

FlyingCab

Analyzing the user acceptance of Urban Air Mobility

Fraunhofer Institute for Industrial Engineering IAO
Sebastian Stegmüller | Franziska Braun



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Experimental acceptance survey in the context of Urban Air Mobility

Sebastian Stegmüller, Franziska Braun

Fraunhofer Institute for Industrial Engineering IAO
Nobelstraße 12, 70569 Stuttgart, Germany

Cooperation Partner: Volocopter GmbH

Content

1.	Introduction	01			Graphic: Flying taxi	21
1.1.	Relevance of the Topic	01		3.7.	Experience in a Flying Taxi	22
1.2.	Problem definition and study design	01		3.7.1	Valuation of comfort	22
	Graphic: Urban Air Mobility	02		3.7.2.	Interior requirements	22
	Graphic: Flying Cab in Berlin central station	03		4.	Summary	22
2.	Methodical Implementation	04		5.	Outlook	23
2.1	Survey in a visionary, but realistic framework	04				
2.2	Implementation of the Survey	05				
	Graphic: Gender- and age distribution	06				
	Graphic: Mobility behaviour	07				
3.	Results	08				
3.1.	Mobility Behaviour	08				
3.1.1	Travel purposes	08				
3.1.2.	Realized benefit	08				
3.1.3.	Substitution/supplementation of existing public transportation systems	08				
	Graphic: Realized benefit	09				
3.2	Urban Air Mobility	11				
3.2.1.	Flying taxi	11				
3.2.2.	Sensible/Reasonable use for the flying taxi	11				
3.2.3.	Luggage	11				
3.2.4.	Communal/collaborative usage	11				
3.2.5.	Motivation to use a flying cab	12				
	Graphic: Awareness of „flighing taxi“ and luggage	12				
	Graphic: Human or AI	13				
3.3	Perception of Safety	14				
3.3.1	Control system	14				
3.3.2	Feeling of security	14				
3.3.3.	Perception of personal security	14				
3.3.4.	Safety precautions	14				
	Graphic: Service Provider	15				
3.4	Service Provider	16				
3.5	Intermodal Integration	16				
3.6	Take-off and Landing Site	17				
3.6.1.	Possible routes for air taxis	17				
3.6.2.	Infrastructure of the take-off and landing sites	17				
	Graphic: Intermodal Integration	18				

1. Introduction

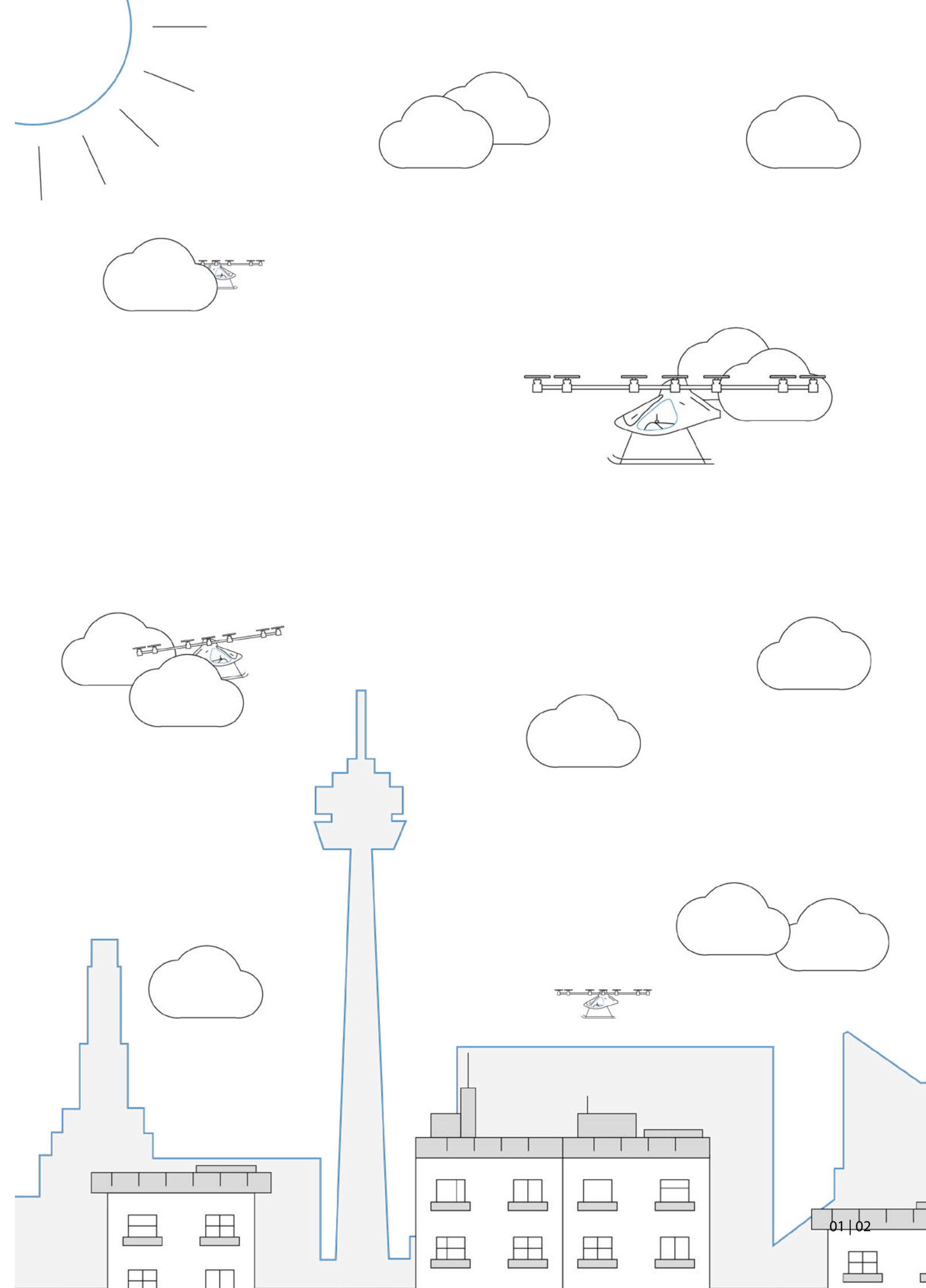
1.1. Relevance of the Topic

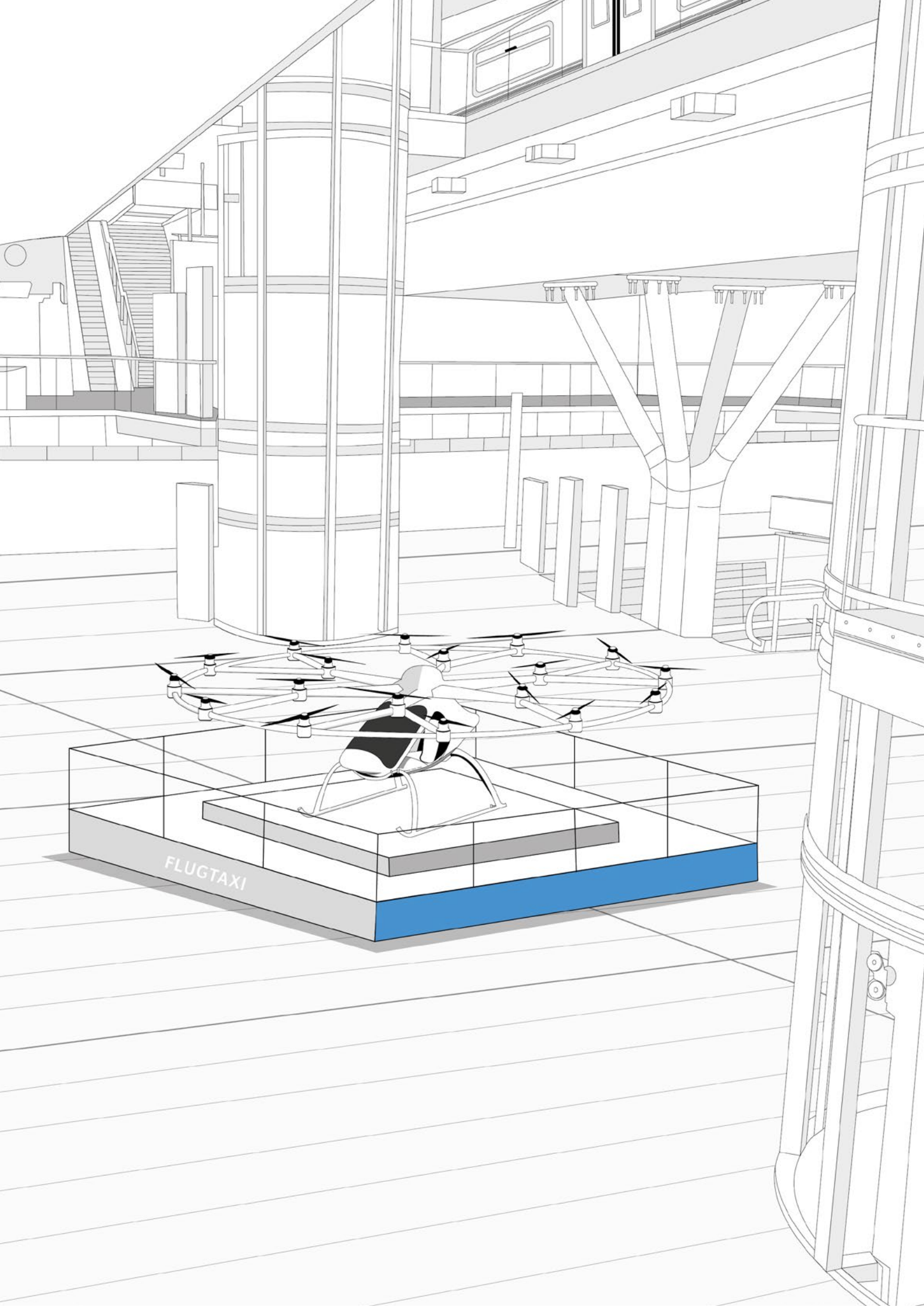
Flying taxi concepts and their integration into urban mobility systems are considered to be one of the most innovative and promising R&D (research and development) topics of our time, which promises high social potential but is also determined by a number of unresolved issues. Conquering the urban airspace not only creates a new form of flexible individual mobility, but also could drastically reduce travel times and relieve existing infrastructure systems. Electric powered air taxis are also considered to be significantly more sustainable than helicopters but also conventional ground-based taxis. In addition to technological and legal issues that are currently being dealt with in development projects and expert committees, in particular social acceptance is still considered a great unknown. A number of different aspects determine the customers' assessment of Urban Air Mobility. Important topics here are, for example:

- Flexible and individual mobility
- Reduction of travel time
- Perceived safety of new technologies
- Sustainable power trains
- Intermodal networking with existing and new transport systems
- Design and traffic integration of landing points

1.2. Problem Definition and Study Design

Especially with radical innovations for end customer markets, success and failure as well as underlying criteria are often difficult to assess. A most positive product experience is crucial for success but with a rising degree of radicalism of innovations it is difficult to investigate empirically in the early stage.





A new approach was applied in the FlyingCab study, which shall allow to collect and revert most objective user feedback at an early stage in the innovation process. The core of the experiment was a set-up that allowed to base the interviews on experiences with a real prototype, on real usage environment, on a widely diversified group of test persons and on a real usage context of the participants. The realistic survey situation enabled the users to be placed in a virtually and actually unknown context and thus most objective and spontaneous user opinions about a very radical innovation could be obtained.

2. Methodical Implementation

2.1.

Survey in a visionary, but realistic framework

To support the experimental acceptance survey, a functional flying taxi prototype was set up at a visionary mobility hub between the elevators in Berlin's central station. Interested travellers had the possibility to fill out a questionnaire about flying taxis and to get into the prototype. In addition, the study participants were able to see video clips of real test flights and simulated run-up scenarios on monitors. They also had the opportunity to have in-depth discussions with experts from the project partners.

The quantitative survey focused on the following topics:

- **Demography**
User groups, technical affinity and mobility behaviour (travel purposes, realized benefits, substitution / Complement to existing public transportation systems)
- **Flying taxi in general**
Number of passengers, luggage, shared use, booking and payment options
- **Infrastructure**
Evaluation of different landing and take-off places
- **Security and acceptance**
Control, passengers' sense of security, safety precautions, probability of occurrence, price acceptance
- **Experience in a flying taxi**
Evaluation of comfort, safety, interior requirements

Essential for the survey was the realistically appearance of the environment and the real travel situation of the participants, which supported the subjects in creating a visionary world of thoughts. The Berlin Central Station was the ideal environment for the survey, as it is one of the largest and most modern train stations in the world and has an innovative flair and is very popular with travellers.

As the mobility centre of Berlin as an international metropolis, it offers a heterogeneous mixture of passers-by of different origins and with a wide variety of travel purposes. Since the survey also focused on the integration of the use of flying taxis into existing intermodal travel chains, the passers-by form an interesting group of subjects in regard to a future integrated air taxi service. Choosing the location and the air taxi shown the real traveling experience could easily be further thought into a future scenario by the test subjects. Thus, the prominent elevators of the main station of Berlin already give the impression of being taken to landing areas on the roof.

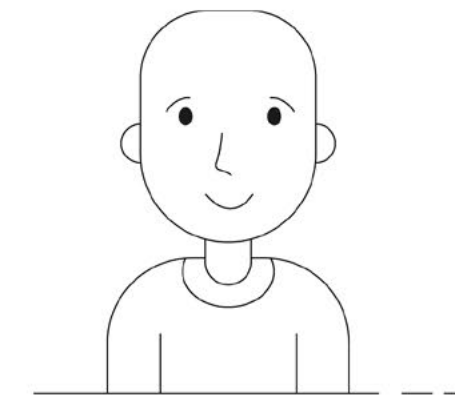
2.2.

Implementation of the survey

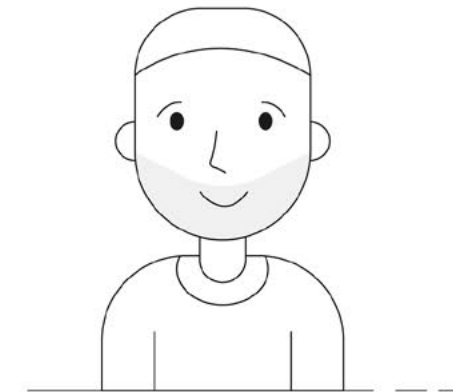
The survey was conducted from May 10, 2019 to May 12, 2019 by Fraunhofer IAO in cooperation with air taxi manufacturer Volocopter. A total of 320 persons were interviewed over three days. Among them 32% were women and 64% men (rest abstentions). 20% of the respondents preferred the English version of the questionnaire.

The age groups of the survey participants are divided as follows: 23% are between the ages of 25-34 while the range of 45 to 59 years is likewise with 23%. 13% of the participants stated their age between 18 to 24. The lowest age group is people over 60 years (5%) (Rest 13% abstentions).

The type of employment was also queried. Here „employees“ were represented most frequently with 38%. This was followed by those in training with 23%. The third most common type of employment is freelance work, followed by the executive employees with 14%. Retired persons (4%), housewives/househusbands (3%) and job seekers with 1%. (Rest 2% abstentions).



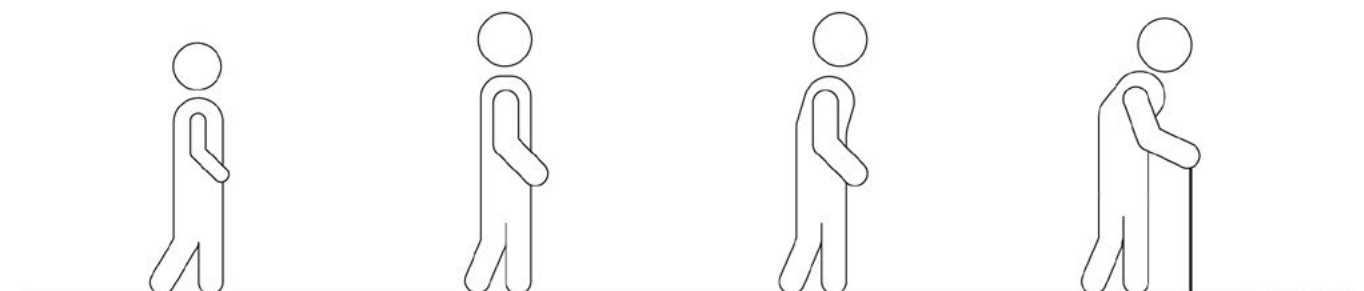
320 persons were interviewed



64% were male



32% were female



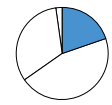
age group
18 - 24 years
13%

age group
25 - 34 years
23%

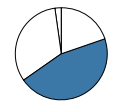
age group
35 - 44 years
24%

age group
45 - 59 years
23%

Public Transport Services



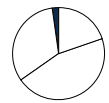
20% use public transport for commuting



46% use public transport for private trips



33% use public transport for business trips



2% have abstained from voting

Reisezweck

3. Results

3.1. Mobility Behaviour

3.1.1.

Travel purposes

When asked about the current purpose of using public transport services, 46% of the participants stated that they use public transport for private travel. 33% use public transport for business trips. Only 20% of the participants use public transport on their commuting route. (Rest abstentions).

3.1.2.

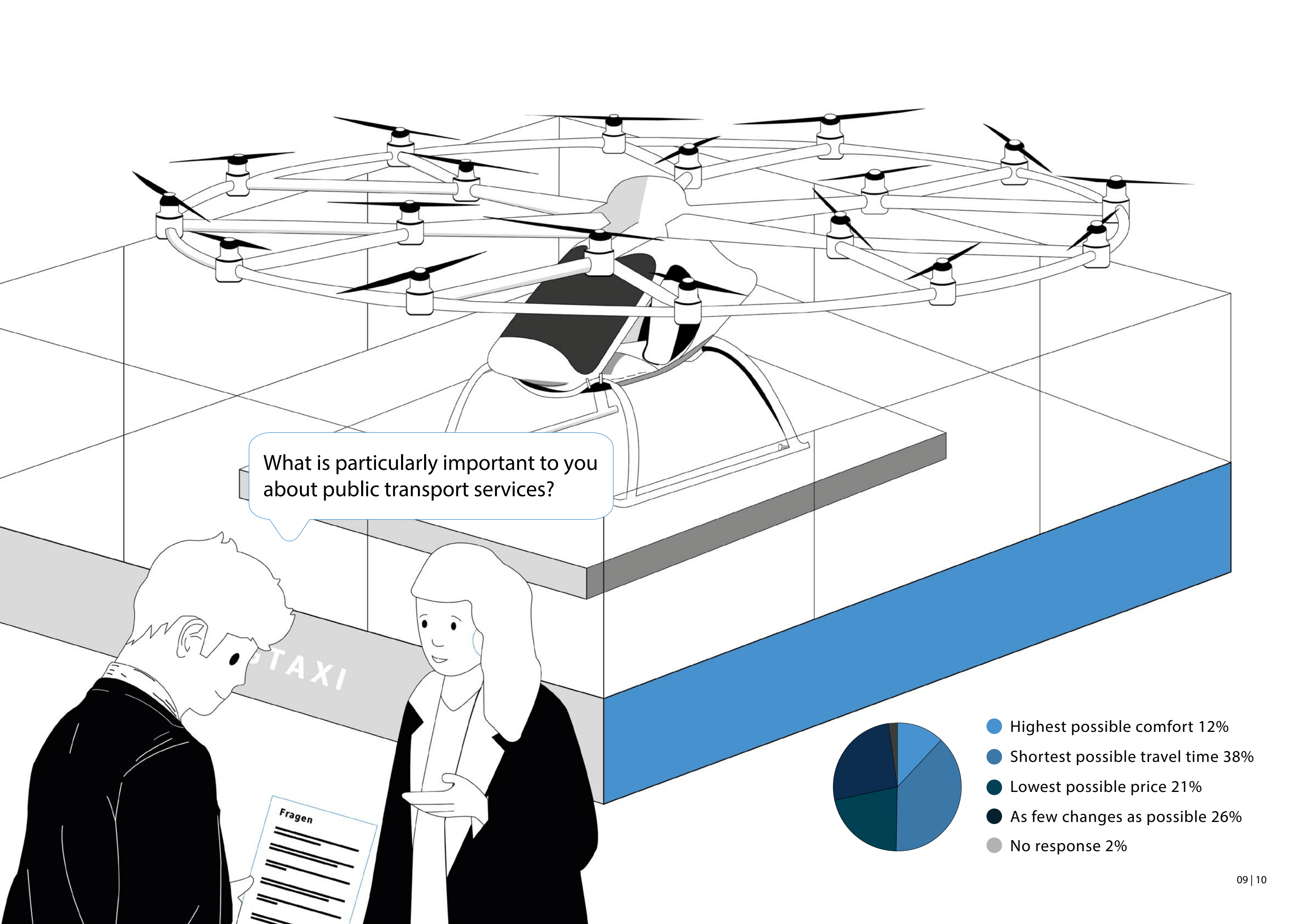
Realized benefit

38% of the respondents said that generally the shortest possible travel time is most important for them when choosing a means of transportation. 26% consider it to be important to have as few train changes as possible and 21% of those surveyed look for the lowest possible price. Only 12% value comfort of great importance. (Rest abstentions).

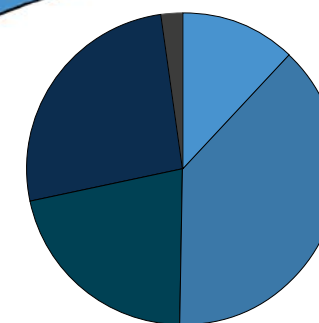
3.1.3.

Substitution/supplementation of existing public transport systems

The survey showed that 50% of those questioned believe that the flying taxi can usefully complement long-distance transport (e.g. inter city train). The respondents also believe that air taxis rather can complement local transport (regional train, airport express etc.), subway, bus / tram, cabs / transport services and car sharing. When assessing taxis or transport services, the interviewees disagree whether they can be complemented (in total 54%) or replaced by the flying taxi (46%).



What is particularly important to you about public transport services?



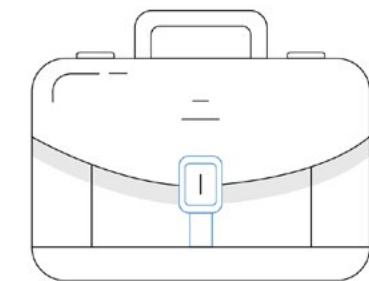
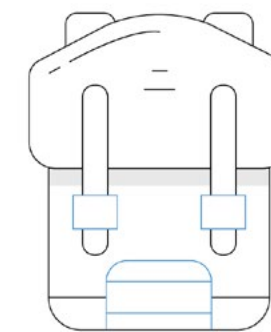
- Highest possible comfort 12%
- Shortest possible travel time 38%
- Lowest possible price 21%
- As few changes as possible 26%
- No response 2%

3.2. Urban Air Mobility

- 3.2.1. **Flying taxi**
51% of the participants were already familiar with the concept of flying taxis, only 32% had not heard of the technological innovation „air taxi“ (rest abstentions). 26% of the respondents who were familiar with air taxis could be assigned to the age groups of 25-34 years and 35-44 years, the age group of 45-59 years represents the largest proportion with 30%.
- 3.2.2. **Sensible/Reasonable use for flying taxis**
79% of the participants found the use of flying taxi to be the most reasonable for business trips, only (in total) 22% consider the usage of air taxis on business trips as meaningless. The daily use of a flying cab for commuting routes is considered by a total of 65% as appropriate and 35% inappropriate. For private trips, around two thirds of those surveyed also rated the use of flying taxi as useful and only 38% as not useful.
- 3.2.3. **Luggage**
37% of the respondents would like to be able to take a small suitcase with them into the flying taxi. 31% would be satisfied with a travel bag or backpack. Larger suitcases played a rather subordinate role for the respondents.
- 3.2.4. **Shared use**
65% of the respondents are willing to fly with unknown people in a flying taxi. The majority of the respondents, on the other hand, would like to have an air taxi for 2-3 people.
- 3.2.5. **Motivation to use a flying taxi**
The participants see the greatest benefit in using a flying taxi in the faster connection or the short travel time (34%). With 21% of the votes, the great flexibility is the second biggest which the respondents expect. The „middle field“ is shared by the reduction of transfers/train changes with 18% and the special experience with 14%. Far behind and less interesting for the participants are a high level of comfort (9%) and the reputation associated with a flight (4%).

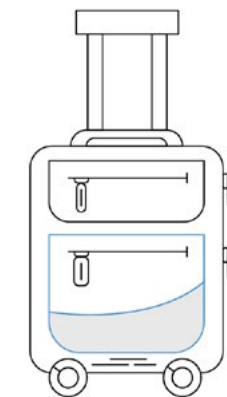
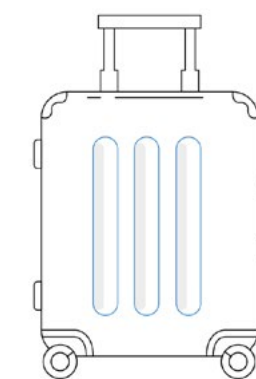
51% know flying cabs

32% do not know the technology flying cabs



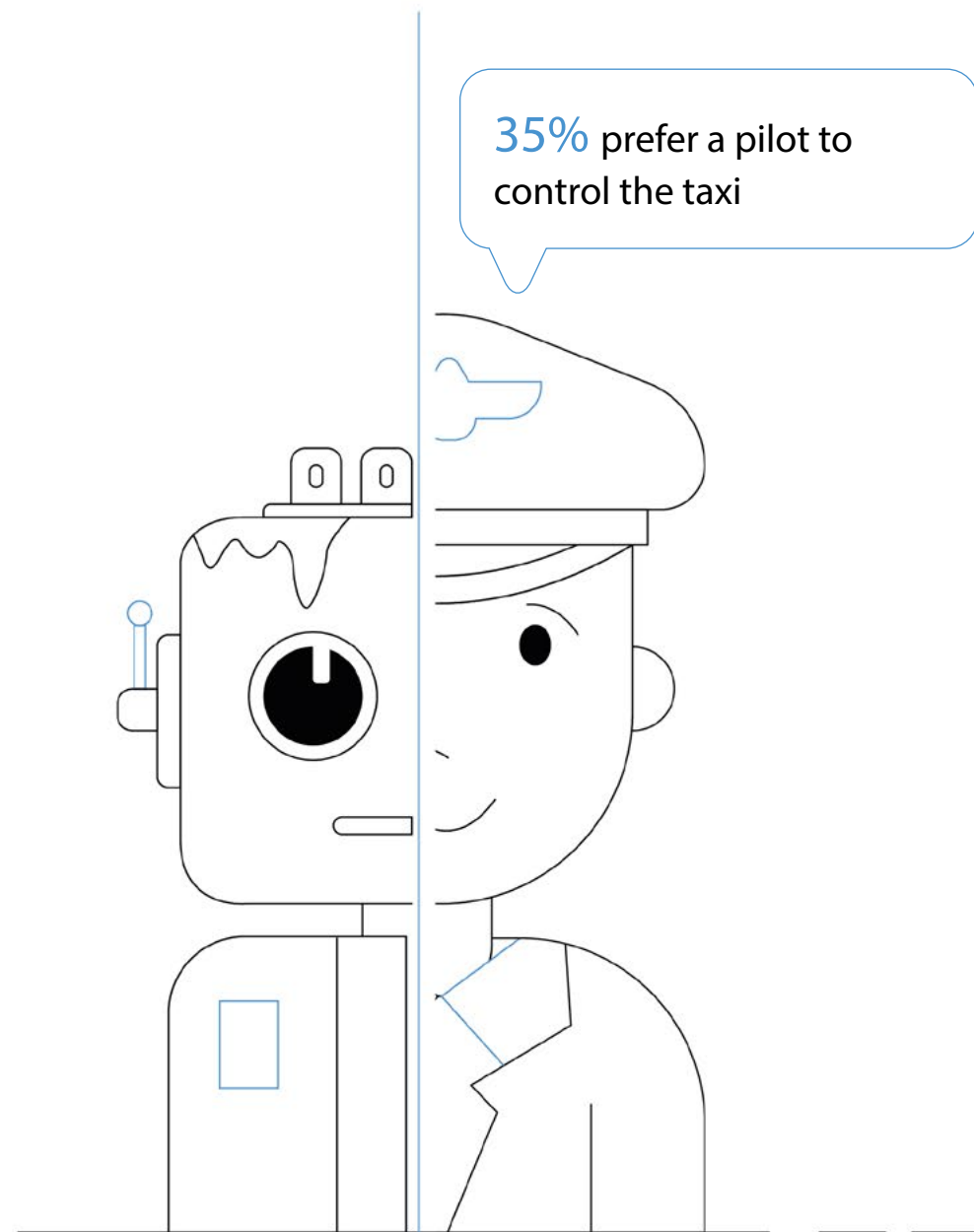
31% travel bag/backpack

21% hand luggage



8% luggage

37% small suitcase



26% already trust the technology and are in favour if the flying taxi is controlled autonomously (rest abstentions)

35% prefer a pilot to control the taxi

3.3. Perception of safety

3.3.1.

Control System

The respondents disagree on how to control an air taxi. 35% prefer that a pilot steers the taxi. Another 35% do not care how the taxi is controlled. Only 26% (remaining abstentions) already trust the technology and advocate an autonomously controlled air taxi.

3.3.2.

Feeling of security

When asked how safe a flight in an air taxi appears to be, 75% of those questioned answered that it appears „rather safe“ to „safe“. Only 13% consider a flight to be „rather unsafe“ and nobody as „unsafe“. It is conspicuously, the people who do have a feeling of insecurity are predominantly over 35 years.

3.3.3.

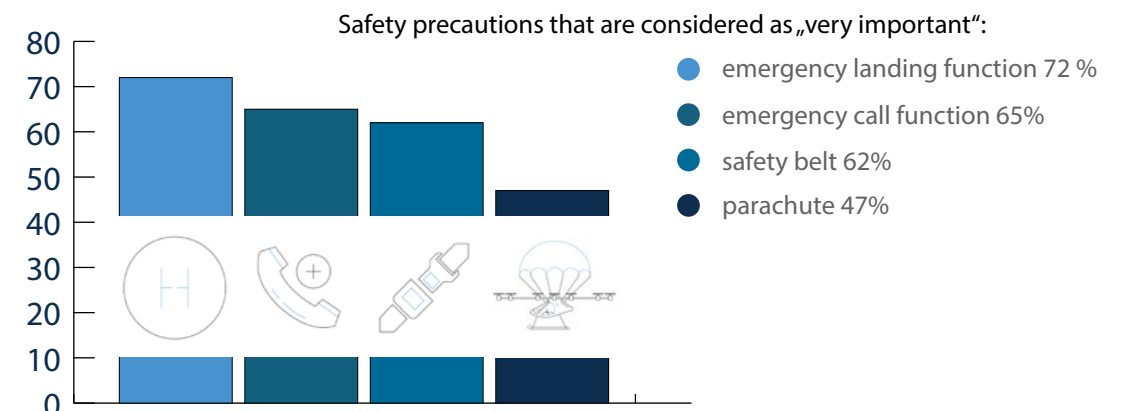
Perceived security

After the passers-by sat in the flying taxi, 40% of the participants felt that the flying taxi exudes a „rather safe“ to „safe“ feeling. Only 8% of the participants felt that the flying taxi exudes a „rather unsafe“ feeling (rest abstentions). After the impressions from the flying taxi, 8 people with a previously „rather unsafe“ feeling decided for a „rather safe“ to „safe“ feeling.

3.3.4.

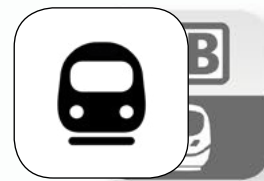
Safety precautions

In general, it has been shown that possible technical safety precautions are very important to the respondents. The emergency landing function was rated as very important by 72%. The second most important precaution is the emergency call function (65%), followed by the seat belt (62%).



34% booking through an existing transport company

36% wish to book through an independent flight taxi provider

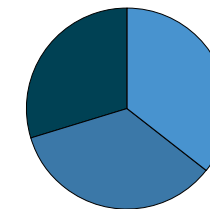


3.4. Service Provider

The interviewees disagree on the question of which provider they would like to book a flight with. 34% would like to book a flight through an independent flight taxi provider and 33% are in favour of booking through an existing transport company.

The participants that live in Berlin represent a particularly interesting group of subjects, whose place of residence, as a metropolis, represents a potentially attractive urban area. A large number of those surveyed living in Berlin and travel for private purposes, prefer a booking through independent air taxi providers (36%).

Respondents outside of Berlin, on the other hand, disagree on whether booking a private travel through an existing transportation company (34%) or through an independent air taxi provider (36%).



Preferred booking

- Booking via independent flight cab provider 36%
- Booking via an existing transport company 34%
- Booking via an independent ticket agency 30%

3.5. Intermodal Integration

41% of the respondents see it as „rather likely“ to „likely“ that flying taxis will be a means of public transport in the future (52% abstentions). There are no anomalies when looking at the age groups. All age groups voted most frequently for „likely“ and second most frequently for „more likely“. It is noticeable that respondents who rate the integration of the flying taxis into the public transport system as „likely“ to „more likely“ would prefer to book through independent flight taxi provider, or through an existing transport company.

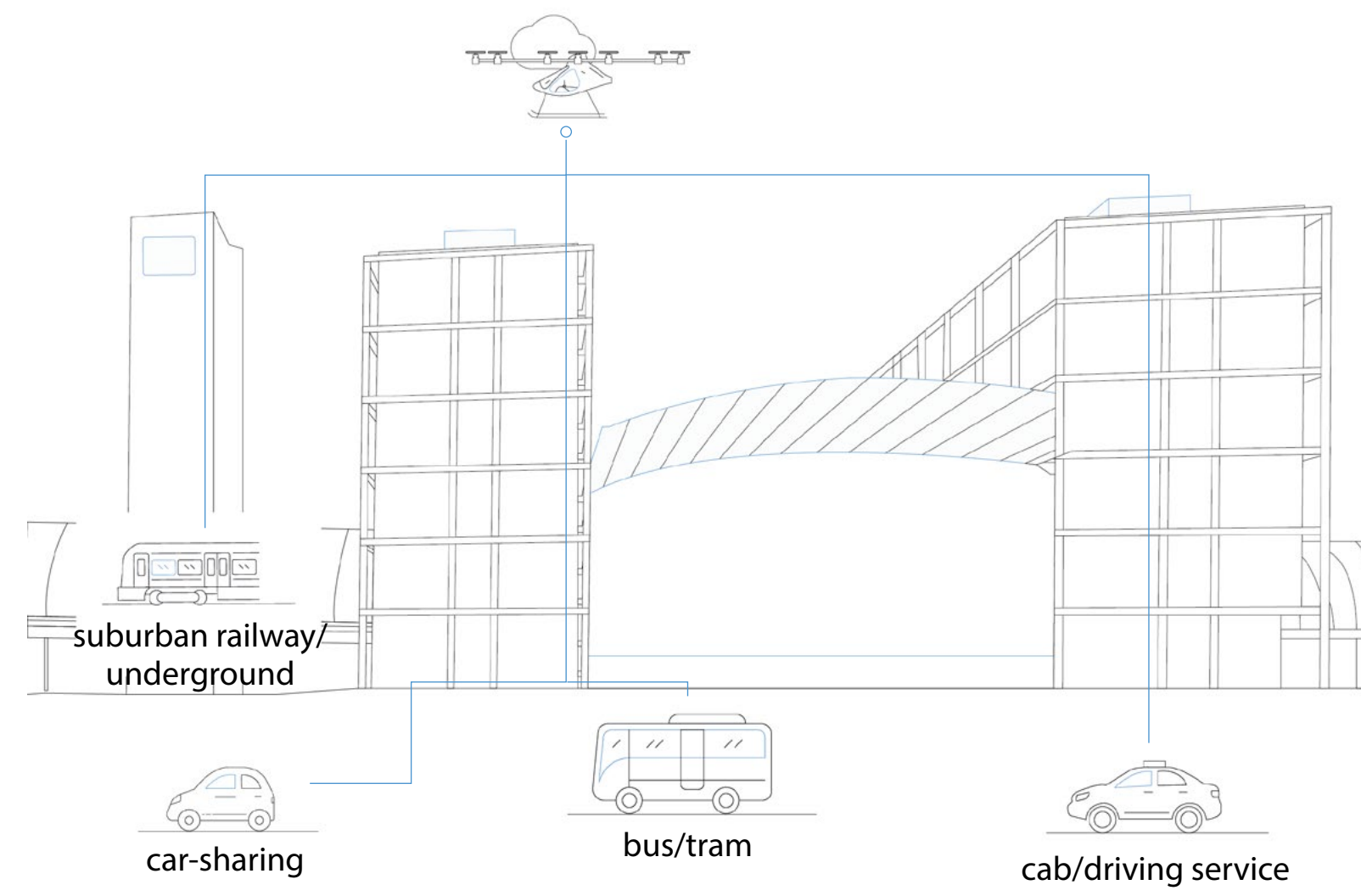
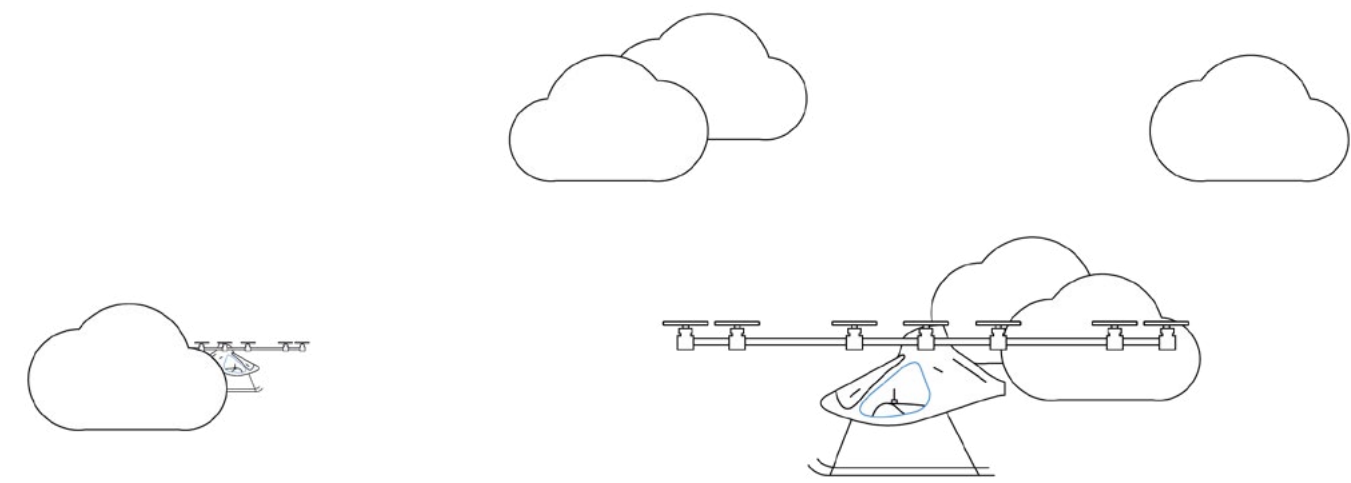
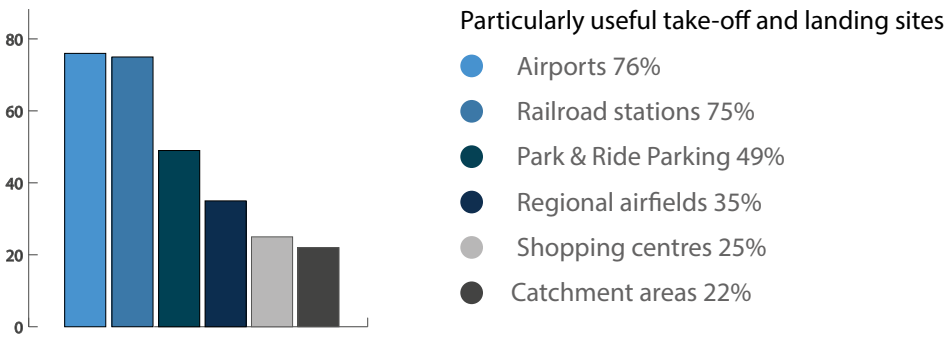
53% of the respondents would be willing to pay a higher ticket price for local public transportation if the flying taxi were integrated into the offer. 26% would not be willing to pay more for it (rest abstentions).

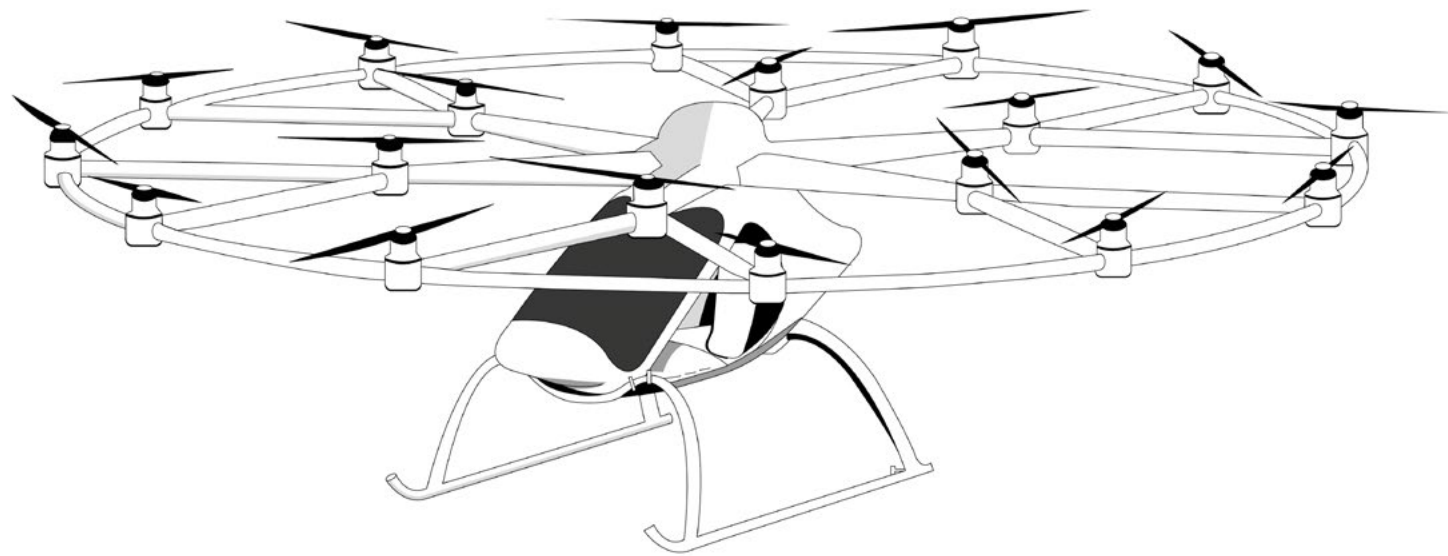
3.6. Take-off and Landing Site

Railway stations (75%), airports (76%) and Park & Ride parking lots (49%) are considered particularly useful locations for landing and take-off. Regional landing sites were not considered as useful with 35%, catchment areas with 22% and shopping centres with 25%.

3.6.1. Routes for flying taxis
When travelling with air taxis, the interviewees are most likely to imagine distances up to 30 km. The greater the distance of the routes, the less the respondents can imagine flying with an air taxi.

3.6.2. Infrastructure of the take-off and landing sites
For 57% of the survey participants it is very important to have a direct connection to other means of public transportation. Also 46% consider a power connection and internet in the waiting area very important. More important to the participants was the availability of a service desk (38%), sufficient parking spaces (45%) as well as quiet working area (42%). By the participants an entertainment offer (in total 73%), a lounge area (70%), or gastronomy offers (70%) were least important.





3.7. Experience in a Flying Taxi

As a thank you for participating in the survey, the participants could get an impression of the interior of the flying taxi by sitting in the prototype. Afterwards the respondents had the chance to evaluate the interior.

3.7.1.

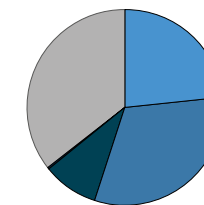
Comfort rating

55% of the participants rated the perceived comfort as „rather positive“ to „posi-tive“, only 1% found the interior of the air taxi to be „rather negative“ (rest absten-tions).

3.7.2.

Interior requirements

In the interior of an flying taxi, an internet connection is important to most of the respondents. Displays for the flight altitude, arrival time and flight time are also important for the respondents, as is a power connection for charging. Less important, however, is an entertainment offer.



Evaluation of comfort

- Positiv 23%
- Rather Positiv 32%
- Rather negativ 9%
- Negativ 1%
- Abstentions 35%

4. Summary

The following findings were identified as key statements:

- Train stations, airport and Park & Rides are particulary useful locations for take-off and landing areas
- The majority of those surveyed consider routes of up to 30 km to be particularly relevant.
- A fast connection and short travel times are the most important things for future users.
- More than 90% of the respondents would share a flying taxi with one or more people.
- The survey also shows that potential passengers, at least in the initial phase of air taxis, would like a human pilot on board.

5. Outlook

The survey was able to show a fundamentally positive and open minded expectation of the interviewees and to raise early theses for further research work:

The results of the survey on take-off and landing sites for flying taxis offer an opportunity to orientate oneself regarding the design of landing sites at train stations and airports. It also seems to be interesting to carry out more in-depth studies of the passenger capacity of air taxis in relation to different usage scenarios.

Carrying luggage has not yet been relevant to previous air taxi concepts. It is necessary to investigate what size (and weight) a passenger's piece of luggage is allowed to have and how carrying luggage affects the interior, pricing, safety and range of the air taxi.

Regarding to the perceived safety and aspects of fear of flying, it appears as interesting to compare the acceptance and the feeling of safety of an autonomous air taxi and a piloted flying taxi in a scientific way.

Further research is needed for the interior design of a flying taxi. The survey showed that a high level of comfort is not considered important. It would be interesting to find out how the experience in a flying taxi can be designed - also regarding a perceived feeling of safety.