Drone acceptance and noise concerns – From NIMBY to NOMOH

H. Eißfeldt; V. Vogelpohl

Institute of Aerospace Medicine, German Aerospace Center (DLR), Hamburg, Germany

To examine the public perception of civil unmanned aerial vehicles in Germany a nationwide telephone study was conducted in spring 2018. Results revealed an attitude slightly more in favour of drones. When asked about their general attitude towards civil drones, 49% of the participants (N=832) responded rather positive, 43% rather negative, and about 8% undecided.

According to the results acceptance of civil drones varies with several sociodemographic factors such as gender, age, income and place of residence (For further information see [1], [2]).
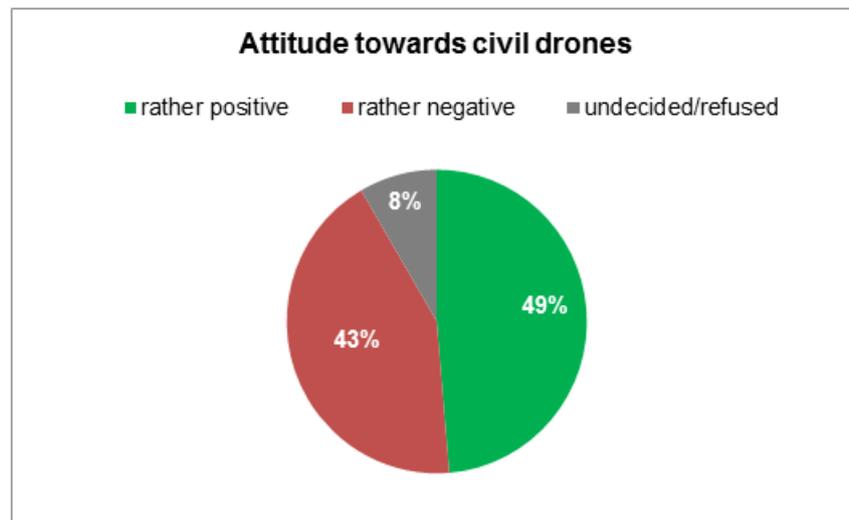

Fig. 1: Attitude towards civil drones.

When asked to what extent they are concerned about certain aspects of civil drone usage, most of the respondents confirmed their concern about misusing drones for criminal purposes (91%, see also Figure 2), followed by privacy concerns (86%). Concerns connected with mishaps all raised concerns in the range of 72% - 75% followed closely by concerns about animal welfare.
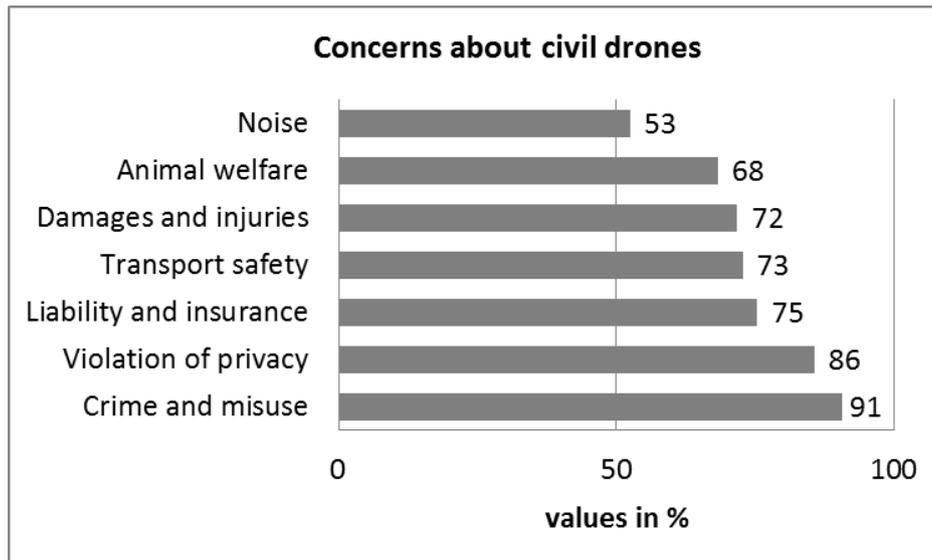
Fig. 2: Concerns about civil drones.

Somewhat surprising was the rather low level of concern about drone noise (53%), as this had been discussed as being a potential barrier of drone proliferation in literature before [3].

About half of the participants (47%) reported having experiences with drones in their personal lives (37%), on the job (4%), or in both contexts (6%). Throughout all areas of concerns these are higher for participants reporting no experience with civil drones. Chi-square tests at the 10% level reveal significant differences for concerns about damages and injuries χ^2 (1) = 3.09, p = .08, OR = .76, animal welfare χ^2 (1) = 4.29, p = .04, OR = .73, and transport safety χ^2 (1) = 3.39, p = .07, OR = .75.

The influence of the various concerns about civil drones on the public acceptance thereof was further analysed using Chi-square Automatic Interaction Detection (CHAID). This method partitions a contingency table produced from cross-tabulation by using a semihierarchical, sequential procedure [4] and can be used with non-parametric survey data. In the resulting model the attitude towards civil drones was the parent group variable to be split up by the different categories of the various areas of concerns. At first level concerns about noise entered the analyis, followed by concerns about transport safety among those concerned about noise, and concerns about the violation of privacy among those not concerned about noise.

Node 0

Category	%	n
■ rather positive	48,7	405
■ rather negative	43,0	357
■ undecided	8,3	69
Total	100,0	831

Legend:
- ■ rather positive
- ■ rather negative
- ■ undecided

Noise
Adj. P-value=0,000, Chi-square=38,591, df=2

Node 1

Category	%	n
■ rather positive	40,0	175
■ rather negative	53,1	232
■ undecided	6,9	30
Total	52,6	437

Node 2

Category	%	n
■ rather positive	58,4	230
■ rather negative	31,7	125
■ undecided	9,9	39
Total	47,4	394

Transport safety
Adj. P-value=0,000, Chi-square=25,759, df=2

Violation of privacy
Adj. P-value=0,027, Chi-square=9,423, df=2

Node 3

Category	%	n
■ rather positive	34,7	126
■ rather negative	58,1	211
■ undecided	7,2	26
Total	43,7	363

Node 4

Category	%	n
■ rather positive	66,2	49
■ rather negative	28,4	21
■ undecided	5,4	4
Total	8,9	74

Node 5

Category	%	n
■ rather positive	54,6	171
■ rather negative	35,1	110
■ undecided	10,2	32
Total	37,7	313

Node 6

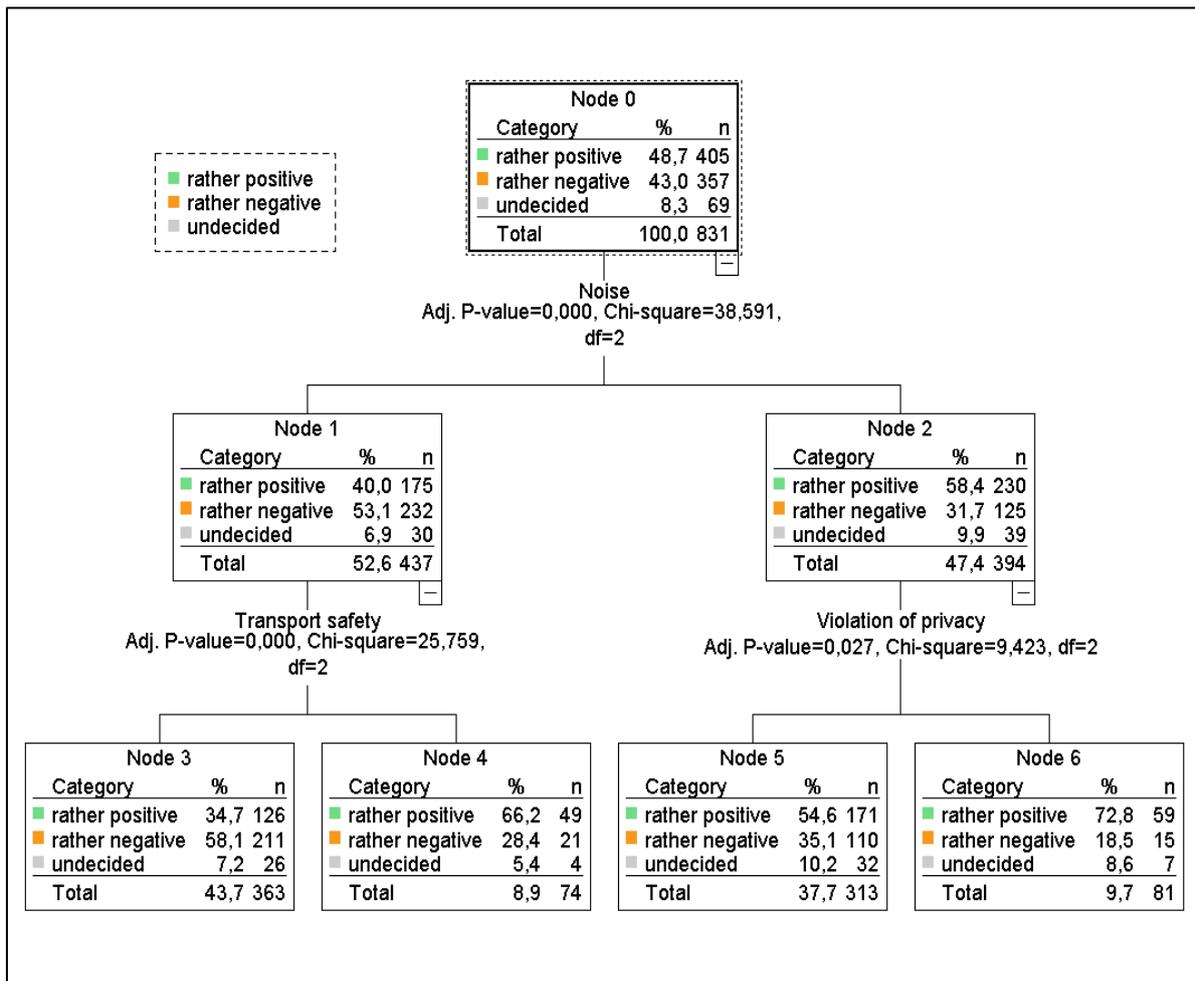| Category	%	n
■ rather positive	72,8	59
■ rather negative	18,5	15
■ undecided	8,6	7
Total	9,7	81

Fig. 3: Decision tree model for attitude towards civil drones partitioned by areas of concern

Of all 7 areas of concerns listed in Figure 2, being/not being rather concerned about noise explained the attitude towards civil drones among all respondents best χ^2 (2) = 38,6, p = .000, OR = .41 and entered the analysis first. Fig. 4 shows the strong interaction effect. Concerns about transport safety among those concerned about noise, and concerns about the violation of privacy among those not concerned about noise followed on the second level of the CHAID model.
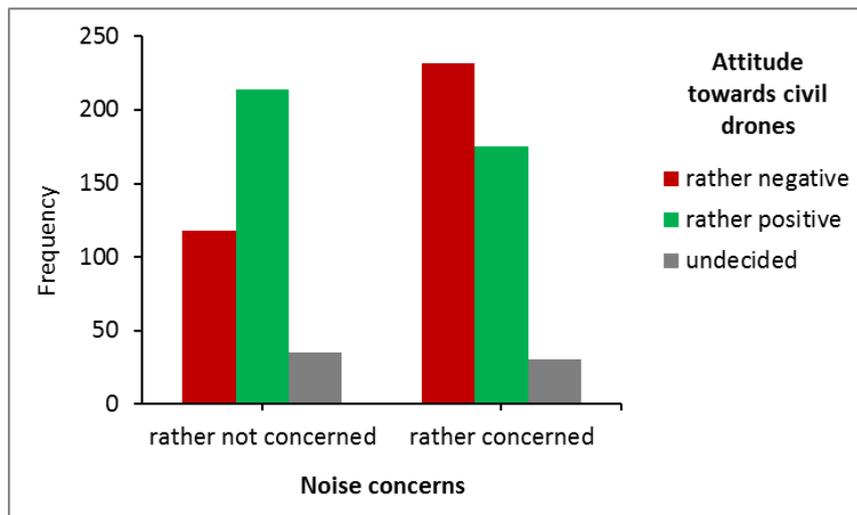
Fig. 4: Noise concerns and drone acceptance

The relatively low level of concern about drone noise (53%) in the total sample could be an issue of lacking acoustic experience. Among those reporting experiences with drones (N=387), a more detailed look into the kind of experience with drones revealed a significantly higher percentage of noise concern for those reporting having heard a drone: χ^2 (1) = 3.29, p = .07, OR = 1.45 compared to those not reporting acoustical experience.

During the interview, the respondents were asked how far they in general would accept various applications of drones, resulting in different levels of agreement. Answers were given on a 4-point Likert scale, ranging from 1 = totally agree to 4 = totally disagree. Acceptance of the various purposes of usage was asked in a randomized order to avoid sequence effects. Agreement was highest for official uses such as catastrophe response (M = 1.43) and life-saving efforts, and for police and security activities (M = 1.56). It was medium for medicine sample transport (M = 1.83) and agriculture (M = 2.07), low for photo and video recordings for newsmedia (M = 2.40) and leisure time activities (M = 2.62), and surprisingly low for parcel delivery (M = 2.73).

A subsequent question asked respondents for what purposes would they agree to use a drone themselves: for leisure time activities, first aid, parcel delivery, police and fire service or as an unmanned taxi. Answers were given on the same 1-4 scale mentioned above.
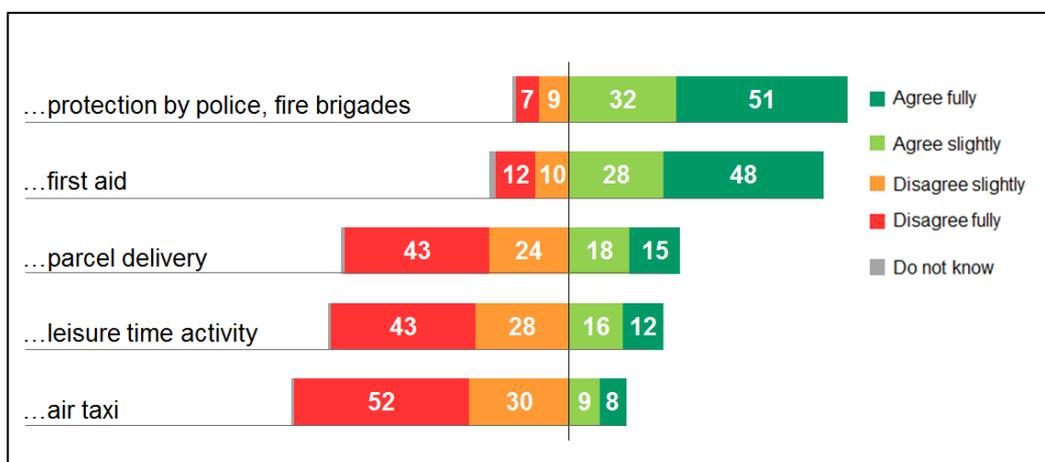

FIG. 5: Agreement to own drone use for different purposes

Interestingly, the willingness to use a drone personally is lowest for those usages that have the highest economic interest (parcel delivery) and are featured most prominently in the

news (air taxi). The two applications that gain the highest acceptance levels are rescue and public safety, which the urban population is already accustomed to because of helicopter overflight.

Concerning the regulations in Germany, similar to flying over groups of people, industrial facilities or public institutions, any overflight of people's homes is prohibited unless the owner has indicated prior consent. However, among the public there is concern how such overflight ban could be controlled and enforced.

When questioned about acceptance of overflights in general during the daytime, results showed slight disagreement (M = 2.8; SD = 1.0). Overflight at night was accepted even less, with an average agreement of (M = 3.1; SD = 0.9), reflecting clear disagreement. However, for previously accepted purposes of drone usage primarily official functions of rescue and protection (see Figure 5), respondents agreed slightly with home overflight (M = 2.2; SD = 0.9) of drones (Table 1).

Table1
Home overflight acceptance for different conditions

Overflight Acceptance	average agreement	Standard Deviation
during the day	2.8	1.0
at night	3.1	0.9
for accepted purposes	2.2	0.9

Agreement: 1 =totally agree, 4 = totally disagree, undecided/refused/very different excluded

As Figure 5 shows, 82% of the respondents indicated they would not use air taxis. However, even being positive about using urban air mobility does not necessarily mean to accept air taxis flying above the own dwelling: Among the 17% of respondents who agreed either fully (8%) or slightly (9%) with the prospect of using unmanned air taxis themselves, only two out of three would accept air taxis flying above their home at daytime (Figure 6), and less than half would agree to night-time flyovers.
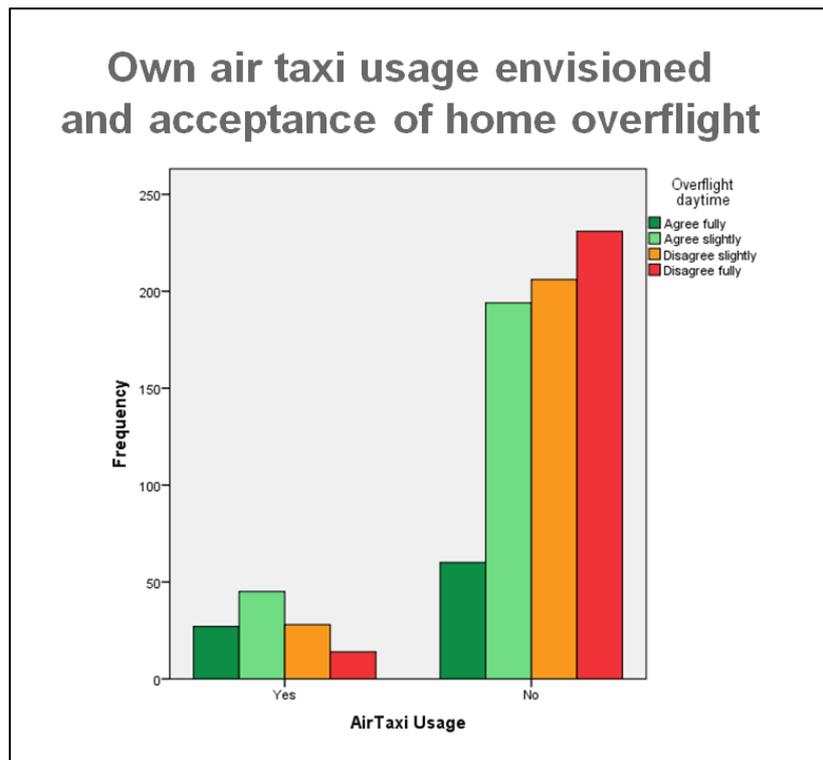
FIG. 6: Own air taxi usage envisioned and acceptance of home overflight

Such a disbalance between a generally supportive attitude towards a new, often technology-related development and the lack of acceptance of change in the direct environment connected with it has been described as NIMBY (Not in my backyard) effect in literature. According to [5] 'Different factors can generate a NIMBY effect, especially fear of loss of the perceived quality-of-life status and economic value of property (p.44)'. This effect s considered as somewhat 'normal' and seems to be relevant in the context of urban air mobility again, when even for those supporting drone usage and considering using air taxis themselves the motivation to accept drones as part of the personal environment is limited. Like with other generally accepted new developments: Nimby'ism will be a factor when it comes to the acceptance of drones flying over the own dwelling. In this special setting however, the term NOMOH (Not over my own home) seems more appropriate. It is hoped that transparent information and careful communication can limit the influence of such phenomenon on the acceptance of civil drones in daily life [6]. Further research will thus focus on perception and mitigation of drone noise to foster public acceptance of civil drones in Germany.

Literature

[1] https://www.dlr.de/content/en/articles/news/2018/4/20181218_use-of-civilian-drones-in-germany.

[2] Eißfeldt et al., CANJ submitted

[3] ITF (OECD), 2018

[4] Perreault et al., JMR, 1980

[5] Pol et al., ERAP,2006

[6] Suau-Sanchez et al., JTRANGEO, 2010