfer between Starship spacecraft (SpaceX) and tests of thermonuclear propulsion (NTP) to shorten travel times to Mars[45].

Second phase: Interplanetary colonization (2040–2070)

- ➔ **Autonome Mondbasen:** Stations that use 3D printing of regolith and solar power to house scientific teams and civilians.
- ➔ **Crew mission to Mars:**First colonists are sent to Mars, supported by closed life support systems and hydroponic greenhouses[46].
- ➔ **Asteroid removal:**Mining robots are sent into the asteroid belt to extract metals and water, which are crucial for building infrastructure in space.

Third phase: Expansion and sustainability (2070–2100)

- ➔ **Marstädte:**Projects such as Nüwa (2050–2100), a city of 250,000 inhabitants built into cliffs to protect itself from radiation, combining living spaces, green areas, and local industries[47].
- ➔ **Space elevators:**Structures connected with carbon nanotubes to reduce the cost of accessing Earth's orbit. Currently, transporting 1 kg to Mars costs about $200,000 (or $130 according to SpaceX), facilitating tourism and the transport of materials.[48]
- ➔ **Advanced drive technologies:**Nuclear power systems (NEP), ionic propulsion, antimatter engines, Alcubierre engines and lasers to reach 10–20% of the speed of light,

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[42] https://universemagazine.com/en/space-missions-2025-the-most-important-things-a-human-will-do-in-space-this-year/

[43] https://www.popularmechanics.com/technology/infrastructure/a18198479/future-machines-2100/

[44] https://universemagazine.com/en/space-missions-2025-the-most-important-things-a-human-will-do-in-space-this-year/

[45] https://www.lockheedmartin.com/en-us/news/features/2024/space-technology-trends-2025.html

[46] https://www.nasa.gov/humans-in-space/humans-to-mars/

[47] https://newseu.cgtn.com/news/2020-11-09/Scientists-reveal-project-to-build-city-on-Mars-by-2100-VgalWX0pWw/index.html

[48] https://www.cnetfrance.fr/news/ascenseur-spatial-de-la-science-fiction-a-la-realite-407545.htm

which would enable manned missions to Europa (Jupiter's moon) or probes to Alpha Centauri.

3.1.5 The challenges of space tourism

Space tourism is still in its early stages of development and faces a multitude of challenges – technological, financial, and social. To better understand its significance, it's worth comparing it to aviation: Flying within Earth's atmosphere was once a vision before becoming a commonplace form of transportation. A look back helps us understand the potential – but also the difficulties – of commercial space travel.

A historic milestone was the flight of Dennis Tito, who became the first space tourist to spend eight days aboard the International Space Station (ISS) on April 28, 2001. He paid approximately $20 million for his trip aboard a Russian Soyuz capsule. This mission was not only a technical but also a symbolic event: It marked the entry of private citizens into a domain previously reserved exclusively for the military, science, and government space agencies.

"I spent 60 years on Earth and 8 days in space, and from my perspective, they were two separate lives. Life on Earth is completely different from life in space."

Dennis Tito 08.05.2001

A lot has happened since then: Companies like SpaceX, Blue Origin, and Virgin Galactic are driving the commercialization of space travel. They are bringing new ways of thinking, alternative financing models, and a more open climate for innovation to a previously monopolistic industry. These new players offer visions and approaches that are intended not only to advance space travel but also to make it more accessible.

Nevertheless, space tourism is currently still elitist and expensive. However, the hope is that – analogous to the development of civil aviation – prices will drop significantly with increasing technical maturity and market penetration. This could make new travel destinations in low Earth orbit or even beyond accessible to a broader audience in the future.

A look at history shows that every technological advance began with dreams and initially required extensive investments in research, material development, and infrastructure. The development of flight—from the initial idea to commercial aviation—illustrates this impressively.

From the idea to scheduled flight – milestones in aviation

The history of flight dates back to ancient times. The Greek philosopher Aristotle studied bird flight and attempted to theoretically capture the movements of birds—an early exploration of the idea of flight.[49]

During the Renaissance, Leonardo da Vinci designed the first flying machines, including the ornithopter – a flying machine with wings powered by muscle power. His designs are documented in the "Codex on the Flight of Birds" and are considered a milestone in flight theory.[50]

A real breakthrough came in 1783: The brothers Joseph-Michel and Jacques-Étienne Montgolfier conducted the first manned hot-air balloon flight. This flight was publicly performed in Paris on November 21, 1783, and marked the beginning of manned aviation.[51]

The first motorized flight is often attributed to the French engineer Clément Ader, who flew a distance of about 50 meters in his aircraft, the "Éole," in 1890. The flight was uncontrolled but is considered a technical precursor to powered aviation.[52]

On December 17, 1903, brothers Orville and Wilbur Wright made the first controlled powered flight in their biplane, the "Flyer," in Kitty Hawk, North Carolina. The flight lasted 12 seconds and covered a distance of 36 meters. It is considered the official beginning of modern aviation.[53]

The world's first commercial passenger flight took place on January 1, 1914, in Florida. Tony Jannus flew a Benoist XIV biplane, traveling 30 kilometers from St. Petersburg to Tampa. The

[49] Bohn, 2012
[50] National Museum of Science and Technology Leonardo da Vinci, 2024
[51] International Aeronautical Federation, 2021
[52] Smithsonian National Air and Space Museum, 2023
[53] Britannica, 2024

flight lasted 23 minutes, and the ticket price was equivalent to approximately 100,000 euros today.[54]

After World War II, the development of aviation accelerated enormously. Many wartime pilots switched to civil aviation, and the industrial production of light aircraft made flying more affordable. This also led to the widespread expansion of scheduled air travel.[55]

The 1960s and 1970s finally saw the democratization of flying. New aircraft types, international flight routes, and a growing competitive market led to falling prices. Flying became increasingly affordable and a mass phenomenon—with far-reaching effects on global tourism.[56]

The development of space travel is closely linked to political, scientific, and technological goals – and it is increasingly moving toward commercialization. The era of space travel began in 1957 with the launch of Sputnik 1: The Soviet satellite was the first man-made object to orbit the Earth.[57]

The next milestone was reached in 1961 – Yuri Gagarin completed the first manned space flight in history on board Vostok 1, orbiting the Earth in just 108 minutes.[58]

On July 20, 1969, Neil Armstrong became the first human to walk on the moon. The Apollo 11 mission marked the culmination of the "Space Race" between the United States and the Soviet Union and changed the understanding of what was possible in space.[59]

Between the 1970s and 2000s, the focus increasingly shifted to the construction of permanent space stations. Programs such as Skylab, Mir, and later the International Space Station (ISS) served both scientific research and the preparation of a long-term presence in space.[60]

In 2001, a new field opened up: space tourism. Dennis Tito was the first paying space traveler and spent eight days aboard the ISS – at a cost of approximately 20 million US dollars.[61]

In 2004, SpaceShipOne became the first private manned space flight: the spaceplane developed by Burt Rutan completed two suborbital flights within 15 days and won the Ansari X Prize.[62]

Another milestone was the opening of the first commercial spaceport by Virgin Galactic in 2011. The goal was to enable suborbital air travel for civilians – initially with numerous tests, later with commercial launches.[63]

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[54] IATA, 2014
[55] Jenkins, 2000
[56] Burghouwt, 2007
[57] NASA (2019). *Sputnik and the Dawn of the Space Age*. https://www.nasa.gov
[58] ESA (2021).*60 Years Since Gagarin's Flight*. https://www.esa.int
[59] NASA (2019). *Sputnik and the Dawn of the Space Age*. https://www.nasa.gov
[60] ESA (2021).*60 Years Since Gagarin's Flight*. https://www.esa.int
[61] Britannica (2024). *Dennis Tito Biography*. https://www.britannica.com/biography/Dennis-Tito
[62] Smithsonian National Air and Space Museum (2023). *SpaceShipOne Collection*. https://airandspace.si.edu
[63] Virgin Galactic (2023). *VSS Unity Mission Timeline*. https://www.virgingalactic.com

Finally, in August 2023, three tourists were transported into suborbital space for the first time on Virgin Galactic's VSS Unity spaceplane. The passengers spent a few minutes in weightlessness at an altitude of around 30 kilometers—a symbolic step toward regular space flights for civilians.[64]

This development clearly demonstrates that space travel is increasingly shifting from the public to the private sector. Spaceflights for tourism purposes are no longer pure science fiction, but already a reality – albeit still heavily regulated and exclusive. However, the key challenges remain: Costs must be significantly reduced, safety during launch, flight, and landing must be ensured, and a suitable infrastructure for medical and psychological preparation must be established. In addition, there are questions regarding international regulations and ethical guidelines for the use of space as a tourist destination.

In conclusion, this analysis and the parallels between the aerospace and aerospace sectors reveal that both sectors faced significant challenges and high costs in their early days. A seat on a tourist aircraft in 1914 was extremely expensive and primarily served a wealthy clientele, much as is still the case in the space sector today. However, World War II brought a significant technological breakthrough that accelerated development and ultimately led to a collapse in prices. The tourism industry was subsequently able to gradually reduce ticket prices, making it possible to appeal to a broader target audience.

In the field of space travel, an additional factor would be required to generate financial resources. Established approaches such as crowdfunding could be considered, but the production of specialized products that require space conditions could also play an important role. These include, for example, the manufacture of medications that can be produced particularly efficiently in microgravity or sophisticated optical components that must be manufactured under vacuum conditions. These innovative possibilities could not only contribute to the financing of space projects but also open up new markets and applications.[65]

Marketing and storytelling play a crucial role today and—as in the case of Elon Musk—are a key factor in generating financial revenue. Through targeted narratives, brands and projects can not only attract attention but also build a loyal following and supporter base, leading to long-term financial success.[66]

Another approach successfully used in the space industry is collaboration with government institutions and organizations. One example is the work of companies like SpaceX, which collaborates not only with NASA, but also with the US Space Force, COnae, SiriusXM, the National Reconnaissance Office, and the Korean Army. Through such partnerships, research and development can be funded with public money, with the space companies acting as contractors. This allows them to benefit from government funding while simultaneously pursuing innovative research projects.[67]

We can see that various companies offer a wide range of space experiences, from suborbital flights to inflatable balloons and space jumps to gravity-defying experiences and visits to the

[64] The Guardian (2023). *Virgin Galactic Flies Tourists to Edge of Space*. https://www.theguardian.com
[65] https://www.sciencefocus.com/space/space-labs-drugs
[66] https://www.youtube.com/watch?v=MDiFFBoHp-g
[67] https://www.youtube.com/watch?v=3vRC5TMbkaU

International Space Station (ISS). In the future, there will certainly be trips to the Moon and Mars. Each of these experiences comes with significantly different costs, which could open the door to ever-greater research and development in this area.

Currently, the cost of transporting one kilogram into space is estimated at approximately $2,261. The operation of rocket launch facilities, such as the SpaceX launch base in California (Vandenberg):

- ➔ 40-60 million USD: Acquisition costs
- ➔ 5-10 million USD: annual costs
- ➔ 85 million USD: Total installation costs

This investment involved 17 rocket deliveries, which equates to approximately $5 million per delivery. The easiest way to reduce costs is to ship as many rockets as possible, as the fixed costs per delivery can be spread across multiple shipments. The space industry essentially needs its "Second World War," a decisive turning point that will enable massive scaling and cost reduction.

Another way to reduce costs is to industrialize the production of rocket components. The larger the order quantity, the more the prices decrease. However, it's important to note that manufacturing reusable rockets doesn't bring significant cost reductions—the most expensive part of the process remains the flight itself. For example, the ISS costs about $4 billion annually to build.

Perhaps the space industry could learn from aerospace and adopt similar models for rocket launches. Similar to the aviation mail system in the early years of aviation, this could help provide the necessary resources to reduce flight costs and revolutionize access to space.

In addition to the above-mentioned objectives, there are currently

"Space tourism is not and should not be limited to space alone... While we can and should consider all the activities of space tourism companies such as Virgin Galactic, Blue Origin, Zero2Infinity and other space tourism companies, we should not discredit the companies and destinations here on Earth that meet the needs and desires of all of us who enjoy traveling for space-related activities. These can vary greatly, from museums such as the Space Center Houston to hotels with rooms forSpace theme."
Dr. Hayley Stainton (Space Tourism)

Through our analysis of the players in space exploration, we have found that each individual field brings specific technological advances to varying degrees. We are still in the early stages of conceptualizing how we might travel through the various layers between the atmosphere and space. These concepts will evolve dramatically by the year 2100. Our goal is to map these developments as realistically as possible.

Today's tourists will attempt to fly into space. But once they get there, a sense of frustration might arise, similar to climbing a mountain and reaching a peak. Submitted? Check.

Breathtaking view? Yes. Crazy experience? Without question. And then it's back down again. Space offers little entertainment. Is there a risk of losing interest in space tourism?

This question is of central importance. What can space tourism offer in the long term? How will it remain attractive in 75 years? There are plans for a base on the Moon or even Mars, but to realize these, an infrastructure with the minimum requirements for survival must be created. Rockets must be equipped with construction machinery, robots, and other materials, which in turn requires extensive programming by artificial intelligence. Such a base must have a reliable power source, shelters with protection against UV radiation, meteorites, and winds, as well as systems for supplying food and water and producing fuel for return flights to Earth or Mars.

We can imagine that space tourism on Earth could initially begin with simulations of weightlessness, such as basketball games, trampoline jumping, or even a weightless play park – all on Earth, before we venture into space.

3.2. Competitive analysis

The space tourism market is booming, and both established companies and startups are developing more and more concepts to enable this new era of travel. Here are some of the leading companies actively involved in space tourism:

1. SpaceX

- ➔ **Founding:**Launched by Elon Musk
- ➔ **Focus:**Lunar tourism and travel beyond Earth's orbit
- ➔ **Goal:**Plans to send paying customers around the moon

2. Virgin Galactic

- ➔ **Pioneering work:**Leader in suborbital flights for tourists
- ➔ **Test flights:**Several successful test flights carried out
- ➔ **Pricing model:**Current price: $450,000 per passenger, future price: $600,000 with new ships for 90-minute flights

3. Blue Origin

- ➔ **Founding:**Founded by Jeff Bezos
- ➔ **Technology:**Development of the New Shepard rocket for suborbital flights
- ➔ **Goal:**Transport of up to six passengers per flight for 12 minutes
- ➔ **Pricing model:**Estimated price: $300,000 per seat

4. Zephalto

- ➔ **Origin:**French company
- ➔ **Technology:**Development of*Celestial*, a capsule lifted by a stratospheric balloon
- ➔ **Goal:**Commercial flights at an altitude of 25 km from 2025
- ➔ **Pricing model:**170,000 euros for a stratospheric balloon ride

5. EOS-X-Space

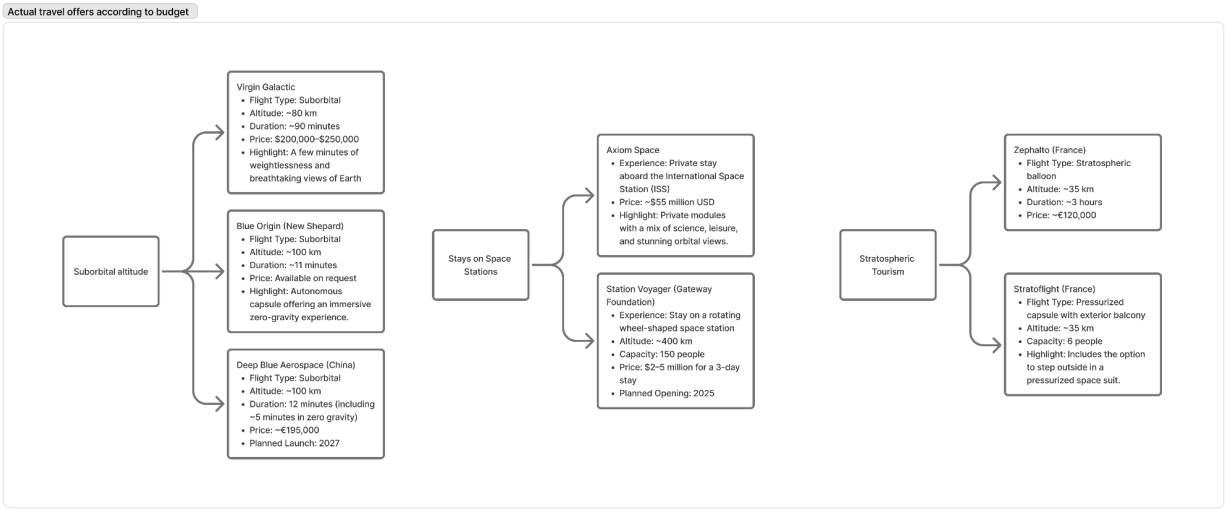
- ➔ **Origin:**Spanish company
- ➔ **Technology:**Development of a stratospheric balloon for flights at an altitude of 40 km
- ➔ **Goal:**The first flights from Seville and Abu Dhabi are scheduled to take place at the end of 2025
- ➔ **Pricing model:**The ticket price is between 150,000 and 200,000 euros per passenger

6. Orion Span (Current news missing)

- ➔ **Origin:** USA.
- ➔ **Project:**Development of a space hotel
- ➔ **Pricing model:**$9.5 million for a round trip to the space station and a 12-day stay on board the Aurora Station (320 km above the Earth's surface)

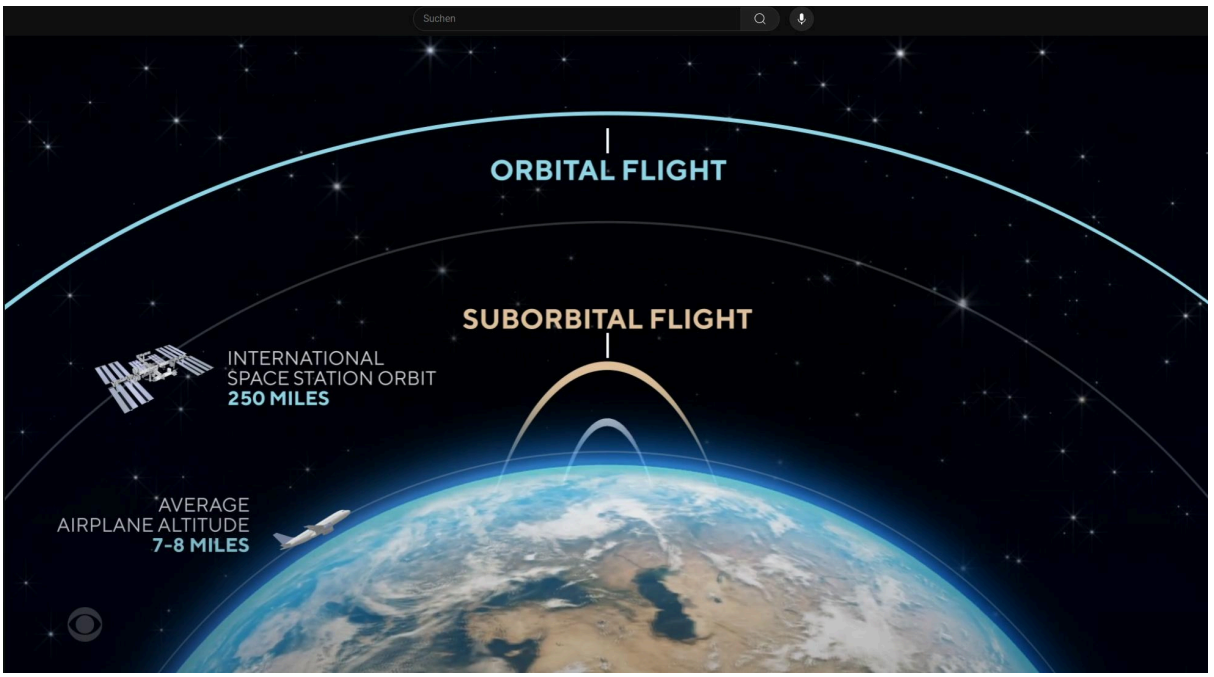
7. Deepblue

- ➔ **Origin:** China
- ➔ **Goal:**Planned flight for 2027
- ➔ **Pricing model:**195,000 euros (1.5 million yuan) for the flight



Link:https://www.figma.com/board/J2QEaH6EdKAUX9tL0R0Siq/UX--ideation?node-id=3-2&t=XlCNqRnyZxwopNTm-0

As we can see, the goals and technologies of the various companies differ considerably, resulting in very different costs for space tourism. Each company pursues a unique approach, from suborbital flights to trips to the Moon and Mars, and targets different market segments. Pricing ranges from a relatively affordable €150,000 to an exclusive $9.5 million for a space hotel experience.



over 98,000 feet: spaceship

Currently, more and more companies are active in the space sector – a clear indication that this field is booming. As space becomes more accessible, so too is the number of projects. These not only pave the way for new scientific discoveries but also provide innovative solutions and ideas. The space industry can be roughly divided into three groups: established major players, innovative start-ups, and emerging European companies.

Key players in the global space industry

- ➔ SpaceX (USA) – World leader in orbital launches and in the development of technologies for Mars colonization.
- ➔ Blue Origin (USA) – Focus on reusable rockets and long-term space exploration projects.
- ➔ Arianespace (Europe) – European provider of launch services with the Ariane and Vega launch vehicles.
- ➔ Airbus Defence and Space (Europe) – Development and construction of satellites, space systems and security-related space solutions.
- ➔ Boeing (USA) – Builds manned spacecraft such as the CST-100 Starliner for NASA missions.
- ➔ Lockheed Martin (USA) – Key partner in programs such as Orion and Artemis for the exploration of the Moon and Mars.

Start-ups and innovative companies

- ➔ Rocket Lab (New Zealand/USA) – provider of small launch vehicles, particularly known for the Electron rocket for satellite transport.
- ➔ Iceye (Finland/USA) – Operates a network of SAR microsatellites for Earth observation.
- ➔ Loft Orbital (USA) – Offers a satellite-as-a-service model where customers use shared satellites.
- ➔ AstroForge (USA) – Develops concepts for mining rare metals on asteroids.
- ➔ Varda Space Industries (USA) – Uses microgravity to manufacture advanced materials and pharmaceuticals in space.
- ➔ Zephalto (France) – Offers stratospheric balloon flights up to 25 km altitude for scientific and tourist purposes.

Notable European companies

- ➔ Thales Alenia Space (France/Italy) – Builds satellites, modules and components for space research and telecommunications.
- ➔ Safran Aero Boosters (Belgium/France) – Supplies propulsion systems for space applications.
- ➔ Spacebel (Belgium) – Develops specialized software for satellites and ground control systems.
- ➔ Cailabs (France) – Leader in optical technologies for laser communications in space.

Emerging companies in France

- ➔ Space Cargo Unlimited – Plans to build autonomous space factories with the REV1 fleet starting in 2025.
- ➔ AIKO – Develops artificial intelligence to automate space missions.

The space industry is evolving rapidly and is being shaped by a wide range of players – from tech giants to small, agile startups. This momentum not only enables new forms of space travel but also drives technological innovations in other sectors. Europe is an important location in this, particularly through collaborations and specialized high-tech companies.

3.3 Qualitative and quantitative research

As part of this study, qualitative interviews were conducted with experts from the space industry. The aim was to capture current assessments, experiences, and visions regarding space travel and space tourism. The discussions provide insight into various technical, ethical, and societal perspectives on future developments in space. The interviewees have many years of professional experience in fields such as aerospace engineering, satellite operations, piloting, and systems development. Their practical knowledge provides valuable insights into the opportunities, challenges, and potential risks of advancing commercialization and automation in space.

Structured interview:

I. Maude Robichon (42):

1. Could you briefly describe your responsibilities and position?

"I am an engineer at a space agency in North America and work on satellite systems—specifically mission preparation: I prepare procedures and simulators for satellite missions."

2. Which technological developments in the mobility sector do you currently consider particularly promising, especially with regard to passenger transport?

"I think the Chinese have made great progress with their projects. They've built a space station called Tiangong, which means 'Heavenly Palace,' in low orbit, which can accommodate up to six taikonauts. The US has also made significant progress in the space sector—except that many projects are now being outsourced from NASA to private companies. Private companies are increasingly replacing state actors. Our satellites here are being built and operated by SpaceX. Blue Origin is also interesting—they're working more cautiously but are pursuing the goal of democratizing access to space with suborbital flights and, soon, commercial orbital missions."

3. How would “clean” travel be possible? What strategies does your company use in the process of integrating ecological aspects into future mobility concepts?

(Big laugh) "Despite my wishes, we almost never talk about the ecological aspect—but you can see that things are slowly changing. So no, we don't have a strategy in that regard."

4. To what extent is sustainability currently taken into account in your research projects?

"The durability of our satellites has changed. We used to build complex, larger satellites that could repair themselves—that was the basis of their design. Today, that's changed: We build smaller satellites that are more cost-effective and easier to replace. No, sustainability is no longer a priority for us."

5. What potential do you see in the increasing digitalization of transport systems for the tourism sector?

“Everything is already digitized.”

6. Are there projects in your company that specifically use AI or intelligent assistance systems?

"We talk about it a lot, but we don't yet know exactly how to use it effectively—that is, which specific service we should entrust it with. Artificial intelligence is still in its infancy and is not yet 100% reliable."

7. What role could artificial intelligence play in traffic control or travel planning in the future?

"We don't know yet—time will tell. For now, though, it's not relevant. Perhaps it will be used in the future for flight tests or to improvise in case of problems during missions."

8. How realistic do you think it is that tourist travel in space – for example into orbit or to the moon – will be accessible to the general public by the year 2100?

"I don't see much that's realistic at the moment—perhaps Earth, lunar, orbital, or suborbital flights. Mars is still technically very far away, and today's tourist can hardly afford to plan several months for a round-trip trip. That's why trips to Earth or the Moon seem much more realistic to me at the moment."

9. How does your company assess the developments of private sector players such as SpaceX, Blue Origin or Virgin in this area?

“As mentioned earlier, the space sector is becoming increasingly privatized, and we are seeing less and less cooperation between countries - which is a real shame!”

10. What technological, ethical or logistical challenges do you see with regard to space tourism?

“The captain - every flight must have a captain or team leader who makes the decisions for the others.”

11. How can we ensure that new forms of mobility are socially acceptable and accessible to different population groups?

"I don't think space travel will be democratized. Moreover, the energy and CO2 costs for long-distance flights this century are enormous."

12. What ethical issues do you encounter in your research on automated or interplanetary passenger transport?

"In the past, the topics were dedicated to science, but now companies do what they want. We're still at the beginning of the conquest of space, and everyone is trying to move forward as quickly as possible. However, the privatization of the market brings with it limitations:

more pollution, fewer controls—that's a shame for our planet! Flights that could lead to Mars are extremely energy-intensive..."

13. What is your personal vision for the journey to the year 2100 and how can you implement it?

"I think we'll make tremendous progress with AI, and I hope it will soon be able to replace pilots, especially given the high cost per person. AI will certainly make expeditions more affordable, but I believe the pilot will continue to play an important role for a long time to come.

Perhaps in the future there will be space or lunar amusement parks for entertainment. I really hope the number of launches doesn't become too high. Due to the privatization of companies, states don't receive any revenue from this tourism."

14. Are there any studies, projects, or contacts within or outside your company that you would recommend for further research?

"Look at Blue Origin's projects."

II. Marc André Sauvage (43)

1. Could you briefly describe your responsibilities and position?

"I work for GMV as a technical officer, which means I'm responsible between the contractor and GMV for the development of ground infrastructure for the Galileo project"

2. Which technological developments in the mobility sector do you currently consider particularly promising, especially with regard to passenger transport?

"What I've noticed is that security is of utmost importance in the private sector. All 'security' aspects are extremely important, as customers need to be assured that no problems will arise.

Technological advances in space benefit not only astronauts, but the entire world - for example, Velcro, diapers, charcoal pencils, and so on!"

3. How would "clean" travel be possible? What strategies do you pursue? Does your company integrate ecological aspects into future mobility concepts?

"In technology, the DTN (Delay Tolerant Network) allows the repair of a connection with a delay in sending packets (on the Internet), thus compensating for the unreliability of the medium. We also do our best to leave no trace when destroying a satellite by letting it disintegrate in the atmosphere and ejecting the debris near Point Némo." [68]

4. To what extent is sustainability currently taken into account in your research projects?

[68] https://de.wikipedia.org/wiki/Pol_der_Unzug%C3%A4nglichkeit

"We are committed to maximizing satellite durability, but also ensuring that they re-enter Earth's atmosphere once their work is complete, using the remaining fuel reserve to allow them to return. Since the 2000s, missions have been required to include an atmospheric re-entry phase. The ISS will also return to Earth, decay in the atmosphere, and, after dismantling, be diverted toward the satellite graveyard on Earth, Point Nemo.

Environmental awareness is increasingly being considered in our projects and is very important to us. In space, ion engines are increasingly being used for trajectory adjustment, as they require very little energy. For long-distance travel, jump travel is particularly advantageous, as it uses the mass of stars to jump to the next star.

5. What potential do you see in the increasing digitalization of transport systems for the tourism sector?

"Just to be clear: Maybe one day there won't be pilots in the shuttles, but we're not there yet. The passenger isn't ready for that yet, even if it's only on the train. AI isn't ready to enable unmanned flights, but it can help the pilot by enabling them to make better decisions and identify the possible options. So, AI, yes, why not, but more as a co-pilot."

6. Are there projects in your company that specifically use AI or intelligent assistance systems?

"We're just getting started. We're trying to integrate the technology, but the applications are very complicated due to the 'need-to-know' principle. Do all employees really need to know everything, and does it actually make sense for them to know everything?"

7. What role could artificial intelligence play in traffic control or travel planning in the future?

"First as a co-pilot, and then when the passengers are psychologically ready to travel without a pilot. But it will take some time!"

8. How realistic do you think it is for tourist trips into space—for example, into orbit or to the moon or something like that?—to be accessible to the general public by 2100?

"Just about everyone knows this: In 10 years, there will be a technological leap, capacities will increase tenfold, and there will be major advances. On the other hand, Mars will be accessible, but not yet for tourism. However, since the transport is still very long and there are climatic problems such as very cold temperatures and radiation, it will not be an entirely easy or pleasant journey."

9. How does your company assess the developments of private sector players such as SpaceX, Blue Origin or Virgin in this area?

It doesn't have much influence, but everyone more or less keeps up with innovations. Some companies evolve very quickly, like SpaceX, thanks to Elon Musk, who can be considered a visionary - the world needs visionary people; you can like what he does or not, like his personality or not, but these visions allow us to push the boundaries that were previously

established. Jules Verne was also a visionary - for example, with "20,000 Leagues Under the Sea," just like Leonardo da Vinci.

10. What technological, ethical or logistical challenges do you see with regard to space tourism?

“Ensure safety again and find a faster drive.

Ethics: It must be advanced in the fields.

Companies need to understand the consequences of weightlessness and what it can bring them.”

11. How can we ensure that new forms of mobility are socially acceptable and accessible to different population groups?

"There are two very important aspects: passenger safety. It is imperative that there are no accidents, and that social acceptance is also established that flights are primarily reserved for a very wealthy social segment. This social segment has already expanded; we've gone from zero to a handful, and then to a few dozen. Flight options are becoming increasingly diverse, with flights, as already mentioned, in zero gravity or with inflatable maiden balloons at high altitude."

12. What ethical issues do you encounter in your research on automated or interplanetary passenger transport?

"As environmentally conscious people, we must not lose sight of the ecological aspect, as is the case with Starlink with its 6,750 satellites on Earth. Galileo (the European GPS) follows a similar approach with 37 satellites, but at an altitude of 22,000 km. It's important to ask the right questions and not just consider the financial aspect of the process. A parallel can be drawn with the era of disposable technology in the 1990s and 2000s."

13. What is your personal vision for the journey to the year 2100 and how can you implement it?

"I think we'll be able to send a much larger customer base into space, and the offerings will become much more diverse. The ecological impact will increasingly become a focus, at least I hope so."

14. Are there any studies, projects, or contacts within or outside GMV that might be relevant for further research? What sources or initiatives would you recommend?

“0 to infinity”[69]

[69] https://www.zero2infinity.space/

III. Patrick Brun (45)

1. Could you briefly describe your responsibilities and position?

"20 years of experience as a business unit manager in engineering and operations services: Responsible for the provision of engineering, program development, and operations services. I also manage satellite assignments and oversee spacecraft operations."

2. Which technological developments in the mobility sector do you currently consider particularly promising, especially with regard to passenger transport?

"Communication has changed dramatically. Flow has evolved significantly in space; thanks to laser transmission, communication is much easier. More data means we can communicate with people in space more easily and frequently. If Boeing were to send a singer into space, there could be streaming, thanks to the increased bandwidth. Advertising and marketing can therefore have a major impact on subsidies.

Security: It's much better than before. There's no room for error; security is super important.

Electric satellite engines are revolutionizing the space sector, offering much longer orbital periods than before and are therefore a replacement (the lifetime of a satellite is determined by its onboard energy)."

3. How would "clean" travel be possible? What strategies do you pursue? Does your company integrate ecological aspects into future mobility concepts?

"The number of satellites and their pollution (material and visual) is a current problem that will continue to increase, especially with the advent of Starlink satellites. This pollutes observations, which can lead to safety problems for others, especially since satellite speeds reach several thousand km/h."

4. To what extent is sustainability currently taken into account in your research projects?

“The problem doesn’t really concern us.”

5. What potential do you see in the increasing digitalization of transport systems for the tourism sector?

"Automation will be mandatory for long-distance travel. Connections are uncertain, and it often happens that the information sent does not reach its destination, which is a real problem."

6. Are there any projects at GMV that specifically use AI or intelligent assistance systems?

“Yes, very often, everyone uses it, for reports, for generating lines of code…”

7. What role could artificial intelligence play in traffic control or travel planning in the future?

"I don't see AI yet. Control a rocket with passengers on board. On the other hand, the response time when sending missions far away can be very long; on the moon, it's 2 seconds, which is already too long in some cases. AI. The answer to this problem could be to act directly, thus anticipating errors and taking action before they occur. Otherwise, AI is often used in our monitoring/controlling work to save time when writing reports and reports. There's a lot to do."

8. How realistic do you think it is for tourist trips into space—for example, into orbit or to the moon or something like that?—to be accessible to the general public by 2100?

"There are three possibilities:

1. *The journey around the world.*
2. *Spend a few days in a hotel in an orbital station (Airbus, Thales, Axiom offer this).*
3. *Go to the Moon (Lunar Orbital Platform-Gateway (LOP-G), which, placed in orbit around the Moon, serves as a relay between the Earth and the surface of the Moon).*

The technologies are there, anything is possible these days. The only problem is the financial aspect, in a broader sense elite tourism, but this will increase."

9. How does your company assess the developments of private sector players such as SpaceX, Blue Origin or Virgin in this area?

"We're currently experiencing a small revolution among space companies, some of whom already have a significant lead. We can compare it to the internet at the beginning. We'll see which ones will survive and all the others will disappear. Which ones will have a solid business case?

The EU has woken up! With Trump's rise to power, this poses a number of risks. Europe must take control of itself and become independent of the US.

There are more and more startups, including in Munich: Tec, Isar Aerospace, which are now gaining importance, to see how many companies will survive. Universities conduct a lot of research and development, but the outcome is more complicated.

IRIS² (European Communications Network), this company is working on a communications network created only by European companies, an alternative to the US network.

There are also projects, One Way, which are still not very credible, although they are being developed by various companies, includingMuskthemselves, were mentioned several times."[70]

[70] https://marspedia.org/One-Way_Human_Settlement_Projects

10. What technological, ethical or logistical challenges do you see with regard to space tourism?

"There's increasing criticism from space observers that space pollution is a problem. There are more and more satellites, and it's not over yet! They're in multiple orbits, and that's a problem. Our goal isn't to let them land on Earth."

11. How can we ensure that new forms of mobility are socially acceptable and accessible to different population groups?

"The business case of startups/companies will determine which ones survive. The more travelers there are, the greater the democratization will be. In 10/15 years, things will be completely different because the new players will be different.

The problem is that working in the space sector is expensive and the process is very laborious. Companies are obligated to produce quality and test everything they produce multiple times. No one has the right to make mistakes.

Boeing pursued a strategy of reducing costs through fewer tests and lower quality. We can now see the problems caused and the number of deaths associated with them...

The democratization of space will be achieved with a good business model and financial support.

Drilling the moon will be very important; it will certainly attract companies; we will discover the benefits of lunar soil in a few years."

12. What ethical issues do you encounter in your research on automated or interplanetary passenger transport?

"We are not often confronted with this issue, but an example comes to mind on Mars: We have the right to modify Mars and, for example, atomise the planet to create a livable atmosphere or even to proliferate low-orbit satellites, first SpaceX, now Amazon's Kuiper.

Do we have the right to change Mars? I think we'll get there one day."

13. What is your personal vision for the journey to the year 2100?

"I think there will be frequent, regular trips to orbital stations or the moon to see who can afford these trips and what ecological problems this entails."

IV. Interview Maud Biernath (52)

1. What is your profession and can you briefly describe your work?

“I have been a pilot for a European airline for 30 years, flying long-haul and ultra-long-haul aircraft on the Airbus A350.”

2. You work in the aviation sector. What connections can you identify with space travel and its development?

"Over the course of my career, I've seen flight and system reliability improve. Teamwork has also made great strides."

3. Are you up to date on technological advances in the aerospace sector? If so, do you see any advances that could improve space tourism?

"Airline companies are keen to lay off pilots. This desire is also evident in the aerospace sector, where automating flights is already possible. Nevertheless, the pilot remains important for two reasons: they are there in case of problems and also provide psychological support to passengers. Artificial intelligence is not yet advanced enough to replace pilots (it is still very little used). Since the beginning of aviation, there has been a very significant modernization, which can also be observed in the aerospace sector."

4. During your flights/training, do you hear ideas/requests about extra-atmosphere flights or other passenger requests?

"I was in Houston several times during my flights and was able to witness the construction of the new launch vehicle. The launcher work is progressing very rapidly. The NASA program calls for the first human launch in 2035/2040."

5. What do you think about space travel and its development? Do you think it will one day compete with land transport?

"I think suborbital flights will be the first profitable flights. Since they are three to four times faster than airplanes, this could be the first flight that can compete with airplanes, with the difference that this flight is for tourism and not for a specific destination. Space tourism itself will only be competitive very late."

6. Given the development of land-based flights, how do you view space travel? How do you view moon and Mars flights?

"I think the moon flight will be the simplest, while the flight to Mars will be much more complicated, and most importantly, the travel times will be much longer. Due to travel time and the alignment of the planets, the first missions will take several years."#

3.4 Analyzing the research results

The interviews helped us to imagine a more realistic overview on how tourism might change by the year 2100 – particularly with regard to new forms of travel such as space tourism, technological developments and societal challenges.

What we clearly take away from this is that space tourism is currently still a very exclusive, expensive, and technically complex undertaking. Nevertheless, experts certainly see the possibility of it opening up in the long term – similar to the way civil aviation once did. For tourism in the year 2100, this means that it could be realistic for at least some of the population to undertake suborbital or even orbital journeys, whether out of curiosity, a sense of adventure, or even as part of extended stays on space stations. However, this requires a drastic reduction in costs, the expansion of safety standards, and, above all, broad social acceptance.

Another key aspect of our project concerns ecological responsibility. Precisely because tourism will be significantly broader in scope in 2100 – both geographically and technologically – sustainability and resource conservation must be firmly integrated into future forms of travel. The interviews showed us that there is still a great deal of catching up to do in this area, both in current space travel and in the awareness of many stakeholders. This is an incentive for us to consistently consider not only technological progress but also environmental impacts when developing new concepts.

The role of artificial intelligence was also discussed. For the tourism of the future—especially for more complex, personalized forms of travel—AI can play a supporting role, for example, in trip planning, navigation, or security management. At the same time, it became clear that AI does not replace human experience, but should serve as a tool that makes travel smarter and more accessible.

Overall, the discussions confirmed to us that tourism of the future must think far beyond today's boundaries – geographically, technologically, and socially. For our work, this means: We want to develop concepts that are not only technically feasible, but also socially acceptable, ecologically sound, and tailored to real needs. The interviews helped us make visions for the year 2100 more tangible – not as mere utopian ideas, but as scenarios we can consciously work toward.

Particularly impressive were individual statements from the interviewees that succinctly capture key challenges and opportunities. They illustrate what the future of travel could entail—and the questions we need to ask ourselves today:

“Elon Musk is a necessary visionary.”

This assessment demonstrates how strongly innovations in space travel are shaped by individuals. Visionary entrepreneurs like Musk are driving developments that would often take governments decades to achieve. For us, this is an indication of how important entrepreneurial courage and private commitment can be for progress in tourism.

“Access to space will open at some point - but not for everyone.”

This statement reminds us that technological feasibility does not automatically translate into social participation. Space tourism will remain exclusive—at least in its initial phase. The question of how equitable access to such travel can be made remains open and will become increasingly important in the future.

“Ecological responsibility is neglected.”

Despite all the technological euphoria, it has been repeatedly emphasized that environmental aspects are currently barely considered in space travel. For us, this is a crucial point: If tourism is to be sustainable by 2100 – on Earth and beyond – ecological responsibility must become an integral part of every new form of mobility.

“AI can do a lot, but it needs clear boundaries.”

The potential of artificial intelligence was recognized, but at the same time, critically questioned. Especially in the tourism of the future – which will become more complex, interconnected, and personalized – AI can take on important tasks. However, it should not replace humans, but rather provide meaningful support.

“Space as a travel destination is changing the way we think about travel itself.”

This statement particularly concerned us. Because if the destination is no longer another place on Earth, but rather leaving Earth itself, this fundamentally challenges our previous notion of travel. It opens up new perspectives – not only spatial, but also cultural, ethical, and emotional.

3.5 Personas that represent our target group

1. Lian Cheng – 34, "Digital Nomad 2.0"

- ➔ **Profession:** Interplanetary Content Curator
- ➔ **Origin:**Singapore / lives on an ocean platform city
- ➔ **Technical affinity:**High (integrated into neural interfaces & AI)
- ➔ **Reasons for the trip:**Inspiration, new perspectives for his immersive work
- ➔ **Goals:**Collect unique images from space, experience creative isolation
- ➔ **Needs:**
  - ◆ Highly personalized experiences
  - ◆ Simultaneous work capability in orbit (stable data connection, mental space)
  - ◆ Visual & multisensory interfaces that stimulate creativity

2. Amina Solberg – 58, “Doubter with a spirit of inquiry”

- ➔ **Profession:**Ethics Advisor for Planetary Development
- ➔ **Origin:** Stockholm, EU-Allianz
- ➔ **Technical affinity:**Medium, critically reflected
- ➔ **Reasons for the trip:**Self-awareness, observation of human development
- ➔ **Goals:**Answering questions about meaning, responsibility and the future
- ➔ **Needs:**
  - ◆ Transparency about technology and security
  - ◆ Emotionally supportive interface
  - ◆ Opportunities for reflection (e.g. visual diary, meditative spaces)

3. Maria Estévez – 76, “Late Adventurer”

- ➔ **Profession:**Retired teacher, lives in a Slow City community
- ➔ **Origin:** Chile
- ➔ **Technical affinity:**Low – uses support systems
- ➔ **Reasons for the trip:**Fulfilling a lifelong dream, last great experience
- ➔ **Goals:**See the earth from the outside, grow from within
- ➔ **Needs:**
  - ◆ Accessible navigation (visual, auditory, motor)
  - ◆ Calm, guided user guidance
  - ◆ Integrative travel preparation (e.g. holographic training, emotional preparation)

4. Aiko Yamada – 47, family mother & cultural scientist

- ➔ **Profession:**Researcher for future cultures
- ➔ **Origin:** Kyoto
- ➔ **Technical affinity:**Medium, but open
- ➔ **Reasons for the trip:**Educational project with teenage daughter, emotional experience
- ➔ **Goals:**Experience the connection between humanity, Earth and the cosmos
- ➔ **Needs:**
  - ◆ Inclusive, family-friendly experience
  - ◆ Intuitive, kultursensible Interfaces
  - ◆ Joint experience documentation (e.g. mother & daughter memory logbook)

5. Johan Meier – 64, retired aeronautical engineer

- ➔ **Origin:** Zurich
- ➔ **Profession:**Former project manager for interplanetary construction program
- ➔ **Technical affinity:**High, but sober
- ➔ **Reasons for the trip:**Lifelong fascination, retirement reward
- ➔ **Goals:**Seeing the Earth from space – an emotional conclusion
- ➔ Problems: Fragile health requiring appropriate medical solutions.

4. Concept design

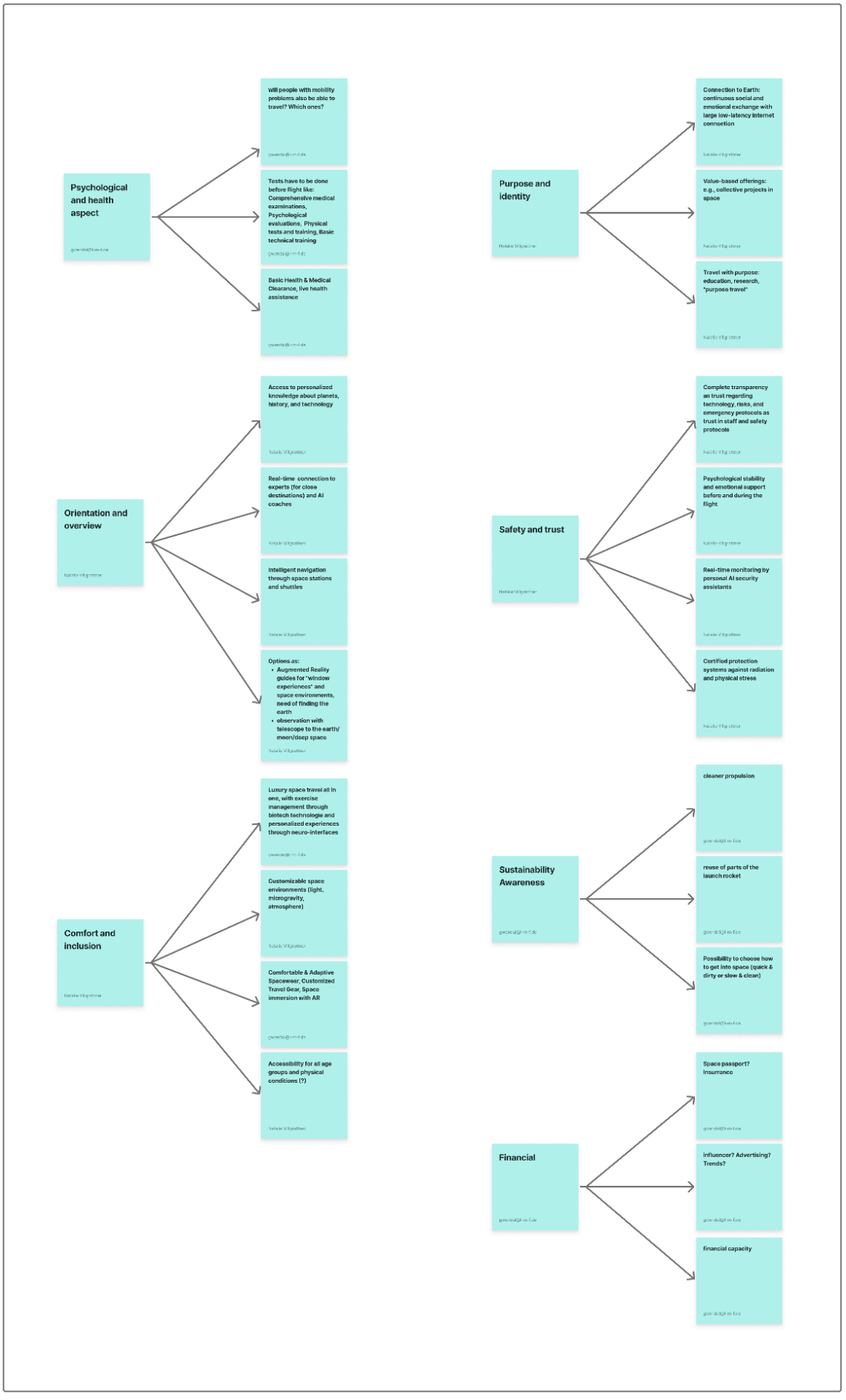
4.1. Idea generation phase

During the ideation phase, our focus was on developing creative and future-oriented solutions for the tourism experience in space. Building on the findings from the research and definition phase, our goal was to gather initial concrete concept ideas that meet the specific requirements of safety, orientation, trust, and user guidance in the context of space tourism.

We used various creativity techniques—particularly brainstorming, mind mapping, and "How Might We" questions—to generate the widest possible range of approaches. We were conscious of creating an open atmosphere that also welcomed visionary or unconventional ideas. This was essential, as space travel places new physical, psychological, and emotional demands on users that must be considered in the design process.

A key aspect was the mental inclusion of different perspectives from our environment. In a fictitious thought experiment, we imagined conversations with people of different age groups to analyze potential fears, desires, and expectations regarding space travel—from preparation and booking to the actual stay in space. Topics such as trust in technology, safety communication, digital training programs, and emotional support before, during, and after the flight appeared particularly relevant.

The resulting ideas were documented in a mind map that includes approaches such as interactive pre-launch training platforms, personalized booking and preparation assistants, VR-supported pre-launch experiences, real-time communication interfaces with Earth, and hybrid experience formats (physical and digital).


Psychological and health aspect
will people with mobility problems also be able to travel? Which ones?
Tests have to be done before flight like: Comprehensive medical examinations, Psychological evaluations, Physical tests and training, Basic technical training
Basic Health & Medical Clearance, live health assistance
Purpose and identity
Connection to Earth: continuous social and emotional exchange with large low-latency internet connection
Value-based offerings: e.g., collective projects in space
Travel with purpose: education, research, "purpose travel"
Orientation and overview
Access to personalized knowledge about planets, history, and technology
Real-time connection to experts (for close destinations) and AI coaches
Intelligent navigation through space stations and shuttles
Options as:
• Augmented Reality guides for "window experiences" and space environments, need of finding the earth
• observation with telescope to the earth/ moon/deep space
Safety and trust
Complete transparency an trust regarding technology, risks, and emergency protocols as trust in staff and safety protocols
Psychological stability and emotional support before and during the flight
Real-time monitoring by personal AI security assistants
Certified protection systems against radiation and physical stress
Comfort and inclusion
Luxury space travel all in one, with exercise management through biotech technologie and personalized experiences through neuro-interfaces
Customizable space environments (light, microgravity, atmosphere)
Comfortable & Adaptive Spacewear, Customized Travel Gear, Space immersion with AR
Accessibility for all age groups and physical conditions (?)
Sustainability Awareness
cleaner propulsion
reuse of parts of the launch rocket
Possibility to choose how to get into space (quick & dirty or slow & clean)
Financial
Space passport? Insurrance
influencer? Advertising? Trends?
financial capacity

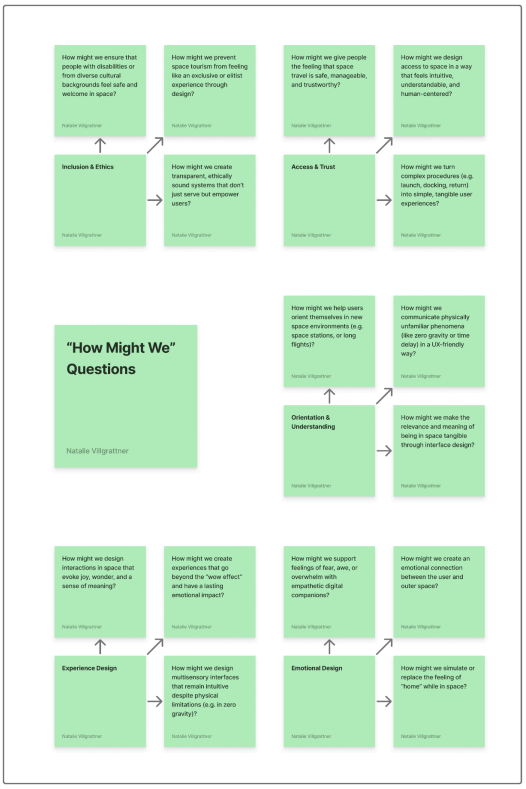
Link:https://www.figma.com/board/J2QEaH6EdKAUX9tL0R0Siq/UX--ideation?node-id=3-2&t=XlCNqRnyZxwopNTm-0

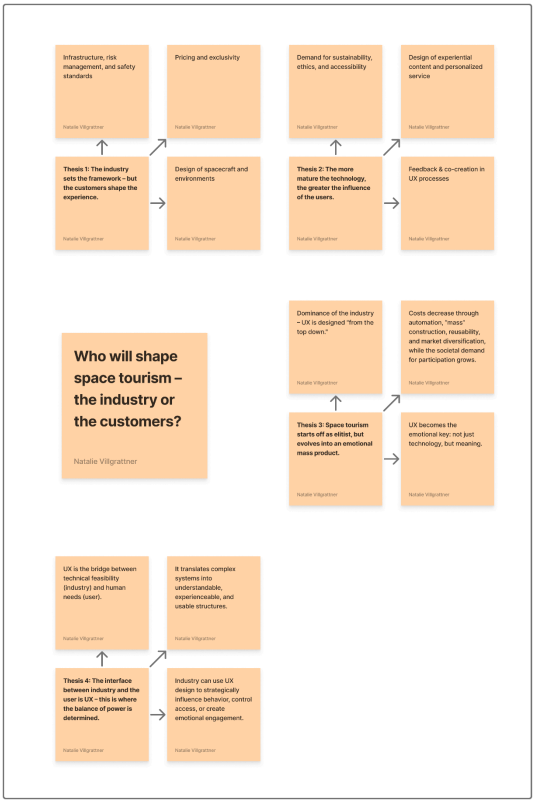
It serves as a visual overview of the current state of ideas and as a basis for the subsequent concept development.

4.2. Idea prioritization

In our brainstorming, we asked ourselves what travel might look like in a future where the physical and digital worlds increasingly merge – and what people really need in that future. This consideration gave rise to the vision of a personal travel companion that not only provides organizational support but also takes us on an emotional journey.

Our idea is based on a self-learning, intelligent system that accompanies us before, during, and after our journey – much like a good friend or coach. It's not just about showing us routes or booking accommodation, but above all about consciously designing experiences, recognizing needs early on, and providing support even in challenging moments.





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Before the trip: The system helps us find suitable experiences – not just by location, but by feeling: Do we want to relax, learn something, be inspired, or meet new people? This takes previous experiences, current mood, and personal interests into account. Digital travel formats – such as virtual city tours or shared remote experiences – are also considered.

During the trip: The accompaniment remains flexible and attentive. They sense when something is overwhelming or boring and spontaneously suggest small stimuli: a new path, a break, a conversation, a place to pause. They help us stay present and perceive our experiences more consciously – regardless of whether we are on another continent or moving in a virtual world.

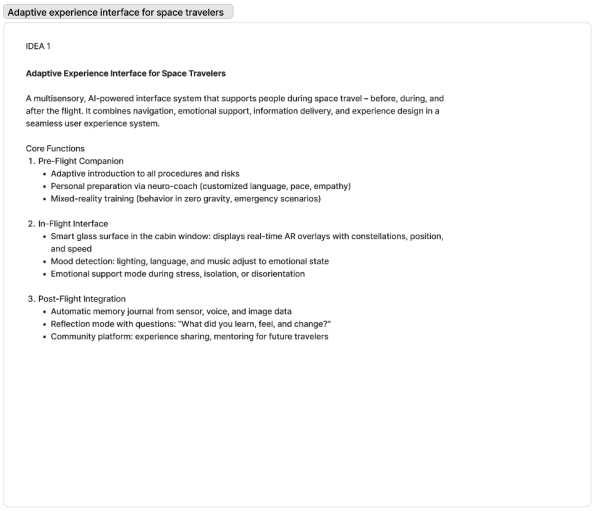
After the trip: The system helps us process and reflect on our experiences. It creates a personal memory archive—with images, thoughts, and moments—and asks questions that help us gain a deeper understanding of what we have learned. This turns a journey into not just an experience, but also a part of our development.

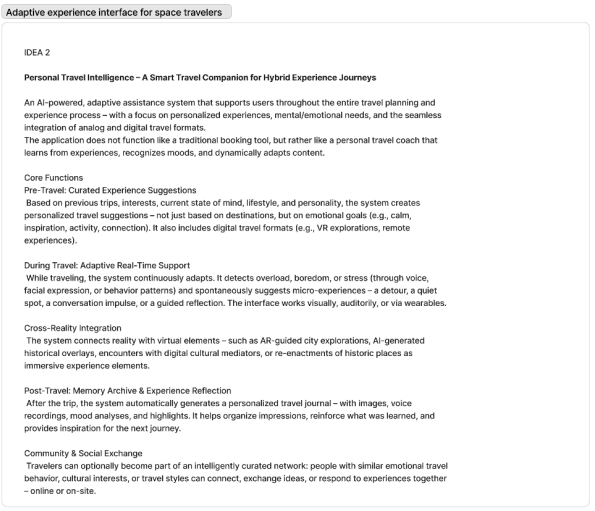
A community feature also allows us to connect with other people who travel similarly or share similar values. Shared experiences can be shared, deepened, and further developed.

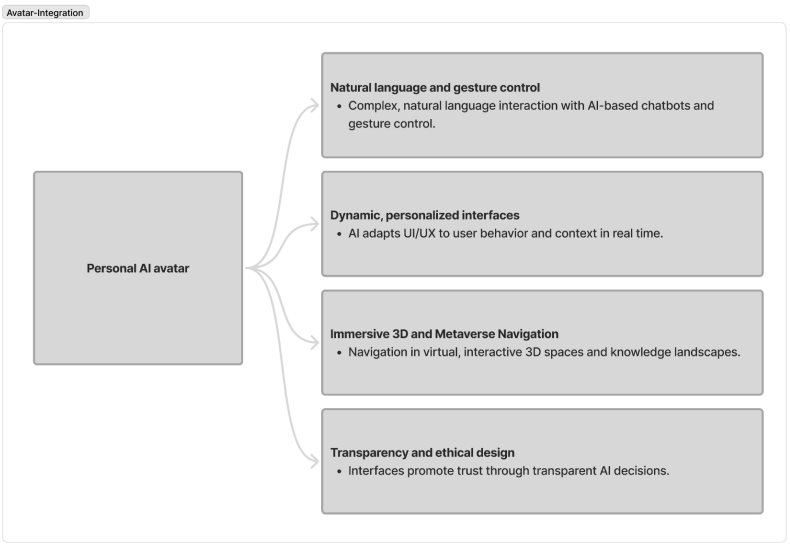
This idea reflects a clear insight: The future of travel lies not solely in technology, but in the way we interact with it. We believe that travel in 2100 will not only be more efficient and connected, but above all, more personal, conscious, and meaningful.

Our concept is therefore not a traditional booking system, but an empathetic travel companion – one who experiences with us, supports us, and helps us understand our travels as part of our identity. We no longer design experiences just for people, but with them – from their perspective, in their way, at their pace.

4.3. Conception







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When we imagine what travel might look like in the year 2100, we don't just think of technological innovations or futuristic means of transportation. We think of experiences that touch, transform, and empower. This is precisely where the idea of "Personal Travel Intelligence" comes in – a learning, AI-supported assistance system that accompanies people on their journeys. However, the focus of this vision is not technology, but the user experience.

Because only through design that touches and supports does technology become humanly relevant.

We envision an application that functions not as a traditional travel booking tool, but as a personal travel companion who learns, feels, and reacts with us. The introduction begins with dialogue: Instead of checklists, users expect empathetic questions. It's not just about where the trip is going—but why. What do we need right now? Peace, inspiration, closeness, exercise? The system recognizes emotional needs and uses them to formulate experiences that suit us. Hybrid formats are also being considered: a mix of analog experience and virtual encounters that transcend spatial and temporal boundaries.

During the journey, UX becomes a sensitive companion. Through language, behavior, facial expressions, or biometric signals, the system recognizes how we are feeling – and adapts accordingly. If we feel overwhelmed or stressed, it suggests a detour, a break, or a change of perspective. It's not about constant presence, but about targeted stimuli at the right moment. Interaction is adaptive: sometimes via a visual interface, sometimes via voice or wearables. Importantly, no one should feel excluded – not even older people or travelers with disabilities. Inclusive design is at the heart of the solution.

The experience doesn't end after the trip. The system helps process and anchor the experience – through a personalized travel diary that collects experiences, moods, and insights. Reflection questions encourage reflection: What moved me? What did I learn about myself? Those who want to can exchange ideas with others who have had similar emotional travel experiences. Here, too, UX remains discreet, empathetic, and oriented toward the desire for genuine exchange.

From a UX perspective, we understand Personal Travel Intelligence as a new type of interface: not a surface, but a relationship. Design is not an end in itself, but a bridge – between people and technology, between the inner and outer world. Our role as UX designers is to make this bridge tangible. Intuitive, meaningful, and supportive. Thus, UX becomes the emotional key in the context of travel of the future – accompanying not only movements in space but also inner transformations.

Adaptive Experience Interface for Space Travelers – a multisensory interface system for space travelers

A multisensory, AI-supported assistance system that accompanies people on space journeys before, during, and after their flight. It combines navigation, emotional support, information provision, and experience design into a seamless user experience system – tailored to the specific requirements of space travel.

Core functions

Before the flight: Interactive preparation

The system offers an adaptive introduction to all the processes, risks, and peculiarities of a space journey. Users receive customized information via a personalized coaching function – a so-called neuro-coach – tailored to their language, pace, and emotional needs. This is

complemented by mixed-reality training that simulates behavioral situations in zero gravity and prepares for emergencies.

During the flight: Intelligent cabin interaction

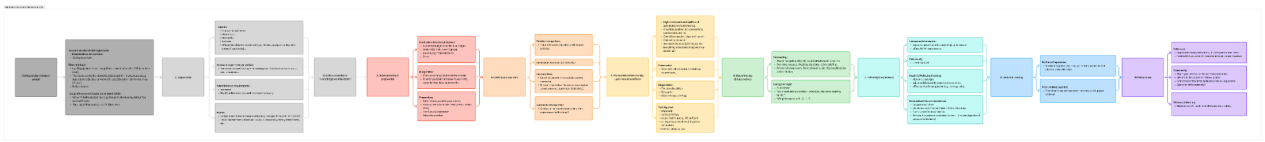
During the journey, users interact via an intelligent glass surface in the cabin. This displays real-time AR overlays with constellations, current position, and speed. Additionally, the system detects emotional states through facial expressions, voice, or body language and adjusts lighting, speech, or music accordingly. In cases of stress, isolation, or disorientation, an emotional support mode is automatically activated.

After the flight: Personal follow-up and integration

Upon return, the system automatically creates an interactive memory journal. Sensor, voice, and image data are compiled into an interactive travel diary. In a reflection mode, questions such as "What did you feel, learn, and change?" are asked. Additionally, a community platform enables exchange with other travelers – for follow-up, mentoring, or to support future space tourists.

The aim of this system is to create an experience that meets the unique demands of space travel—emotional, cognitive, and sensory. It accompanies travelers not only technically but also humanly—for a safe, inspired, and reflective experience in space.

This is how we structured the steps of the travel assistant:



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01. registration

Of course, the travel assistant (TA) has not yet been created for this step.
First, the prospective traveler must create an account with all their information (name, address, job title, etc.). In addition to this (basic) information, information about their job/position within the company is also required, as well as health insurance details and registration. A journey into space requires certain physical requirements; not everyone will necessarily be fit to travel one day.

02. Registration

Once registration is complete, the avatar (AV) is created by the travel site and facilitates the processing of required information, such as health checks with cardiovascular, pulmonary, neurological, ophthalmic, hearing, and blood tests, as well as psychological and physical fitness

tests, in addition to travel-specific criteria. The AV is also there to send forms and contracts, communicate what is missing, and how all required documents will be sent.

The user can view the suggested flight offers/options, such as:

- Orbital jump
- jump to earth
- fly to the moon
- Orbit around the Earth or the Moon
- fly to the moon/stay there/have a honeymoon

Each trip also offers options such as exiting the shuttle/driving a vehicle, visiting the launch site, guided tours, etc.

Depending on the information entered, the prospective traveler is offered a selection. These suggestions are based on possibilities, agreements, and preferences.

03. Travel planning & preparation

The flight/trip has been selected, and preparation can begin. A fitness plan is suggested by the AV:

- medical examination, 1 to 3 months before the flight
- physical preparation (optional but recommended), 2-3 months before the flight
- Safety training and microgravity training
- mental and behavioral preparation
- D-Day: Light medical examination

In addition, information on emergency procedures is provided and VR flight simulations are offered so that the customer can get a taste of what to expect from up there.

04. Booking & Payment

Once the flight has been selected and the training plan submitted, the traveler can select a departure date depending on the space company's availability. Since prices have dropped dramatically, the queue is likely to be very long.

The traveler is now aware of everything that will happen. They will pay for their ticket in accordance with the terms of contract termination in the event of a problem/cancellation on the part of the traveler or the space company.

When purchasing the ticket, you will be offered the options (as previously outlined). The traveler also has the opportunity to spend a few days before departure in a hotel near the launch site and observe the pre-flight(s) or even visit the rocket/shuttle/capsule production/assembly line.

He will also be able to stay for a few days after the trip and talk to other extraterrestrial tourists who have also spent time outside of Earth and share their experiences with them.

05. Pre-launch (before the trip)

Once the ticket has been purchased, the future traveler has downloaded his timetable via his AV and has virtual access to his information.

The formalities are simplified by the AV, who signs the important documents that the traveler needs to review. This data is stored on the blockchain and thus secured (this applies to important life insurance contracts/travel tracing, bank accounts, etc.).

The AV computer advises the traveler what to eat the day before. Because it's connected to the body via sensors, it understands this and can suggest relaxing meals/activities for the day before the flight. Information about weather conditions is provided and examples are shown of what previous travelers may have observed during their identical flight. The latest information/updates have been provided, and the traveler is finally ready—thanks AV!

06. Travel day

On the day of the flight, the excitement is at its peak; the traveler must remain calm, making a final call to loved ones before departure. The escort will be very important on this day to keep the traveler's attention and calm.

The AV takes/guides the traveler to his destination (the rocket) and tells him what he should/can take with him (for example, his children's favorite stuffed animal/object).

The AV provides instructions on check-in and safety procedures, demonstrates a check of the rocket to ensure everything is operational, confirms the departure time, etc.

07. In the flight experience

The AV provides recommendations regarding appearance, posture, and suit adjustment, and demonstrates what absolutely must-haves during a flight. Should a problem arise during the flight, the AV system is also there to reassure the pilot, make the situation easier to manage, and demonstrate what needs to be done. Because it's generated by the AI, decisions can be made more quickly and pragmatically.

There are a variety of VR possibilities, such as seeing yourself without a capsule in the room the traveler is currently in.

The AV explains the stars, what's visible, and what's a must-see. It will be crucial during those moments in space, whether it's 1 or 2 minutes or several days. It must be present to show that the journey was worthwhile. This moment will be very important, as all the preparations for the flight will culminate in this moment(s). As the journey becomes more and more extensive, it's very important that customers are completely satisfied, or even more so.

The AV will be there to immortalize the moments spent, allowing travelers to fully enjoy their trip without having to take photos. All their experiences will be documented without them having to worry about it.

08. Return & Landing

The flight is over, the euphoria will fall gradually. For a flight that only lasts a few minutes, the realization that the flight is over is quite brief and a somewhat less unpleasant moment. For a longer journey lasting several hours/days (in the case of Earth orbit or a trip to the moon), the return journey becomes more boring. The AV then needs to demonstrate how interesting the trip was and whether it was worth the cost.

The base staff will take care of personal belongings and ensure that the traveler is presentable for press/souvenir photos (remember that there are no showers or bathtubs on long missions).

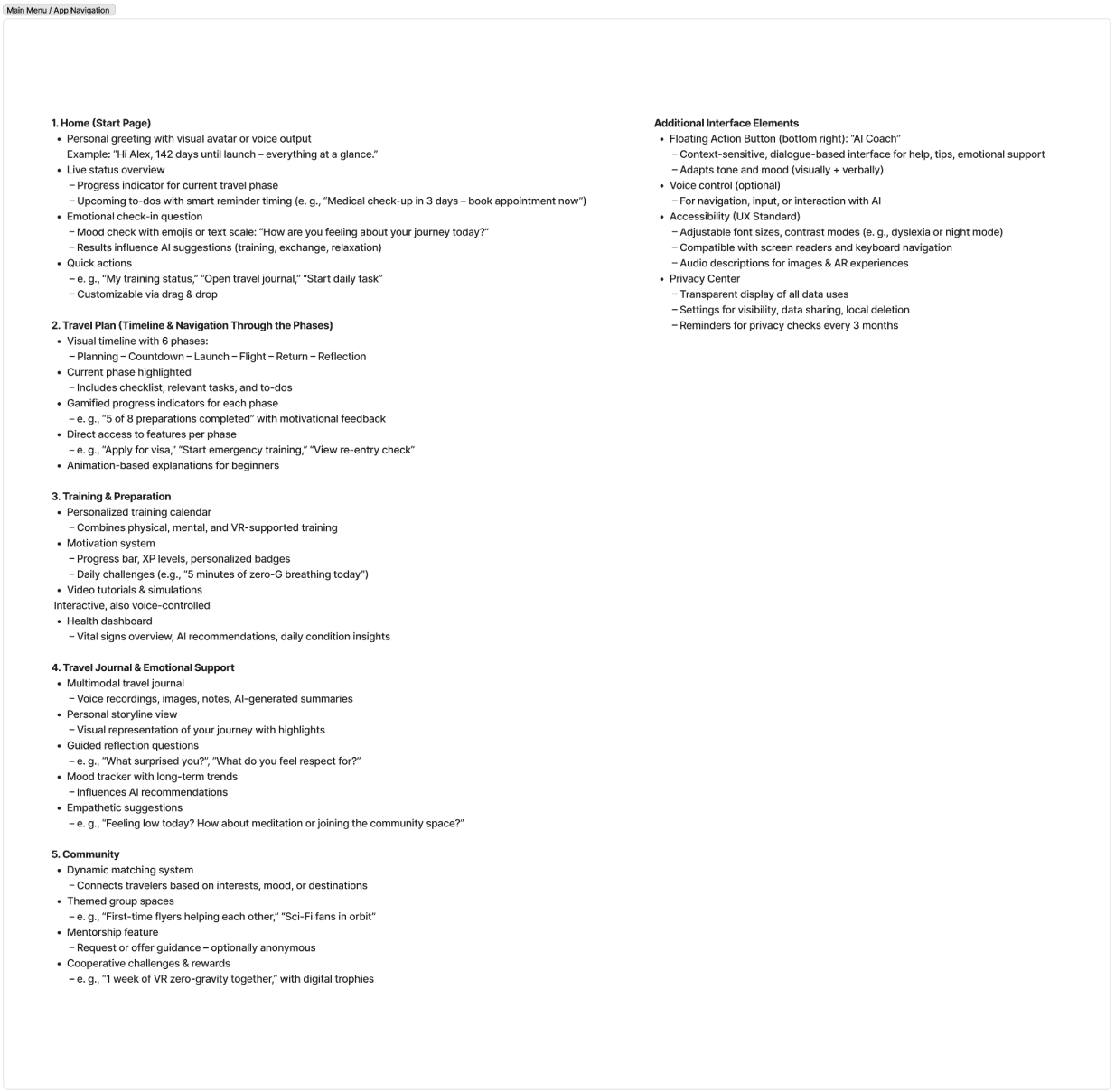
09. After the flight

After the flight, the traveler returns to Earth and is completely disoriented because they have left Earth. The AV will remain there to give them the opportunity to connect with other travelers who are still present and have had the same experience. The goal is to help them reduce and channel the excitement, and avoid feeling that frustration when they return from vacation.

The AV also collects photos of the travelers and creates a video/memory album of their trip, which may be printed.

10. Conclusion

Since space travel is still reserved for a wealthy clientele, it seemed essential to us that the preparation be as good as possible and be completely free from the constraints of preparation, photography, and psychological stress. For us, the traveler is the focus, and everything surrounding them is everything. It seemed important to us to free them from this. A trip like this has to be perfect; you tell your friends about it. Furthermore, it's an opportunity to sell the trip to other future customers.



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5. Conclusion

Vision of an AI-based travel interface in 2100 – Dealing with the CO_2 problem

The development of tourism up to the year 2100 will be significantly shaped by technological, societal, and ecological factors. A central issue remains the question of the role of climate change, and in particular the CO_2 problem. The future could hold two opposing scenarios: Either the CO_2 problem will be largely solved through technological and societal transformations, or the climate crisis will have massively restricted travel, and especially international tourism.

To address these uncertainties, a future-oriented, AI-based travel interface should be flexibly prepared for both development paths. CO_2 emissions can thus either be treated as a secondary consideration if climate-neutral technologies and practices have become standard, or they can be placed at the center of travel planning if ecological crises have a significant impact on travel.

Scenario 1: Climate-neutral world

Ideally, by 2100, we as humanity will have largely solved the CO_2 problem through innovations such as emission-free mobility, the circular economy, and renewable energies. In such a society, sustainability is naturally integrated into all areas of life. Our travel interface of the future can focus on experience quality, customization, and new forms of travel. Sustainability metrics such as the CO_2 footprint will continue to be communicated transparently, but will play a subordinate role. Instead, other aspects such as biodiversity, cultural impact, and social responsibility will take center stage.

Scenario 2: Climate crisis as a central challenge

If we fail to successfully contain the climate crisis, tourism will face massive restrictions in 2100. Many travel destinations could become inaccessible due to environmental destruction, extreme weather events, or political instability. In this case, we must design the interface to actively inform users about risks, environmental impacts, and sustainable alternatives. AI will take on the task of planning trips so that they are as resource-efficient, safe, and socially acceptable as possible. CO_2 reduction and offsetting will then be an integral part of every travel decision.

The CO_2 problem thus remains a central issue in tourism development, even if its significance may change over time. An AI-based interface of the future should therefore be designed to be flexible and forward-looking, able to respond to both a resolved and a worsening climate situation. In this way, we support travelers in planning responsibly, individually, and with a focus on the future – regardless of how the world develops by 2100.

Sources

Adler, J. (1989). Travel as performative art. American Journal of Sociology, 94(6), 1366-1391.
Black, J. (2003). The British Abroad: The Grand Tour in the 18th Century. Sutton Publishing.
Brodsky-Porges, E. (1981). The Grand Tour: Travel as an Educational Tool, 1600–1800. Annals of Tourism Research, 8(2), 171–186.
Holloway, JC, & Humphreys, C. (2019). The Business of Tourism. SAGE Publications Limited.
MacCannell, D. (1976). The Tourist: A New Theory of the Leisure Class. University of California Press.
Theobald, WF (2005). Global Tourism. Elsevier.
Towner, J. (1985). The Grand Tour: A Key Phase in the History of Tourism. Annals of Tourism Research, 12(3), 297–333.
Tribe, J. (2009). Philosophical Questions in Tourism. Channel View Publications.
Urry, J. (2002). The Tourist Perspective. Sage Publications.
Gössling & Hall, 2019, Journal of Sustainable Tourism
Buhalis & Law, 2008, Tourism Management
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://elib.dlr.de/22475/1/Lufthansa-Artikel_Kuehne-DLR_fuer_LH20040119.pdf
https://www.resourcespace.com/blog/augmented-reality-in-museums
https://de.wikipedia.org/wiki/Tourismus
https://plant-values.de/tourismus-und-nachhaltigkeit-1-3/5342/
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://d-nb.info/1096170299/34?utm_source=chatgpt.com
https://www.br.de/nachrichten/wissen/erfindung-der-ferien-geschichte-einer-wunderbaren-zeit,RXbVi7U
https://www.kalender-365.eu/feiertage/1963.html
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://library.fes.de/gmh/main/pdf-files/gmh/1979/1979-03-137.pdf
https://journals.sagepub.com/doi/abs/10.1509/jmr.15.0204
https://wttc.org/research/economic-impact
https://www.nature.com/articles/s41558-018-0141-x
https://plant-values.de/tourismus-und-nachhaltigkeit-1-3/5342/
https://universemagazine.com/en/space-missions-2025-the-most-important-things-a-human-will-do-in-space-this-year/
https://www.popularmechanics.com/technology/infrastructure/a18198479/future-machines-2100/chrome-extension://efaidnbmnnibpcajpcglclefindmkaj/https://elib.dlr.de/22475/1/Lufthansa-Artikel_Kuehne-DLR_fuer_LH20040119.pdf
Lenzen et al., 2018, Nature Climate Change
https://www.ultralytics.com/de/blog/the-impact-of-ai-on-the-tourism-industry
https://mize.tech/blog/6-examples-of-how-ai-is-used-in-the-travel-industry/
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://elib.dlr.de/22475/1/Lufthansa-Artikel_Kuehne-DLR_fuer_LH20040119.pdf
https://www.resourcespace.com/blog/augmented-reality-in-museums
https://innoarea.com/en/noticias/fitur-2025/
https://www.traveldailynews.com/hotels-lodging/marriott-international-is-leading-the-virtual-reality-race-for-the-meetings-events-sector/
https://www.linkedin.com/pulse/future-virtual-reality-tourism-2025-moneyadviceofficial-81t1f
https://www.smartvel.com/resources/blog/big-data-for-analyzing-travel-trends
https://thinkz.ai/ai-iot-smart-tourism-project-thinkz-libelium/
https://urbact.eu/articles/how-use-data-analysis-making-tourism-more-sustainable-cities-and-communities-solutions
https://www.revfine.com/de/tourismus-trends/
https://de.statista.com/themen/10581/trends-im-tourismus/
https://utopiegestalten.de/2024/11/27/zukunfte-von-tourismus-und-events-interview-mit-catharina-fischer-uber-narrative-zukunftswerte-und-den-faktor-mensch/
https://www.ihk.de/schleswig-holstein/ihk-magazin/tourismus-gastronomie/tourismus-lotsen-interview-martinlinne-6431736
https://www.wirsindanderswo.de/artikel/keine-nachhaltigkeit-in-sicht-interview
https://www.wirsindanderswo.de/artikel/keine-nachhaltigkeit-in-sicht-interview
https://www.travelbook.de/natur/umwelt/wie-sieht-eine-nachhaltige-reise-aus-interview
https://www.tagesschau.de/wirtschaft/unternehmen/virgin-galactic-weltraumtourismus-100.html
https://flypix.ai/de/blog/commercial-space-exploration/
https://de.wikipedia.org/wiki/Virgin_Galactic
https://flypix.ai/de/blog/commercial-space-exploration/
https://www.cnetfrance.fr/news/ascenseur-spatial-de-la-science-fiction-a-la-realite-407545.htm
National Museum of Science and Technology Leonardo da Vinci, 2024
International Aeronautical Federation, 2021
Smithsonian National Air and Space Museum, 2023
NASA (2019). *Sputnik and the Dawn of the Space Age*. https://www.nasa.gov
ESA (2021).*60 Years Since Gagarin's Flight*. https://www.esa.int
NASA (2022). *Apollo 11 Mission Overview*. https://www.nasa.gov/mission_pages/apollo/apollo11.html
ESA (2020).*ISS: Research in Space*. https://www.esa.int
Britannica (2024). *Dennis Tito Biography*. https://www.britannica.com/biography/Dennis-Tito
Smithsonian National Air and Space Museum (2023). *SpaceShipOne Collection*. https://airandspace.si.edu

Virgin Galactic (2023). *VSS Unity Mission Timeline*. https://www.virgingalactic.com
The Guardian (2023). *Virgin Galactic Flies Tourists to Edge of Space*. https://www.theguardian.com
https://de.wikipedia.org/wiki/Pol_der_Unzug%C3%A4nglichkeit
https://www.zero2infinity.space/
https://marspedia.org/One-Way_Human_Settlement_Projects