Acceptance, Preferences and Willingness to Pay Analysis for Flying Cars and Passenger Drones

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ABSTRACT

The advent of flying cars and passenger drones for urban air mobility is one of the most promising hypes in the contemporary mobility system. It is mainly caused by the proceeding urbanization and the ever-growing demand for mobility on the one hand and technological spillover effects from the automotive industry on the other hand. However, so far it is unclear whether this innovative means of transportation will be accepted and adopted by a significant proportion of the population. This paper is not a social science paper, but will give an estimate of a broader customer acceptance, preferences and willingness-to-pay for 3d mobility and delivers a list of relevant aspects for marketing flying cars and passenger drones as a product or a service.

Keywords:
urban air mobility, flying car, passenger drone, customer acceptance, willingness to pay

1 Introduction

Flying cars and passenger drones especially for urban air mobility are amongst the most hyped developing means of transportation in the beginning of the 21st century.

Is individual air mobility (also called 3d mobility) an innovative product or service? At first sight no. General aviation is well known since more than hundred years and does not face any general acceptance issues besides CO_2 emissions. In particular, the rich and famous commonly use private jets. Short distance flights within a city are known from helicopter aviation and fully accepted irrespective of the noise and costs.

Moreover, individual aviation is known from sports airplanes. Overall, it seems to be nothing new.

However, various aspects of 3d mobility make flying cars and passenger drones a product and a service, respectively, that is worth to be looked at closer:

- The new technological concepts of 3d mobility aim at the integration of a fully electric propulsion system which can be more ecological and produce less noise. Furthermore, they shall be capable of starting, flying and landing fully autonomously thus making professional flying skills obsolete. Both technological trends can be considered as technological spillovers from the automotive industry.

- Helicopters are very loud and only accepted, because they usually fly to fulfill sovereign tasks (police, rescue etc.).
- An increasing number of 3d mobility in the air will require considerable new safety regulation and surveillance.
- The development of autonomous cars led to broad discussions on ethics and liability raising concerns in the German society. 3d mobility vendors also plan to offer autonomous services. Thus, a public discussion about the risk associated is likely to start soon.
- In general, 3d mobility vendors promise the provision of faster mobility in cities and the connection of areas in which mobility is not available or only to a small extent. Specifically, they offer diverse applications as shown in table I.
- An alleged value proposition of 3d mobility is its intended contribution to solving traffic problems in bigger cities.

Until now it is unclear whether 3d mobility will actually be accepted by the society and a significant share of customers. For instance, 3d mobility might be perceived as a means for “the rich” capturing the third dimension and lifting off from “earthy problems”. 3d mobility traffic might also raise concerns of noise pollution with increasing occurrence. And last but not least, a higher consumption of resources might be linked with 3d mobility as compared to 2d mobility.

The research question is: What are the expectations, preferences and requirements of 3d mobility to understand and consider in order to develop products and offerings that are accepted by the customer?

TABLE I. APPLICATION FIELDS FOR 3D MOBILITY

	Individual	Public	Corporate	Environment
Mobility	Personal Aerial Vehicle	Air Taxi (urban, inter-city, airport, ferry, mountain, event)	Campus air taxi	
Surveillance		Traffic flow, road condition, dangerous and contaminated areas	Agriculture (humidity, disease), solar parcs, wind mills, inventory	Weather, species conservation
Safety		Police, military, fire brigade, emergency evacuations	First aid	
Provision		Critical ´products‘ such as scarce food, organs, blood	Goods delivery (operating area extension and last mile acceleration)	Waste disposal, mobile phone network extension
Business & Entertainment		Motto Taxi	Air race, live stream, display of advertisements	

2.1 Findings on the Acceptance of 3d Mobility

Some studies have already been conducted on personal 3d mobility such as the ones from Uber [1], Frost & Sullivan [2], Roland Berger [3] and Porsche Consulting [4].

However, only a few studies have broached the subject of customer acceptance. A Bitcom 2016 study showed significant concerns regarding autonomous flying with 90 percent of the interviewed people rejecting it because of safety concerns [5]. A recent study of Horváth & Partners from 2019 which is based on a sentiment analysis showed that autonomous flying is generally perceived positive and specifically better perceived than autonomous driving [6]. Hence, it seems that with the rising awareness of the innovative means of transport, the acceptance is increasing. However, 3d mobility is more than just autonomous flying as described in chapter one. Therefore, a profound customer acceptance and preference analysis is required.

2.2 Measuring the Acceptance of Innovative Technologies

3d mobility certainly is an innovative technology product or service. As shown in the following sections, the introduction and diffusion of 3d mobility may not necessarily be an easy ride though.

Whether or not 3d mobility will be accepted by customers, will depend on many influencing factors. Literature shows comprehensive research in the field of product and service acceptance and resistance, respectively. Research on acceptance began, when parts of the society started to critically discuss innovations like the introduction of nuclear power. The most famous approach is provided by Davis' Technology Acceptance Model (TAM) [7], which is based on the Theory of Reasoned Action [8] and the Theory of Planned Behavior [9]. TAM focused on the introduction of information technology and stated that the attitude toward using a technology is driven by the perceived usefulness and the ease of use. 10 years later, TAM 2 was introduced, which found social factors to be relevant too and added to the model [10]. Further research led to refinements and development of the Unified Theory of Acceptance and Use of Technology (UTAUT) [11], TAM3 [12] and an increasing amount of further impacting factors [13, 14].

While social scientists think about acceptance from the viewpoint of the society, researchers from business science work on acceptance, adoption and resistance from the viewpoint of the individual customer [15]. The most prominent approach for product adoption has been developed by Rogers [16], who thinks of it as a multi-step process from getting aware of a product, assessment of information, decision, implementation and confirmation of the decision.

In the case of acceptance, a positive adoption decision is likely [17], while resistance will very likely lead to rejection. Extensive research has been done on the factors influencing rejection. Ram and Sheth identified functional and psychological barriers [18]. Functional reasons for rejection can stem from too high an effort of changing behavior (usage barrier), an unclear value (value barrier) and risk barriers referring to physical, economic, functional and social risk. Psychological barriers can result from tradition or image. Additionally, situational factors are found to impact acceptance [19, 20] and whether the decision is just postponed, the innovation fully rejected or even actively opposed [21]. To add to the complexity, adoption barriers are not free of overlaps [22].

While Herbig recommends to focus on the average customer in research on acceptance [23], Moore's chasm theory has become a widely accepted standard [24] stating that each customer segment has to be understood and conquered one after the other. The authors believe that the latter makes certainly sense for 3d mobility.

In practice, product managers and marketers try to evaluate drivers of adoption of a new technology from the viewpoint of the customer. Vendors, however, tend to overrate the value proposition of their own product, while customers compare possible gains and losses of their decision [25, 26]. Customers tend to be more critical than vendors and prefer products they already know [27]. These findings can be explained with the Endowment Effect, showing that customers compare a new product or service from the viewpoint of their current solution [28]. Furthermore, a customer's estimation of the value of a new product becomes distorted with an increase of the degree of innovation of new products [29].

Research and development of 3d mobility is far down the road. Prototypes are in the air, multiple testbeds are being planned in Germany and vendors seek for marketing their products and services as quickly as possible. An analysis of the general acceptance is recommended, vendors need to go ahead and require practical advice for marketing quickly. Understanding the reasons of acceptance and rejection will be crucial for successfully introducing and marketing 3d mobility.

3 Methodology

3.1 Preferences for 3d Mobility

In order to analyze the acceptance and preferences of customers for 3d mobility, an international study of the general preferences was performed in 2018 and 2019 amongst 100 randomly selected people using a paper survey with direct questioning. This technique was selected because of its practicability and the lack of a prototype. Indirect questioning techniques such as the conjoint analysis have proven to not be suitable for complex radical innovations [32] such as flying cars and passenger drones as it is hard for people to fully grasp the usage setting, ecosystem and functionality. Because of the setting and relatively small sample size, the results are not representative for any specific population, but give a first indication for customer preferences. The respondents were asked questions with regard to their acceptance, preferred technology, usage preferences, requirements on the integration into the mobility system, product preferences and preferences with regard to the offering:

Acceptance:

- Main reason to use 3d mobility
- Main reason to not use 3d mobility

Technology:

Preferred propulsion system technology

Usage:

- Preferred area of usage
- Preferred starting point
- Preferred operation?

Integration into Mobility System:

- Preferred intermodal connection
- Willingness of abolition of alternative means of transportation
- Mode choice

Product:

- Equipment preferences

Offering:

- Preferred ownership?
- Willingness to pay for the acquisition of the product
- Willingness to pay for the service

The preferences have in parts been analyzed for different types of technological 3d mobility concepts. These can exemplarily be divided into concepts with and without driving capability and concepts with and without wings as shown in table II. Gyrocopters such as the one from the company PAL-V and modular quadcopters such as the Pop.Up Next from Airbus and Audi are roadable vehicles without wings. Multicopters such as the one from the company Volocopter have no wings and are non-roadable. Neither roadable are jets with wings such as the one from the company Lilium.

TABLE II. SELECTION OF TECHNOLOGICAL CONCEPTS

	With wings	**Without wings**
Roadable		Gyrocopter, Modular quadcopter
Non-roadable	Jet	Multicopter

For the analysis of the willingness to pay, the panel has been combined with the panel of the different survey on acceptance described in the next subchapter thus featuring 228 respondents in total. This was necessary to smooth the willingness to pay curve as only about half of the respondents of the survey stated a willingness to pay of greater than 0€.

The willingness to pay can generally be determined with different methods. Breidert et al. distinguish between stated and revealed preference methods [30]. Market data, field and laboratory experiments, auctions and lotteries belong to the methods of revealed preferences. Because of the basis on historical data and the required but expensive prototypes, these methods hardly qualify for the use for radical innovations such as the concepts for 3d mobility. Expert interviews, the contingent valuation method, the price sensitivity meter, the conjoint analysis, the self-explicated measurement, and the discrete choice analysis belong to the methods of stated preferences. According to Roll et al., expert interviews and the conjoint analysis are not suitable for radical innovations though according to Roll et al. [31] and Armstrong [32], respectively. Also, the self-explicated measurement and discrete choice analysis seem to not be suitable because the features of the vehicles are not clear yet. As it is hard for people to state different price points for a radical innovation, the price sensitivity meter also disqualifies. For these reasons and the ease of the method, the contingent valuation method has been applied directly asking the interviewees for their willingness to pay, even though biases are possible because of social reasons or the unreal setting.

3.2 New Approach for Testing the Acceptance of 3d mobility

In practice, most managers don't have the time, means and know-how to develop acceptance and diffusion models. This holds true especially for start-ups and young technology driven companies. Entrepreneurs need an agile approach allowing them to quickly find out whether or not a product concept or solution will be successful in the market. They need a tool with the following deliverables:

- Proof of concept from a customer point of view for the product owner or investors during the early phases of development.
- Quantitative evaluation of the value proposition and possible barriers for adoption. Ideally a KPI including a threshold value which is critical for adoption within the target customer group and / or customer retention.
- Qualitative insights for product owners, engineering and marketing as well as action items for an increase of conversion and diffusion after the market launch.

The proposed evaluation is based on the theoretical concepts of acceptance and resistance developed for TAM and technology diffusion models and merges them to a mental accounting approach. The so-called PAIN-GAIN Acceptance Test combines all factors influencing acceptance and resistance from above to a standardized agile approach. The test captures the following elements:

- Value proposition perceived by the customer. Value can emerge from a gain of time, cost reduction, comfort, access, safety, image or others. In the survey, respondents were asked to rate a set of advantages of 3d mobility on 5-point scale reaching from "do not agree at all" to "fully agree".
- Problems or disadvantages associated or experienced with the use of the product or service. This combines challenges with regard to the cultural and ethical fit, efforts for registration and usage, problems due to a lack of fit to the current product ecosystem, safety or data security concerns, or costs and losses due to a change in behavior. In the survey, respondents were asked to rate a set of problems of 3d mobility on 5-point scale reaching from "do not agree at all" to "fully agree".
- After each section, respondents were asked to rate the overall GAIN and the overall PAIN on a 10-point scale.

The overall GAIN and PAIN values are aggregated to the so-called PAIN-GAIN-Index (PGI) that serves as a KPI for acceptance or customer retention as shown in figure 1.

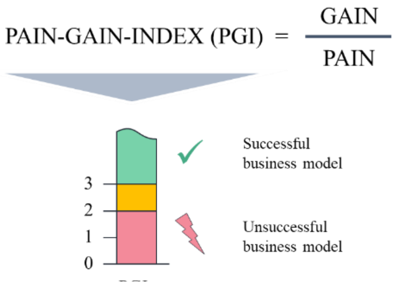

Figure 1: Calculation and interpretation of the PAIN-GAIN-INDEX (PGI)

Gourville's research has shown that for adoption of an innovation the expected or experienced GAIN needs to be significantly higher than the losses, i. e. the PAIN [27]. According to Gourville a business model will only be successful, if the ratio of gains to losses is higher than 3, i. e. the GAIN value needs to be three times as big as the PAIN value. Gourville did not give a scale for measuring this factor, but the 10-point scale for calculating the PAIN-GAIN-Index has been confirmed by practice to lead to very useful results.

An index of lower than 1 indicates that the product causes more PAIN than GAIN, which will very likely lead to the rejection of an innovation. Even PGI values in the range of 1 to 2 will in most cases not be sufficient to attract customers without a significant amount of incentives. Index values between 2 and 3 will be a grey zone: the closer the index value gets to 3, the fewer effort is needed to improve the product toward a convincing offer, whereas a product with an index close to 2 will lead to serious impediments when attracting customers and converting them to paying users.

Acceptance of 3d mobility is expected to be culture specific. Therefore, a more specific sample of 204 potential customers in Germany have been asked for their individual perception of gains and pains of flight services for 3D mobility. The sample was recruited at conferences dealing with 3d mobility and in online forums, i. e. the respondents have a clear understanding of the pros and cons of 3d mobility.

The sample is not representative to the German population or a specific buyer segment, but respondents are expected to belong to the group of innovators or early adaptors. Their opinion is not representative, but relevant for developers, marketers and vendors of 3d mobility as they can be opinion leaders in the diffusion process.

During the survey, various concepts of 3d mobility solutions were presented and a theoretical use-case of a 10 min ride from the city center to the airport was introduced. Respondents were first asked for their ratings of possible GAINs and an overall assessment of the value added by the service. After that, respondents were asked to rate possible PAINs and give their overall assessment of the problems associated with using the service.

4 Results and Discussion

4.1 General Preferences

In order to find out which share of the population shows acceptance for the flying cars and passenger drones, the interviewees were asked to state which means of transportation they would generally use with or without a pilot regardless of the type of propulsion system. The result shows that less than 50% of the interviewees indicate acceptance, while the acceptance is significantly higher if the vehicle is piloted by a professional. The modular quadcopter system, which resembles a car the most, shows the smallest discrepancy between a piloted and non-piloted system.

TABLE III. ACCEPTANCE FOR 3D MOBILITY

Acceptance [%]				
%	Multi-copter	Jet	Gyrocopter	Modular quadcopter
with pilot	44,7%	48,7%	44,7%	43,4%
without pilot	35,5%	27,6%	26,3%	40,8%

The interviewees were asked whether faster mobility, higher flexibility, emission-free mobility or another reason are the most important motive to use 3d mobility. Most of them stated faster mobility to be the most important reason. One fourth of the people esteem emission-free mobility. The promised higher flexibility is of less relevance. Apart from that, people also stated that innovativeness and privacy are their main reasons.

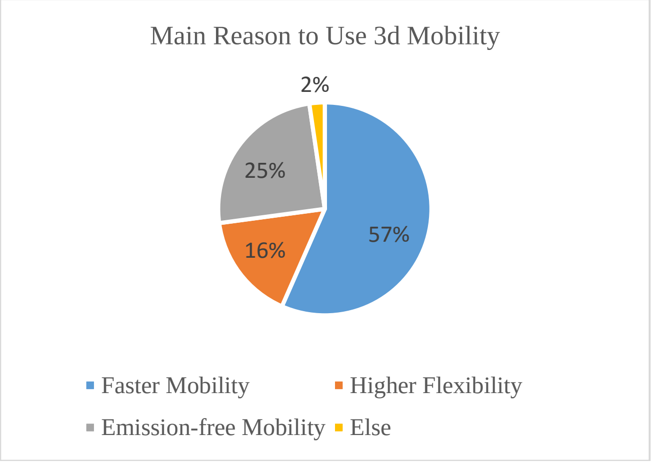

Figure 2: Main Reasons to Use 3d Mobility

Moreover, the interviewees were asked which factors discourage them from using 3d mobility. Of the predefined answers safety concerns, sky view nuisance, and noise, safety concerns are the most important reasons for not using 3d mobility, followed by sky view nuisance and noise. However, respondents also stated other reasons such as environmental issues, nausea, limited availability, costs, legal issues and land requirements to be important factors in this regard.

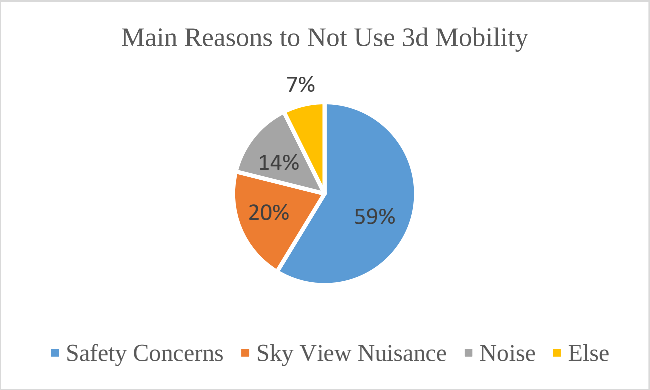

Figure 3: Main Reason to Not Use 3d Mobility

In terms of different propulsion systems, around one third of the respondents are indifferent. Most other people prefer a battery electric system followed by a fuel cell electric system. The conventional combustion engine shows the least relevance amongst the respondents.

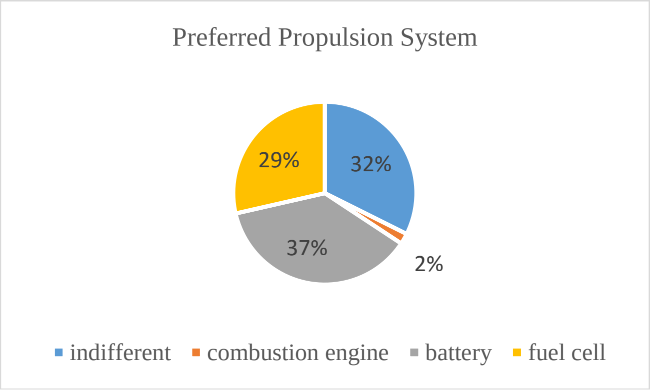

Figure 4: Preferred Propulsion System for 3d Mobility

With regard to the preferred area of usage, differences between the technological concepts are evident. Whereas a jet is considered to be more suitable on the countryside, modular quadcopters are clearly preferred for usage in the city.

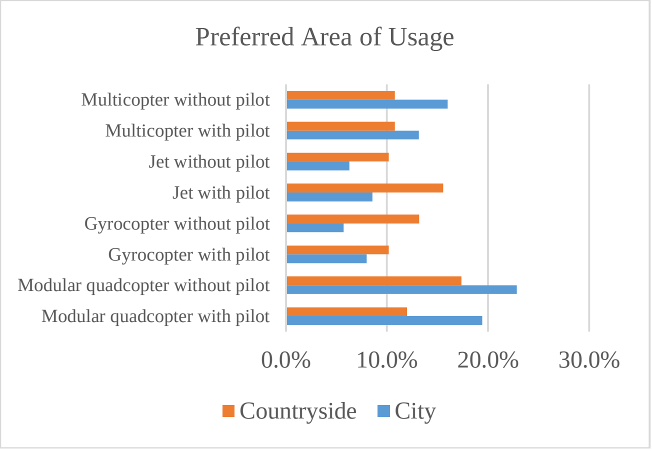

Figure 5: Preferred Area of Usage for 3d Mobility

On the question, whether to start flying at home or at a train station, people have a clear mind: 88% of them want to start directly at home and want to avoid additional journeys and detours.

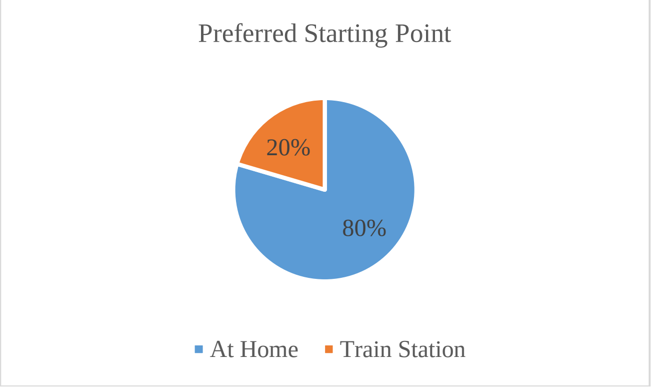

Figure 6: Preferred Starting Point for 3d Mobility

However, people clearly prefer a commitment to mobility hubs and restricted flight paths indicating that a sound regulation is important to them. The findings that most people want to start at home but prefer a commitment to mobility hubs and a restricted flight path might not be contradictory as the commitment to mobility hubs and restricted flight paths were given as one possible answer.

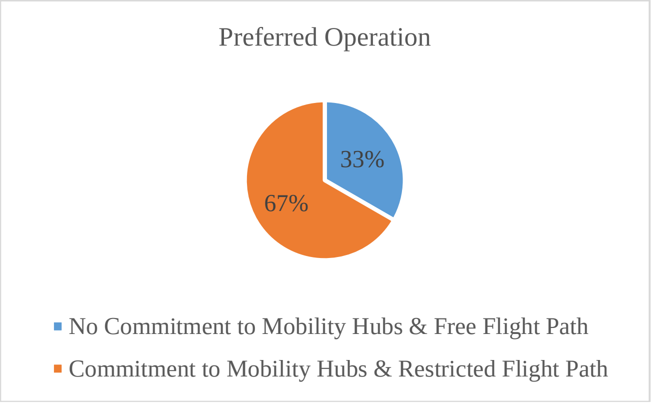

Figure 7: Preferred Operation of 3d Mobility

With regard to which means of transportation 3d mobility shall feature intermodal interfaces, public transport is top rated. The linkage to private cars is considered the least important possibly indicating that 3d mobility might be considered an alternative to private cars rather than a complement.

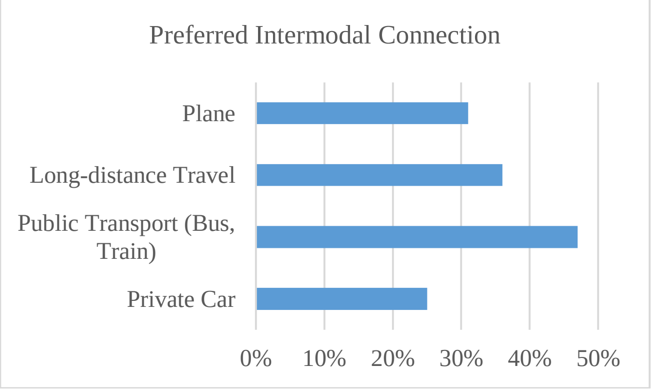

Figure 8: Preferred Intermodal Connection for 3d Mobility

The interviewees were furthermore asked whether and if so, which alternative means of transportation they are willing to substitute for a 3d mobility product or service. The results show that the majority is not willing to give up any current means of transportation. Around one third, however, is willing to substitute their private car accordingly. Other than that, a significant amount of people stated that they willing to give up public transportation even though this was not a given possible answer.

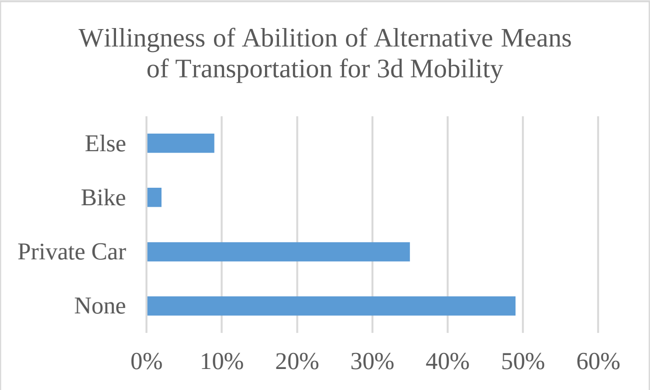

Figure 9: Willingness of Abolition of Alternative Means of Transportation for 3d Mobility

The survey also featured questions on mode choice, that is, which means of transport they are willing to use for different applications. The answers of the respondents show that for all distances, flying cars and passenger drones have been preferred. This indicates that 3d mobility is generally of particular interest for all distances.

TABLE IV. MODE CHOICE FOR 3D MOBILITY

Mode Choice				
	Car	Public Transportation	Flying Car / Passenger Drone	Plane
long distance (500 km)	2%	20%	54%	24%
medium distance (200 km)	12%	37%	49%	2%
short distance (daily commute)	29%	35%	36%	-

The interviewed people were also asked for equipment they desire in a flying car and passenger drone without giving them predefined answers. Based on the number of mentions they were grouped into three priority groups similar to the ‘must’, ‘should’ and ‘could’ of the MoSCoW method. Most of the mentioned equipment concern safety, comfort, automation, connectivity and entertainment with distinct priority differences.

Equipment Preferences for 3d mobility

Equipment Preferences		
Priority 1 (must)	**Priority 2 (should)**	**Priority 3 (could)**
Comfortable Seats	Seats for Children / ISOFIX	Stowage Space
Maximum Safety Equipment (Parachute, Ejection Seats, Airbags, Seatbelts)	Air Conditioning / Heating	Vomit Bag
Autopilot / Flight Assistant Systems (Distance Measurement through Radar and Camera, Start-/Land-Assistant)	Windows	Tablet-Mount
WiFi / Internet	Bluetooth	USB
Entertainment System (Radio, Speaker)	Information System (Airborne Computer, Destination Board)	Maximum Speed of 500 km/h
	Noise Cancellation	Alarm System
		Hands-free Headset

Regarding ownership, people tend towards sharing rather than owning a flying car or passenger drone. The average person to prefer ownership is 6 six years older than the average person to prefer sharing.

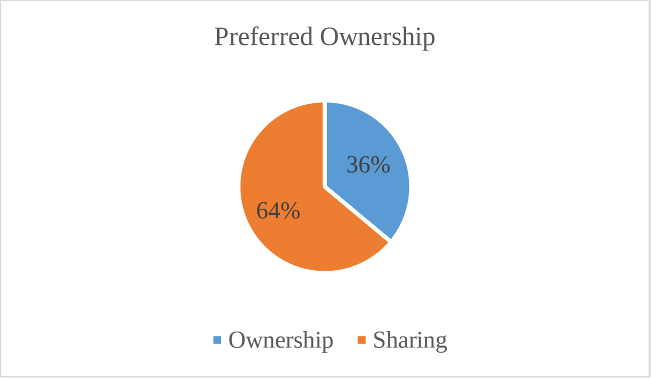

Figure 10: Preferred Ownership for 3d Mobility

Respondents were also asked for their willingness to pay for the acquisition or usage of corresponding services for different air vehicle concepts. With regard to the acquisition, the results show that more than 50 percent of the respondents have a willingness to pay more than 0 € for each concept. The concepts with the maximum and minimum share of people with a willingness to pay more than 0 € are the modular quadcopter with 63 percent and multicopter with 61 percent, respectively. The medians amongst all respondents with a willingness to pay more than 0 € range from 30.000 € for a gyrocopter to 50.000 € for the modular quadcopter and the jet. The means are around 30 percent higher than the means for each innovative product.

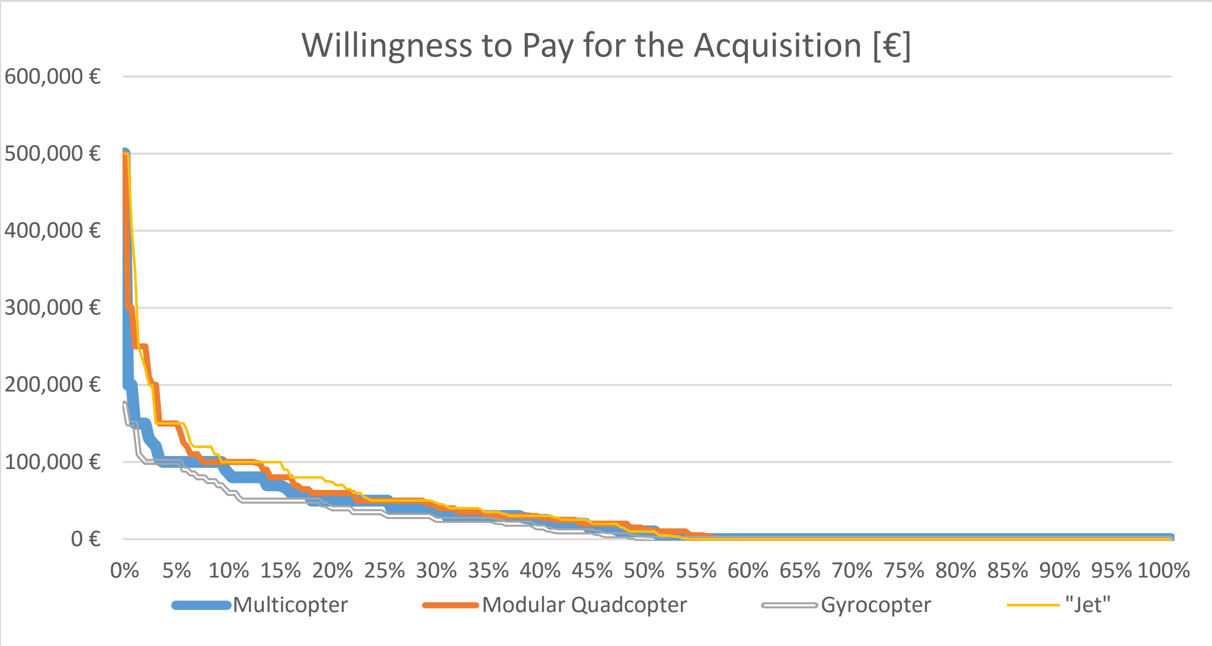

Figure 11: Willingness to Pay for the Acquisition

With regard to a service, between 45 and 58 percent have a willingness to pay more than 0 €. The modular quadcopter system has the most, the jet the least people with an according willingness to pay. The medians amongst all people with a willingness to pay more than 0 € are 0,65 € per kilometer for the multicopter and 0,50 € per kilometer for all other concepts.

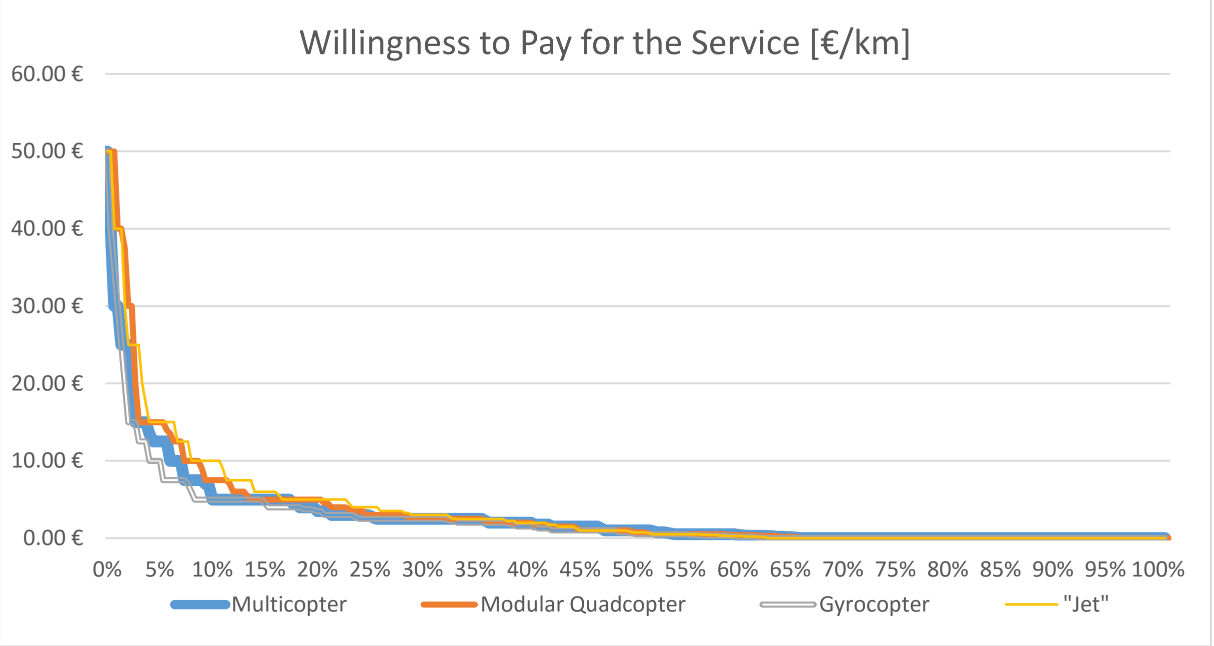

Figure 12: Willingness to Pay for the Use of a 3d Mobility Service

4.2 Pains and Gains of 3d mobility

The PAIN-GAIN Acceptance Test yielded GAIN values of 5.6 and PAIN values of 6.8 on a 10-point scale. The resulting PAIN-GAIN-Index (PGI) of 0.8 indicates a very low acceptance. Figure 13 shows the PGI compared to results from other projects. PGI values from subscribers of car sharing services, who rent a car only once ("passive users"), i. e. tried the service, but weren't convinced, show a value of 1.3, while customers who use the service regularly have a PGI value of 1.9. Having active users with a PGI value below 3 is a good thing, but industry experts assume that most car sharing services in Germany are not profitable because of a lack of users and a usage frequency too low for a positive business case. The only car sharing offer with a PGI value of 3 has been achieved by customers of stationary car sharing who don't own an own car any more. Another example is a very successful b2b industry platform, which delivered a PGI value of 3.0.

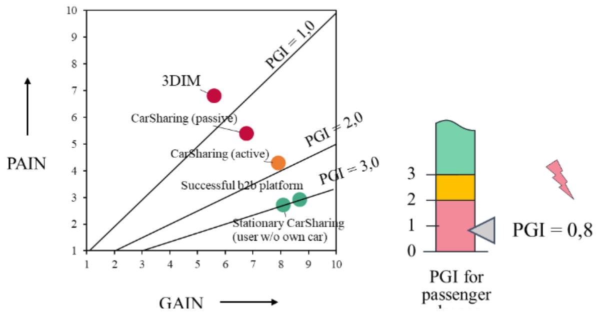

Figure 23: PAIN-GAIN values for passenger drones in comparison to other PAIN-GAIN evaluations

The low PGI indicates that 3d mobility services will face issues in gaining acceptance, wining users and scaling the business in Germany.

In order to understand the reasons for the low acceptance and find possible measures for improving the situation, individual GAIN and PAIN values collected on a 5-point scale add the necessary details. As shown in figure 14, GAIN values clearly show advantages for the individual user, like fast transport, flexibility and being independent of the traffic situation on the ground. When it comes to value contributions for the society like advantages for infrastructure, environment or discharge of the ground transportation system, respondents are more critical and don't see significant value.

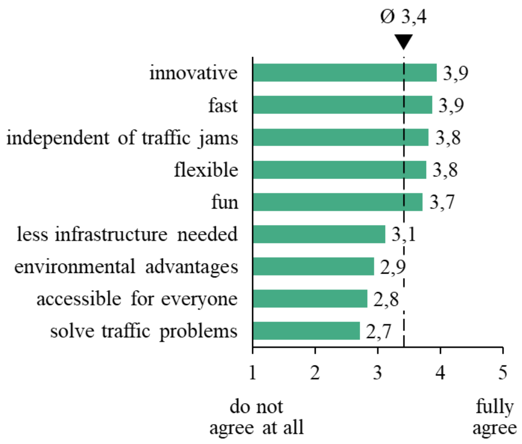

Figure 34: GAIN factors of 3d mobility in order of importance

While the value propositions seem convincing, the PAIN side indicates a tremendous amount of problems, as shown in figure 15. Respondents see serious impediments for individual usage like price, the necessity of dedicated starting and landing spots and regulatory issues. Additionally, respondents see serious issues for the society like noise, safety risks, environmental disadvantages and social image issues that 3d mobility is likely to be perceived as a means of transportation for an upper class. Interestingly, individual risks like safety concern due to hacker attacks or personal fear of flying a small battery powered aircraft with short time track record do not raise concerns.

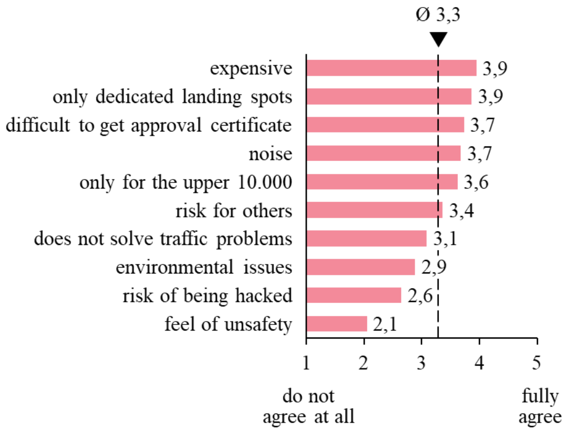

Figure 45: PAIN factors of 3d mobility in order of importance

Cultures are different, countries are different. The interdependencies of adoption behavior, however, are similar for different countries and cultures [31]. At the same time, differences in regulation and values [32] will certainly lead to different recommendations when marketing 3d mobility in different regions of the world.

For Germany, the acceptance test results raise the point that even a technically convincing and highly innovative artefact will not be sufficient to automatically reach an acceptance level leading to a broader adoption and diffusion.

Respondents see clear value for improving individual mobility but no contribution to solving general traffic problems. At the same time 3d mobility will create new problems of significant severity like noise and risk for others.

Some of the pains with high ratings will be solved by developers and marketers (price) or by regulation (landing spots, approval) but barriers have to be addressed. They cannot be compensated by emphasizing the great value alone [33, 34].

5 Conclusion

The results give important insights into the customer acceptance and preferences. It was shown that possible customers want to use 3d mobility mainly for faster mobility and prefer an electric propulsion system. The majority wants to share the vehicles, that shall feature safety, comfort, connectivity and entertainment equipment, but tend to not abolish a private car. Respondents prefer to start their journey at home, however, they want a clear commitment to mobility hubs and a restricted flight path. The connection with public transport is important. Around half of the interviewed people indicate a willingness to pay more than 0 €.

Overall, 3d mobility is a highly innovative technology with convincing values for the user and will start to find its place in today's mobility eco system step by step. On the flipside, 3d mobility will likely lead to critical discussions in the German society with diffusion in the market. Vendors should be prepared and restrain themselves from marketing 3d mobility with the value proposition of contributing to a general traffic problem. The study rather recommends to focus on individual gain for the user. In order to address societal rejection, vendors are recommended to partner with public authorities. Apart from the obvious value of 3d mobility for the respective applicants, this will frame the introduction of 3d mobility as a contribution to the benefits of everyone.

Difficulties and restrictions in applying the results of this study stem from two major aspects:

- Culture: The acceptance, preferences and willingness to pay will vary a lot in different countries. While German are generally known to be less adaptive to new technologies, other countries are expected to be more open to innovative products and services like passenger drones. Additionally, the drivers and barriers for acceptance are expected to differ in different cultures.
- Time: 3d mobility is an innovative product or service, respectively. Respondents of this survey gave their ratings based on their thoughts and assumptions, very likely without having seen or tested 3d mobility themselves. Once 3d mobility is introduced to the market, ratings will change with public perception - if to the positive or negative will depend especially on the actually experienced service level and whether severe accidents will happen or not. Furthermore, drivers and barriers will change from customer segment to segment with ongoing diffusion.

Moving forward, a more thorough evaluation is recommended enabling to set up a regression model considering all relevant factors and differentiating between different customer segments. With time, 3d mobility will receive increasing public attention which will affect the attitude of future customers. During the market diffusion of 3d mobility, evaluations of customers' perception will have to be done on a more regular basis.

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