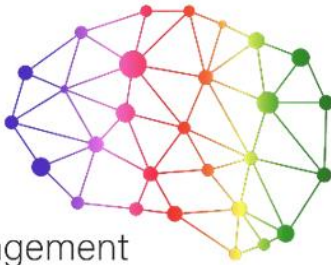


ANIMA



Aviation Noise Impact Management
through Novel Approaches

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[D3.9. Engagement Guideline]



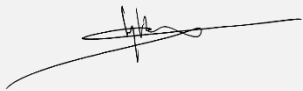
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DEM=Demonstrator, pilot, prototype, plan designs
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1. Executive Summary

Non-acoustic factors can be summarized as factors that are not directly related to noise, but modify, moderate or contribute to its effects. To address aircraft noise annoyance, it is therefore imperative to not only reduce aircraft noise exposure, but to address non-acoustic factors as well. Non-acoustic factors can be attitudes towards, expectations of, or trust in stakeholders related to aircraft operations.

One aspect that can influence perceptions and, thus, personal attitudes towards aircraft noise is the way it is portrayed in the media. In an analysis of media reports published from 2011 to 2013 during the implementation of a night flight ban at Frankfurt Airport with the simultaneous opening of a new runway, the effect on aircraft noise responses was investigated. Results show that reports on various topics such as noise abatement measures, flight routes, and noise exposure can influence annoyance or sleep disturbance due to aircraft noise.

Communication and engagement can directly affect non-acoustic factors, for instance through aspects such as fairness. They can help make Balanced Approach interventions more effective by involving residents in the design of such interventions. Proper communication and engagement are needed to directly address non-acoustic factors such as perceptions of aircraft noise issues, trust, expectations, and fears. Communication is primarily relevant for conveying information and as a unilateral form of exchange, whereas engagement is an interchange, a dialogue, in which residents and airport operators can respond to each other.

Although there has been an increasing interest in non-acoustic factors in recent years, there are still some unanswered questions, such as what form of communication and engagement should be undertaken, which forms are particularly effective and what aspects play a role in this. This Deliverable proposes an 'IDEAL' approach to communication and engagement that can act as a useful framework on which noise communicators can develop their communication strategies.

Another factor that can underpin any kind of communication and engagement is fairness. Derived from psychological models of fairness, specific aspects can be identified that should determine the nature of communication and engagement.

The aspects relate to procedural fairness, i.e. how fair the process is that leads to a decision, or informational fairness, i.e. that the communication of information should be honest.

The perception of fairness can also be seen as an indication of how the airport is currently perceived and what points still need to be emphasized. Therefore, a questionnaire is being developed within the ANIMA project to measure the fairness facets in an objective, reliable, and valid way.

In order to answer further open questions, such as what needs affected residents have with regard to the provision of information, the manner in which it is provided and how, in their opinion, a fair, neighbourly relationship can generally be established, in-depth interviews and focus groups were conducted in the vicinity of various European airports. Based on this work, specific recommendations can be made on what aspects of good communication and engagement should be considered.

The Deliverable closes by introducing the important concept of evaluation, which refers to measuring, validating and assessing the success of an intervention. The benefits of evaluation are discussed, as well as specific methods that can be utilized. The evaluation process is discussed in depth, with the importance of considering evaluation from the onset of developing a noise measure or strategy. Practical recommendations for the implementation of an evaluation process when designing an intervention are made.

2. Introduction

2.1 Short summary of impact of non-acoustic factors

Non-acoustic factors can be summarized as factors that are not directly connected to the sound (Asensio, Gasco, & de Arcas, 2017), but *modify, moderate* or *co-determine* the response to it. In this way non-acoustic factors can be seen as a crucial determinant in tackling levels of annoyance due to noise. Empirical findings show that the acoustical features of noise only explain part of the annoyance response, regardless of how noise annoyance is measured or operationalized (Guski, 1999). The non-acoustic factors are in so far non-acoustic as they are not directly linked to the sound of the noise source of interest. But they may be acoustically relevant in reference to the acoustic environment of the noise situation (e.g. background noise, access to quiet and recreational areas, to quiet facades of the residential building). Therefore, non-acoustic factors are also called personal and contextual (social, situational) factors (e.g. van Kamp & van den Berg, 2018)

Non-acoustic factors can be differentiated into several categories (Bartels et al., 2021):

1) Personal and social factors

- a. Attitudes, concerns, expectations
- b. Noise sensitivity and personality traits
- c. Coping strategies
- d. Trust in authorities and perceived fairness
- e. Residential satisfaction
- f. Demographics

2) Contextual and situational factors

- a. Degree of urbanization and background noise exposure
- b. Access to a quiet side of the dwelling

- c. Access to greenery and recreational areas, appearance of neighbourhood
 - d. Temporal factors of a noise situation
- 3) Social aspects of the noise management
- a. Noise insulation
 - b. Shift or redistribution of noise exposure across populations.

Annoyance occurs even at low noise levels and is not only regarded as a primary adverse effect of noise, but is also considered part of the causal relationship between noise and health effects (Brown & van Kamp, 2017). Annoyance can therefore mediate between noise exposure and health aspects. Several studies have shown that the health effects of noise depend on the level of perceived annoyance. For this reason, interventions that actively reduce annoyance are necessary (Baudin et al., 2020; Baudin et al., 2021; Guski, Schreckenberg, & Schuemer, 2017)

Many of these non-acoustic factors are closely related to the perception of annoyance and are, by their nature, modifiable through interventions that use communication and engagement. In the following section an attempt was made to examine the potential effect of the portrayal of aircraft noise issues in the media on perceived annoyance.

3. Aircraft noise annoyance and media coverage

3.1 Introduction

The media has an important role in informing the public about relevant topics. In the noise context, changes are naturally accompanied by media coverage, e.g. when changes around airports take place. The variety of media has considerably increased in recent years with rising numbers of social media channels and online versions of print media besides the classic media channels of print, radio and TV. The former is a new way of distributing and sharing information and not only allows for one-way interaction, but also to engage with people and to learn about people's opinion.

In a recent study conducted within the scope of ANIMA, social media posts from Twitter were collected and analysed to monitor location-based and emotion-based responses of residents on noise around Heathrow Airport (Meddeb, Lavandier, & Kotzinos, 2019). The aim was to directly gather information from people living in the area around the airport expressing their opinions and emotions about aviation noise. Such monitoring activities can be used to derive and capture information about noise hotspots and possibly derive implications on how to address the noise problem when certain areas or people with certain characteristics are identified to be represented above average.

In the course of investigating factors that influence noise responses, it can be asked whether media coverage can have an influence on responses to environmental noise.

Research shows that not only the sound itself, but also non-acoustic factors play a role for the perception of sounds as annoying or disturbing. Only 1/3 of variance of annoyance can be explained by acoustics (Guski, 1999), although this is a very rough estimate and the exact amount of common variance may differ from study to study. Non-acoustic factors are assumed to contribute to annoyance ratings and how noise is perceived and processed; these are situational, personal, and social factors (see ANIMA deliverable D.2.4, Haubrich et al. (2019)). Several non-acoustic factors have been identified as most influential on noise annoyance so far, including one's general sensitivity to noise, personal (mis-)trust in noise authorities, attitudes towards the airport and aviation in general as well as expectations and fears.

Hence, non-acoustic factors are not directly connected to the sound (Asensio et al., 2017), but are seen as crucial to minimize annoyance reactions and reduce adverse effects of noise. This is in particular important as noise exposure reduction alone did not necessarily result in a corresponding decrease in annoyance. Addressing non-acoustic factors in addition to acoustic factors is seen as an effective way to tackle annoyance and other noise responses. One sparsely studied factor is the role of media coverage about noise sources in affecting noise annoyance.

The media can be linked to influencing expectations, discourse and socially shared information (Bröer, 2008; Crichton, Chapman, Cundy, & Petrie, 2014a; Crichton et al., 2014b; Crichton, Dodd, Schmid, & Petrie, 2015; Kroesen & Bröer, 2009).

The few existing studies on the impact of media on community noise responses suggest that media reports can influence expectations regarding potential effects of noise. Findings from other environmental noise sources indicate that the valence of media coverage, i.e., if the content is framed in a positive or negative way, can influence expectations about the noise source and can subsequently alter the perception of the noise itself (Crichton et al., 2014a; Crichton et al., 2014b; Crichton et al., 2015). Furthermore, expectations that are related to possible adverse health effects were found to contribute to the occurrence of these negative health outcomes (Benedetti, Lanotte, Lopiano, & Colloca, 2007). Thus, the framing of media information can influence the perception of noise. In wind turbine noise studies, the framing of information about infrasound shaped the expectation and in turn the experience of noise: when participants were shown negative framed information about infrasound, the number and intensity of health complaints after exposure to infrasound were significantly higher than in people seeing positive or neutral information (Crichton et al., 2014b). The same was shown for annoyance: annoyance ratings were higher after exposure to infrasound which followed the presentation of negatively framed material (Crichton et al., 2015). The same was true when positive information about infrasound was shown: participants then reported less health complaints and even some positive effects resulting from the exposure to infrasound (in line with the content of the presented information). The underlying assumption is that media coverage about potential adverse health effects forms expectations on the adverse effects of exposure, which can contribute to potential health outcomes. This seems to be especially the case for ambiguous sounds such as infrasound. In general, ambiguity and uncertainty in the perception of noise increases the relevance of available information.

Research provides evidence that public discourse has an effect on annoyance ratings and policy discourse affects private discourse (Bröer, 2007; Kroesen & Bröer, 2009). Private discourse often directly reflects the story lines of annoyance policies, which shows that policy discourse is actively perceived and used in private communication and does matter in private discourse (Bröer, 2007). By comparing two airport regions, Amsterdam Schiphol and Zurich Kloten, it was shown that

residents use policy discourse arguments to explain their annoyance ratings (Bröer, 2007; Kroesen & Bröer, 2009). It can be hypothesized that media coverage informing about policies and thereby potentially contributing to public discourse can directly resonate in private discourse. Further, public discussion and related media coverage can contribute to the impacts of noise. One could summarize by saying “Dominant policy discourses shape our experience” (Bröer, 2008, p. 94), which suggests that media coverage of those discourses is at least able to shape our experience and perception of noise in addition to the sound itself.

A change situation for instance is usually accompanied by increased media coverage. The perception of situations as avoidable, unpredictable, and uncontrollable can increase stress responses and reduce the perception of being able to cope with these situations. In particular, when the exposure situation will change, for example due to an airport expansion, residents might feel the need for information on the future noise situation. In this case, the media are an essential source of information and can enhance and diminish residents’ perception of having control over the situation. However, we should keep in mind that people usually select their source of information by themselves – except when participating in a psychological experiment. That is, there may be a “circle of information seeking”: people select a source of information according to their preference and evaluation of the source, and this evaluation is partially driven by their expectations with respect to the content, and by the social esteem of the source. Additionally, this is reinforced as algorithms (of social media and web browser) propose news articles that are in line with a readers’ interest when browsing/searching for news articles. Yet, in line with Bröer (2007), media can encourage socially shared information as people not only read the information but tend to discuss and distribute relevant topics within their social environment (online and offline). These shapes one’s understanding, informs and inspires private discourse. Hence, socially shared information and social interactions can have an effect on how sound is perceived (Crichton et al., 2014a). Therefore, the way people distribute and process media information indicates that media coverage can affect noise annoyance.

According to the *agenda setting hypothesis* it is assumed that the perception of an issue can vary depending on the emphasis of mass media on the topic (e.g. Selb, 2003). Simultaneously, it is assumed that the public opinion concurrently shapes

the focus of the media on topics and issues (e.g. Selb, 2003). In a long-lasting public discourse about the opening of a new runway in Frankfurt prior to the NORAH study (**Noise Related Annoyance, Cognition and Health**; www.laermstudie.de; see below) and ongoing protests it can be assumed that the thematic focus was influenced by the linkage of planned changes, the study itself, media framing and protests and vice versa.

In this sense, it is hypothesized that media coverage about noise topics influences the way in which noise exposure is perceived and processed, and consequently, can influence annoyance levels. Media coverage here is understood in the sense of “something is mentioned in the media”, irrespective of evaluative terms. This study explores the associations between (exposure to) media coverage of aircraft-noise related terms in the course of the project period of the NORAH study and aircraft noise annoyance. It examines if and to what extent there is a relationship between the frequency of media articles and noise annoyance due to aircraft noise.

3.2 Media-Analysis in the NORAH Study

3.2.1. Background

The NORAH study is an extensive and elaborate research project combining longitudinal and cross-sectional assessments of the physiological and psychological effects of (primarily) aircraft noise on people living near major airports in Germany (with respect to annoyance and quality of life, see Schreckenberget al., 2015). The main assessments were carried out in the vicinity of the airport Frankfurt/Main from 2011 - 2013, including annual questionnaires. The questionnaire covered topics such as noise annoyance and health as well as the type and frequency of media used by participants for information about the airport. The NORAH study was divided into three work packages (WP):

- WP 1 – annoyance and quality of life,
- WP 2 – health,
- WP 3 – children’s cognitive development and quality of life.

Within WP 1, a team of researchers from ZEUS and Ruhr-University Bochum (RUB) received the press reviews of daily news in print and online media from the Fraport AG in the timeframe from 2011 until 2014. Those press reviews contained the titles and subtitles, name of the newspaper, release date of the relevant print papers

and those articles that had any reference to the airport. The overall aim of the accompanying media analysis was to register the news to reflect the media focal points and / or media climate regarding the airport and the NORAH study (Guski, Peschel, & Wothge, 2014). The scientific literature on noise indicates that media reports about a certain noise source may lead to a higher number of spontaneous complaints and answers in assessments (e.g. Fidell et al., 1985; Hume, Morley, & Thomas, 2004; Laszlo & Hansel, 2011). Until 2014, no scientific publication could be found that showed a direct effect of media articles on noise annoyance or other variables regarding the effects of noise. Instead, the WP 1 team assumed that the personal experience of a person with a certain noise source has a higher impact on the individual manifestation of noise annoyance than media articles. Nonetheless, contents of media articles may have a moderating effect in terms of the concept of "Agenda setting" in which both the media and the population (through public actions) set thematic focal points. Concerning aircraft noise, it can be expected that the awareness of adverse health effects has been maintained over the years, because the expansion of the Frankfurt Airport with a new runway was openly discussed repeatedly. Further, the perspective under which a certain topic is discussed ("framing") could have an effect. For example, from an economy's point of view the (increase of) air traffic offers advantages in terms of jobs, financial gain for communities etc., whereas from the perspective of residents exposed to certain noise exposure levels the adverse effects on health, decreasing worth of properties or noise annoyance are important.

The daily press reviews consisted of approximately 30 regional and national daily and weekly newspapers as well as dispatches from news agencies, interest groups and the airport operator, the Fraport AG. Primarily, the press reviews are used as an information tool for the employees of the Fraport AG, where the economic and transport political topics play a bigger role than noise. A crucial condition for the arrangement of the press reviews is the reporting on the Frankfurt Airport or on the Fraport AG. Due to those limitations, in summer 2011 the press reviews were randomly checked for completeness of articles and reader's letters concerning the Frankfurt Airport. It could be confirmed that the press reviews are complete in this respect. Therefore, the press reviews are admittedly a so-called "accidental sample", but they can be used as a comprehensive source for monitoring the regional events regarding the airport.

3.2.2. Methodology

For the monitoring of media articles about aircraft-related topics, a variant form of the quantitative content analysis (Krippendorff, 2018; Neuendorf, 2002) was applied. A detailed description of the method can be found in 10.1.1.

3.2.3. Association between media reports and study participation

In the accompanying media analysis, next to the monitoring of media reports concerning the Frankfurt Airport and the NORAH study, it became of interest whether the mentioning of the NORAH study had an impact on study participation (Guski et al., 2014). The completed interviews and refusals to participate from one day were linked with media reports which occurred within two days before. Results showed the amount of all headlines that were related to the NORAH study during the 2nd panel wave to be statistically significantly associated with the amount of completed interviews (Spearman's Rho = 0.311; $p = 0.001$; $N = 102$; effect size: Cohen's $d = 0.6545$). A similar association could be found with the number of neutral headlines concerning the NORAH study and the number of completed interviews, even though the effect is not as strong (Spearman's Rho = 0.255; $p = 0.006$; effect size: Cohen's $d = 0.5274$). The correlations indicate a higher number of completed interviews with exposure to a higher number of neutral headlines and headlines in total that were related to the NORAH study. The association between positive NORAH reports and completed interviews is positive but not statistically significant (Spearman's Rho = 0.132; $p = 0.164$; effect size: Cohen's $d = 0.2663$); the association with the numbers of participation refusal is negative, but smaller (Spearman's Rho = -0.075; $p = 0.832$; effect size: Cohen's $d = 0.1504$). Further, the association between negative NORAH reports and study participation is weakly positive and only when the considered time-lapse between media article and study participation is reduced to 1 day (instead of 2 days) (Spearman's Rho = 0.227; $p = 0.015$; effect size: Cohen's $d = 0.4662$).

Overall, the results show that the amount of NORAH-related media reports without the consideration of their content or with a neutral content show a significant statistical association with the number of completed interviews with a moderate effect size. In contrast, positive or negative connotations show only weak or no significant associations.

Those results cannot in any way be interpreted as causal. One reason is that the data is strongly aggregated and the individual media usage has not been considered. Another reason is that the number of NORAH-related media coverage has been very low in 2012.

3.3 Media analysis in ANIMA

3.3.1. Method

Within the framework of ANIMA, we did a re-analysis of the media data combined with the NORAH WP1 survey data on the residents' noise annoyance and quality of life. The aim of this re-analysis was to investigate whether media coverage during the study period had an influence on the aircraft noise annoyance ratings of participants.

3.3.2. Participants

The study area was defined according to the noise levels around Frankfurt Airport. The envelope of the noise contours of continuous energy equivalent sound level during the day (L_{day}) and night (L_{night}) of air traffic had to be 40 dB or higher to be included in the sampling pool. A stratified random sampling procedure was used within the study area. That is, participants were randomly selected within 5 dB classes of noise levels. In this study, the data of participants who participated in all three waves of the study from 2011 to 2013 are analysed. Participants had to be at least 18 years old at study entry. This results in a sample of 3,308 people.

3.3.3. Measures

The full questionnaire used in the NORAH study consisted of more than 200 questions. Of interest for the current analysis are the questions on noise annoyance, self-reported sleep disturbance, noise sensitivity, perceived coping capacity, fairness items, frequency of media use and sociodemographic variables such as age and sex and noise exposure levels at the residential address of each participant.

In the questionnaire, participants were asked to rate their annoyance due to aircraft noise with the standardised question „Thinking about the last 12 months, when you are here at home, how much does noise from aircraft bother, disturb,

or annoy you?" (ISO/TS 15666:2003; Fields et al. (2001)), to be answered on a 5-point verbal scale from (1) *not at all* to (5) *extremely*. The same question was adapted for self-reported sleep disturbances asking for disturbances when falling asleep, sleep during the night and sleeping in. The three sleep disturbance questions are combined to a mean score of sleep disturbance.

Among other sociodemographic variables, age and gender were assessed. The socioeconomic status was assessed by using the Scheuch-Winkler-Index (Winkler & Stolzenberg, 1999, 2009), a score measure composed of school education, professional education, job position, and income. The value range of the Scheuch-Winkler Index is 3 – 21, indicating one of three socioeconomic classes: values between 3 – 8 belonging to lower class, values between 10 – 14 to middle class and values from 15 to upper class.

Additionally, in relation to the expansion of the Frankfurt Airport, three questions concerning the media usage were asked in every panel wave (2011, 2012, and 2013). Those questions covered a) the frequency of informing oneself about the expansion in different media, b) the preferred source of information (radio, TV, internet, newspaper) and c) the exact source of information (e.g. name of newspaper). In each panel wave, most people inform themselves once a month (22-28 %), followed by once a week (20-22 %) and daily (14-17 %). In all three waves, the most preferred information source were newspapers (57-60 %).

For each participant address-specific equivalent sound levels and maximum sound levels were calculated, for details see Möhler et al. (2015).

3.3.4. Media material

As described in section 10.1 the daily press review from Fraport AG was followed during the study period from 2011 to 2013 and onwards in 2014. Articles from pre-selected newspapers and sources that were available for public readers were screened. This selection included nationwide newspapers as well as local newspapers from the Rhine-Main region available in the study area. The frequency of occurrence of identified specific terms in the headlines of articles in newspapers was assessed with a text analysis program (name of program: FRA_Headlines). This resulted in different categories representing relevant topics in the focus of the NORAH study at Frankfurt Airport.

The numbers of articles for each category a day were documented. From this, the relative number of articles in each category was calculated (number of articles in a category a day in relation to the total number of articles a day).

In this re-analysis, from the original 19 categories the following 7 categories are used, considering the most common ones mentioned, complemented with those that are related to interventions or engagement processes: "sound insulation", "protest", "flight path", "sound exposure", "increase sound exposure", "night flight", and "mistrust/trust in authorities".

In the media analysis of the NORAH study only reports published in print media and online versions of newspapers were considered. Guski et al. (2014) argue that communication scientists assume that print media are the leading source of opinions and published reports in print media have a stronger influence on other media and the public than reports in any other communication format (radio or TV);(Selb, 2003).In the present study feeds in social media platforms are not considered but may be taken into account in further research.

3.3.5. Statistical Analysis

New variables were calculated for each category of media coverage used in the analysis and each year of the study from 2011 to 2013. This resulted in 21 new variables (for each of the selected 7 categories x 3 years). New variables reflect the relative average media coverage of one category as percentage of the mentioning of this category among all reports related to Frankfurt Airport in the press review for the 180 days prior to the interview date of a participant. As values of variables of media coverage are non-normal distributed (right-skewed) variables are logarithmized for the regression analysis.

Correlations of annoyance ratings and potential determinants are calculated using Pearson's correlation coefficient. According to Field (2013, p. 402), correlation values over $r = 0.8$ indicate multicollinearity. Correlation values over 0.8 for two independent variables would point to exclude one of them from further analysis.

A Generalized linear model (GZLM) with repeated measures is calculated in order to investigate the influence of media coverage on annoyance ratings. Additional predictors are included in the model, including different noise metrics (L_{den} , L_{night}).

Additionally, a GZLM is calculated to investigate the influence of media coverage on “night flight” on sleep disturbance ratings. The reference year was set for 2013 as an anticipated auxiliary baseline. From March 2011, configurations of flight paths began as preparations for the airport expansion and implementation of further measures. Media coverage increased even before the study began in 2011, while preparations for the airport opening were underway. In 2011 and 2012, due to the opening of the new runway and the implementation of the night flight ban, media coverage was higher. In 2013, reporting is assumed to have normalized as the processes around the airport expansion were completed.

3.3.5.1. Results

Descriptive statistics in terms of minimum, maximum, means, and standard deviations are reported in Table 5 (for tables, see section 10 - annexes).

At study entry, the mean age of the sample was 52.6 years ($SD=14.6$) with a range from 18 years to 96 years. 53.5 % of the sample is female. The mean socioeconomic status (Scheuch-Winkler-Index, SWI) was $M= 13.8$ ($SD=4.4$) in 2011, with a small increase in 2012 to $M=14.0$ ($SD=4.2$) and 14.2 ($SD=4.2$) in 2013, which indicates an average upper middle-class status.

The average aircraft noise exposure in the sample measured in the day-evening-night-noise level L_{den} was 51.8 dB ($SD=6.2$) in 2011 with a small decrease until 2013 ($M=50.5$, $SD=6.5$). For night time levels L_{night} , the average L_{night} decreased as well with 42.4 dB ($SD=6.3$) in 2011 and 41.6 dB ($SD=5.9$) in 2013.

Average aircraft noise annoyance in the sample was higher in 2012 with $M=3.4$ ($SD=1.3$) in comparison to 2011 ($M=3.3$, $SD=1.3$) and 2013 ($M=3.2$, $SD=1.3$). In contrast, average sleep disturbance from aircraft noise decreased in the sample during the study years from 2011 ($M=2.3$, $SD=1.3$) to 2013 ($M=2.2$, $SD=1.2$).

Media variables differed in distribution. Highest values were shown for the percentage of articles about the category “noise exposure”, with a peak in 2012. “Protest” was the category with the second most indication. Historically, Frankfurt Airport has a long history of protests about the expansion. Mediation between different stakeholders was performed from 1998 to 2000, but the implementation differed from the solution obtained in the mediation process resulting in ongoing

protests of citizens (e.g. action groups). Those protests addressed not only aircraft noise, but also the airport operator Fraport AG and the Hessian and Rhineland-Palatinate state governments. Further, there was a significant difference in the occurrence of protest-related articles in the press media between the study years, with a peak in 2012. For the category “night flight” a peak of media coverage was shown in 2012, following the implementation of a night flight ban around Frankfurt Airport in 2011. For the category “flight paths”, there was a peak in reports in 2011, which relates to the fact that residents express worry about a future increase of aircraft noise and flyovers due to the opening of the new runway in 2011. More reports about “sound insulation” were published in 2012 in comparison to the other study years, which can be explained by the launching of a fund for sound insulation in 2012.

Table 6 shows the results of the correlation calculations for the association of acoustical measures, annoyance ratings, and sleep disturbance ratings. High correlations are observed between the acoustic variables with $r > 0.87$. The acoustic variables correlate moderately with the noise annoyance ratings with coefficients of $0.36 \leq r \leq 0.48$ ($p < .001$). Similar correlations can be found for the acoustic metrics and the self-reported sleep disturbance with $0.31 < r < 0.41$ ($p < .001$). These correlations indicate a higher degree of noise responses (annoyance, sleep disturbance) with increasing sound levels L_{den} and L_{night} . The correlations between ratings of annoyance and sleep disturbance with coefficients of $0.56 \leq r \leq 0.74$ ($p < .001$) confirm that these are interrelated responses to aircraft noise. Naturally, correlations between variables of the same concepts from different years are on average higher compared to correlations between variables addressing different concepts. Table 7 shows the results of the correlation calculations for the association of impact variables (annoyance and sleep measures) with media exposure variables. For most media exposure variables, no overall significant associations with annoyance variables were observed across all years. Significant associations with noise annoyance variables were only observed for some media variables in specific years, but with redundantly small effects (e.g. the highest effect was observed for the association of noise annoyance in 2012 and media exposure about “night flight” in the corresponding year of $r = .07$, $p < .001$). The same was observed for sleep disturbance variables from 2011 to 2013.

Intercorrelations among media variables were high. For example, media variables about “night flight” and “increase exposure” in 2012 correlated with $r = 0.83$, $p < .001$. The media variables “sound insulation” and “media protest” had a correlation of $r = 0.96$, $p < .001$ in 2011. The media variables “flight path” and “sound insulation” were correlated with $r = -0.83$, $p < .001$ in 2011. Therefore, regression analyses were calculated separately for each media variable category

3.3.5.2. Generalized mixed linear models

Linear mixed regression models for aircraft noise annoyance were calculated separately for each media category variable with noise measures (L_{den} , L_{night}) as additional predictors. A change of the predictor variable of 1 unit means a change in the value of the regression coefficient (here referring to the annoyance levels).

In all models, the acoustic measures (L_{den} , L_{night}) were significant predictors.

Table 8 shows the results of the regression model with the media category “sound insulation” as a predictor. The predictor L_{den} has a significant positive effect on annoyance ($B=0.09$; $SE=0.01$; $p < .001$). No main effect was found for the media variable “sound insulation”. A significant negative effect of the year 2011 in comparison to 2013 was found, showing that the annoyance ratings were lower in 2011 in comparison to 2013 ($B=-0.42$; $SE=0.18$; $p < .05$).

An interaction effect of the year 2012 and the media category “sound insulation” was significant, i.e. significantly higher annoyance ratings with higher relative shares of media coverage about “sound insulation” were found in comparison to the reference year 2013 ($B=2.49$; $SE=1.23$; $p < .05$).

In Table 9, the results of the regression analysis with the media category “protest” as a predictor are depicted. No main effects were observed. Only an interaction effect between the year 2011 and L_{den} was found, showing that in reference to the year 2013 annoyance was predicted by noise levels in 2011 ($B=0.01$; $SE=0.01$, $p < .05$).

Table 10 shows the results of the regression analysis with the predictor “flight path” as the media variable. In addition to a significant main effect of the predictor L_{den} ($B=0.09$, $SE=0.01$; $p < .001$), a significant interaction effect was found for the year 2011 and the media variable “flight path”, showing that the media

coverage about “flight paths” in 2011 had an annoyance elevating effect ($B=2.2$, $SE= 0.93$; $p < .05$).

Table 11 depicts the results of the regression analysis with the media category “mistrust” as the predictor. A main effect of L_{den} was found ($B=0.1$, $SE=0.01$, $p < .001$). Further, the year 2011 in reference to the year 2013 was significant ($B=-0.97$, $SE=0.44$; $p < .05$) as well as the interaction between the year 2011 and L_{den} in reference to the year 2013 ($B=0.01$, $SE=0.00$, $p < .05$).

Table 12 shows the results of the regression analysis with the media category “noise exposure” as a predictor. Main effects for L_{den} ($B=0.27$; $SE=0.09$; $p < .01$) and media coverage about noise exposure ($B=11.85$; $SE=5.58$; $p < .05$) were found, but with a rather wide confidence interval of the predictor “noise exposure”. Further, an interaction effect of L_{den} and media reports about noise exposure was found ($B=-0.21$, $SE=0.11$, $p < .05$).

In Table 13, regression results with the media category “increase noise exposure” as a predictor are depicted. A main effect was significant for L_{den} ($B=0.09$, $SE=0.02$, $p < .001$).

Three regression models were calculated for the media category “night flight” with different acoustic predictors (L_{den} vs. L_{night}) and for annoyance as well as sleep disturbance as outcome measures.

Table 14 shows the results for the regression of the predictors L_{den} and the media category “night flight” and annoyance as the outcome. Main effects were observed for L_{den} ($B=0.09$; $SE=0.002$; $p < .001$) and the media category “night flight” ($B=2.18$; $SE=1.07$; $p < .05$). Further, effects of the year 2011 ($B=-0.68$, $SE=0.22$, $p < .001$) and the year 2012 ($B=-1.61$, $SE=0.75$, $p < .05$) in comparison to the year 2013 were observed. Significant interaction effects were shown for the interaction of L_{den} and media category “night flight” in 2011 in comparison to 2013 ($B=-0.04$; $SE=0.02$; $p < .05$) and the year 2011 and media category “night flight” ($B=-1.15$; $SE=0.54$; $p < .05$), i.e. with an increase in media coverage about “night flight” a decrease in annoyance ratings was observed.

Table 15 shows the results for the regression model with the acoustic predictor L_{den} and the media category “night flight” and the outcome sleep disturbance. Main

effects of the media category “night flight” ($B=2.58$; $SE=1.02$; $p < .05$) and L_{den} ($B=0.07$; $SE=0.003$; $p < .001$) on sleep disturbance were observed. Further, the year 2011 ($B=-1.16$, $SE=0.2$, $p < .001$) and the year 2012 ($B=-1.58$, $SE=0.71$, $p < .01$) had significant effects. A significant interaction effect was observed for the media variable “night flight” and L_{den} ($B=-0.06$; $SE=0.021$; $p < .01$) on sleep disturbance. Interaction effects were also observed for the year 2011 and L_{den} ($B=0.02$, $SE=0.00$, $p < .001$) and the year 2012 and L_{den} ($B=0.04$, $SE=0.00$, $p < .001$) in reference to the year 2013.

Table 15 depicts the results of the regression model with the predictors L_{night} and the media category “night flight” and the outcome of sleep disturbances. Significant main effects were found for the media category “night flight” ($B=2.58$, $SE=0.96$, $p < .01$), L_{night} ($B=0.073$, $SE=0.003$, $p < .001$) and the years 2011 ($B=-0.8$, $SE=0.18$, $p < .001$) and 2012 in comparison to 2013 ($B=-1.43$, $SE=0.66$, $p < .05$) on sleep disturbance. Moreover, an interaction effect was observed for L_{night} and the media category “night flight” ($B=-0.07$; $SE=0.02$; $p < .01$) and the year 2011 and L_{night} ($B=0.02$, $SE=0.00$, $p < .001$) and 2012 and L_{night} ($B=0.05$, $SE=0.02$, $p < .001$).

3.3.6. Discussion

This media analysis examined the effect of media coverage of aircraft noise related topics on aircraft noise responses from 2011 to 2013 in a sample living in the vicinity of Frankfurt Airport in the course of a change situation (with the implementation of a night flight ban and the opening of a new runway). Effects of media coverage were observed for media reports on several aircraft noise-related topics, namely sound insulation, flight path, noise exposure, and night flight.

Media coverage about “sound insulation” was found to be associated with higher aircraft noise annoyance ratings in 2012 in comparison to 2013. The Hessian State Government – together with air traffic stakeholders - issued a new regional fund to financially support the implementation of a passive sound insulation scheme around Frankfurt Airport in 2012. The novelty of the program and related attention in the media might explain that media coverage about sound insulation only had relevance for annoyance ratings in 2012.

No effect was observed for media coverage about “protests” on annoyance ratings. There have been frequent protests since the announcement of the first plans for the airport expansion. Further, the implementation and study process was continuously accompanied by protests. However, the results indicate that the media coverage about the protests is not affecting annoyance ratings but rather the topic of the protest is critical for the evaluation of noise. Further, reports about “mistrust” showed no effect on annoyance ratings. One possible reason might be the comparatively little media coverage that was reported about this topic.

Media coverage about “flight path” had an effect in 2011 in comparison to 2013 on annoyance ratings showing higher annoyance with higher media coverage about flight paths. Even before the opening of the new runway in 2011, a change in flight path configuration was implemented in preparation for the runway opening. This was accompanied by increased reporting by the media. The result might also reflect negative expectations about the influence of changes in flight paths on the noise distribution. For some residents, the flight path configuration was associated with an increase in aircraft noise exposure which might have formed their expectations regarding the aircraft noise after the expansion. In addition, there was a redistribution of overflights in some areas and consequently a redistribution of aircraft noise exposure, so that some areas actually experienced an increase in noise exposure after expansion of the airport and change in flight paths, while other areas experienced a reduction of noise exposure.

The strongest effect of media variables was observed for media coverage about “noise exposure” on annoyance ratings. An assumption is that almost all concern about the airport expansion evolves around negative expectations about the future noise situation. Residents could be worried about a potential decrease of the quality of their living situation or residential environment due to an increase in noise exposure. This is the case for acute and short-term disturbances (disturbances in daily activities, annoyance, sleep disturbance) and long-term concerns such as the worry about future health effects of aircraft noise, socioeconomic disadvantages as the airport expansion and associated noise increase could affect house prices around the airport. However, this result must be interpreted with caution as the upper confidence interval of the effect size is very wide, resulting from high variance which indicates that the effect might be considered as highly imprecise (according to the GRADE system, Guyatt et al.

(2011)). The term “noise exposure” can be considered very broad. Articles in this category could be very diverse in their focus reflecting a great variance (except those that are separately considered in the category “increase of noise exposure”). Media coverage about “increase of noise exposure” showed no effect on noise annoyance. This might be due to the fact that articles about noise exposure were collected within the category “noise exposure” and only a few articles specifically mentioned an “increase in noise exposure” in their headline. It further indicates that already general reporting about noise exposure can affect annoyance ratings.

Additionally, it was tested whether media coverage about “night flight” had an effect on noise responses. Significant effects were found for both annoyance and sleep disturbance. In detail, a significant interaction effect between 2011 and night flight was found, which can be explained by a higher media coverage of night flight related topics as first already in the mediation process to the airport expansion 1998 to 2000 the stakeholders agreed on a night flight ban from 11pm to 5am (so-called ‘mediation night’). This then was skipped in the approval decision to the airport expansion in 2007, but then implemented temporarily by the airport on a voluntary level in October 2011 and eventually confirmed by administrative court in March 2012. After the implementation, the number of reports about the night flight ban decreased. The interviews were conducted before the night flight ban was in place, when there was a regional debate about the so-called ‘violation of the mediation agreement’ regarding the abolishment of the night flight ban in the approval decision. Thus, this result could reflect the current situation of the category “night flight”.

A central objective of the media is to report about existing issues. High media coverage can be interpreted as an indicator of the relevance of a topic. Pending or relevant topics are assumed to receive more attention, such as local noise issues around an expanding airport. Some results are in line with the argumentation by Bröer (2007), who reasons that people’s annoyance reflection is often consistent with policy discourse (Bröer, 2007). A basic question is whether the media always properly reflects the public discourse. Extreme debates tend to get more media attention than neutral debates. The interest of the media can also focus on covering deviating opinions and events, such as demonstrations, not on activities that confirm existing practices. This might be more the case in local media as it can be assumed that local media is more focused to report about local events.

National media might be more focused on a bigger picture and sometimes frame the topic as attention-generating as possible.

Media coverage can be discussed as a potential non-acoustic factor. However, modifiability of that factor is only feasible via a broader indirect approach. As the origin of the noise issue is the noise source itself and its management, priority focus has to be set on directly tackling the noise problem. It can be argued that in changing the noise problem it will change information processes and, thus, the media coverage about the noise issue. Therefore, when elaborate communication and engagement processes focus on determining the discourse about the noise issue in the region, it needs to be integrated in interventions that focus on the reduction of noise by technical or operational changes. Meaningful communication and engagement processes need to accompany interventions, airport policy and any interactions with residents as “neighbours”, as these will influence how media is reporting about them. Thus, when airports and other authorities directly target solutions to a problem, it can be assumed that media coverage will represent this accordingly. Transparent information and guidance through a phase of change is a key factor that can be reflected in media coverage, which in turn can even promote the perception of trust and fairness.

A recent study found communication engagement of conflict parties in an aircraft noise context to be influenced by perception of media coverage in two groups of opposing stakeholders (Post, 2015). The study was conducted among promoters of air traffic (members of companies related to the aviation industry) and activists against air traffic. It revealed that their perception of media coverage influences their communication strategies in response to the media reports (Post, 2015). Results showed that promoters of air traffic believe that media generally reports in favour of a reduction in air traffic and activists against air traffic growth seem to have the opposite view (Post, 2015). This is in line with the *hostile media phenomenon*, which states that conflict parties often perceive the media coverage as hostile regarding their own position, even when reporting is balanced (Vallone, Ross, & Lepper, 1985). Group affiliation or attitude regarding a topic determines whether reporting is perceived as hostile. Following the perception of the media reports, the result of the analysis further revealed that advocates for air traffic engage in noise communication especially when they perceive media coverage to be hostile in combination with low media interest whereas the activists against air

traffic especially engage when they perceive interest of media to be high, but not necessarily as a reaction to perceived hostile media coverage (Post, 2015). Subsequent effects of these results are uncertain. It can be assumed that response to media follows a dynamic process indicating implications for the importance of good communication and engagement to be addressed between different parties. Depending on if the media is in line with a person's attitude towards the topic it might also influence a private person's motivation to get engaged.

This study has a few limitations. One limitation is that the analyses are lacking information about the framing of the media coverage, this means that there is no information about the value of the articles. An article about sound insulation can be positive, negative or neutral depending on the topic, i.e. if it is about a potential subvention of sound insulation, about cancelled funding of sound insulation programs or just information about specific types of sound insulation. This could be influential for the effect of the media coverage. Future studies could investigate further the valence of the articles to examine if the effect of general reporting about noise exposure differs from effects of information that is framed in a certain direction.

A further limitation is that there is no sufficient baseline. The study started after the beginning, i.e. the announcement and the planning of the expansion process and shortly before opening of the new runway and the implementation of the night flight ban. Since then, changes in sound insulation measures occurred after the expansion. The events related to the opening and the night flight ban were completed in 2013, resulting in less media coverage in 2013.

Nonetheless, the media analysis identified potential factors influencing the perception of noise in order to inform intervention processes (communication and engagement) about critical factors that can contribute to beneficial (or adverse, respectively) effects. All in all, these findings indicate that media coverage about noise topics can influence the noise response in the community.

4. Communication and Engagement

4.1 Importance and role of communication and engagement

Given the nature of the described non-acoustic factors, it is hardly surprising that researchers and the aviation industry have in recent years identified communication and engagement as key elements in noise impact management.

The aviation industry has gone to considerable effort to reduce noise and noise impact over the past 50 years, mostly via significant reductions in noise from individual aircraft, driven by increasingly stringent certification regulations regarding aircraft design. These reductions have not, however, resulted in corresponding reductions in annoyance. Instead, public opinion is an increasing constraint to airport activity, despite fewer people being exposed to higher levels of noise than in previous years (Guski et al., 2017). The ICAO Balanced Approach has looked to help address this by not just reducing noise at source (although this remains important), but also through other measures that are designed to better manage noise for the benefits of residents. As well as encouraging reductions in noise at source, the Balanced Approach also outlines actions that can be taken with regard to: land-use planning and management policies that seek to reduce noise exposure on the ground, either by keeping noise sensitive developments (i.e. conurbations) away from high-noise areas, or by managing sound on the ground, through insulation programmes; operational procedures, such as moving flight tracks so as to not overfly communities, and; operating restrictions, for instance night flight limits or absolute caps on aircraft movements.

And, finally, in 2007 the Balanced Approach Guidance was expanded to include 'People Issues'. The aim of this 'fifth pillar' was to focus on communication strategies, advocating the use of enhanced information that is easily accessible by the public, and that emphasizes the role of consultation. Although not formally adopted through the Balanced Approach as a core pillar, the concept of communication and engagement as a noise management tool is now seen to be increasingly important.

Communication and engagement do not purely exist as an additional pillar through which noise can be managed - it can also help aid the successful implementation

of other balanced approach measures. Successful noise management actions must be technically feasible or viable in order to be implemented. And together with a range of technical data, the industry has typically focused the development of Balanced Approach interventions on such data in order to develop interventions that are deemed to have the greatest potential impact and benefit for noise affected communities. Indeed, national noise policy is often focused on such considerations, leading airports to develop, for instance, new operational procedures based on aggregated noise metrics and success criteria such as the number of people exposed to certain levels of noise. This is a sensible approach that provides airports with confidence that the noise management actions they develop will result in positive outcomes. As previously mentioned however, improvements in noise levels as measured through such approaches is not a guarantee that residents will perceive them as successful, or that there will be a positive impact on annoyance and complaints. The reason for this is that truly, successful noise management interventions require a further consideration to technical feasibility and viability – desirability. Put simply, if a noise management intervention looks good on paper, but is not deemed to be effective or desirable in the eyes of those it is designed to serve (i.e. residents), then it is less likely to be perceived by those same residents as being an effective or appropriate response to the noise they experience. Through communication and engagement, airports are able to explain noise and noise management processes to residents, but also gain their feedback and insight into what success looks like in residents' own eyes. This information can be incorporated into decision-making and help to produce noise outcomes that are more likely to be viewed as appropriate.

4.2 What is communication and engagement

At its core, communication refers to the dissemination of information from one person or organisation, to another person or organisation. For instance, governments may communicate information about certain changes to legislation, or about new laws or policies to the public. Government health and safety warnings around the time of the Covid-19 pandemic being a good example. For aviation, airports may communicate for a range of reasons, for example sharing noise data or operational changes to their communities or performing marketing activities regarding things like the promotion of noise management measures, reductions in noise levels as described through metrics such as L_{den} , or quality of life benefits

afforded to residents as a result of airport activity and contributions to the national or regional economy. What really defines communication, however, is the one-way flow of information that it typically implies. That is, the airport passes on information to its stakeholders. Typically, communication tools, therefore, include things like newspaper articles, radio advertisements, websites, mail and other printed media such as noise action plans, noise contour maps or other corporate reporting. The intent of such activities is for a specific message, or messages, to be heard by a target audience, at a specific point in time, and with a targeted outcome. As such communication activities tend to lose meaning over time, and whilst their one-way flow of information and generic targeting can be helpful in explaining things to residents, they can also lead to disengagement from receptive audiences or confusion if messages are unclear, misunderstood or not trusted. This is particularly difficult for airports, which are tasked with explaining highly complicated, multi-faceted and technical data in simple and easily digestible formats. This is a significant challenge as simple communication measures can lack relevant information, whilst communication materials that show a range of information can be too complicated to understand. This is compounded by the fact that communicating noise through different metrics has a range of different advantages and disadvantages. Noise contours for example, do a good job at illustrating aggregated noise levels around an airport, however, they fundamentally describe an audible factor, through a visual medium, and describe noise in a way that is not experienced by residents, who live through individual noise events. The result is that contour maps are often poorly understood by residents (Hooper & Flindell, 2013), despite legislation such as the Environmental Noise Directive 2002/49/EC requiring airports to produce such contour maps and to disseminate them to the public. In worst case scenarios, poor communication can lead to mistrust between airports and community groups who may begin to question the information that they are being told, thus raising the question of the value of the communication itself.

Engagement on the other hand, refers not just to the provision of information to stakeholders, but to establishing a dialogue. Here, the objective is to embark on a conversation with stakeholders to explain things to them, but importantly, to also listen to them. The concept is rooted in the fact that residents are the experts on their own lived experiences and can offer important insight that may otherwise

remain unknown, and that could play an important role in decision making around the development of noise management interventions that are likely to be perceived as acceptable. Hence, the aim is not only to pass information onto stakeholders, but to also listen to stories about their lives, their fears, the things they do in life, and build empathy for them and their perspectives on given issues. Put simply, engagement implies not just talking, but also listening, understanding, and the need to tailor messages and information to different people, in so doing having the potential to become more meaningful interactions over time. It also implies an openness and willingness to adjust pre-held perceptions of a situation, and doing things that may not have previously been considered (or not doing things or modifying things that an airport may have originally planned to do). The importance of engagement can be seen through concepts such as design thinking, which are applied in organisational settings to develop solutions to a range of operational challenges. The process is based on the idea that considering the needs of a given beneficiary of a service is essential in order to maximise the likelihood of the success of that service. The process is rooted in deep engagement with stakeholders, including the use of multi-stakeholder design teams, collecting qualitative data to complement quantitative information, and understanding and addressing core challenges directly. Similar approaches are already set out in aviation noise through proposed processes in the United Kingdom's Civil Aviation Authority CAP 1616 (CAA, 2021) document and the United States Federal Aviation Authority Program 150 (FAA, 2015). Both take iterative step processes to develop noise management interventions that include a focus on understanding resident needs and embed them as core principles in the development of noise management actions. Methods for engagement go beyond the mere dissemination of information as with pure communication, and involve more participatory methods such as consultation, focus groups, workshops or full collaborative and participative working groups. Hence, communication and engagement can be seen as sitting on a spectrum, from the simple provision of information, through to more participatory levels that afford degrees of citizen empowerment through partnerships, delegation of control. This has been helpfully illustrated by (Asensio et al., 2017) who, as illustrated in Figure 1, created a Wheel of Participation for airport noise management, adapted from the work of Arnstein's Ladder of Public Participation (Arnstein, 1969).

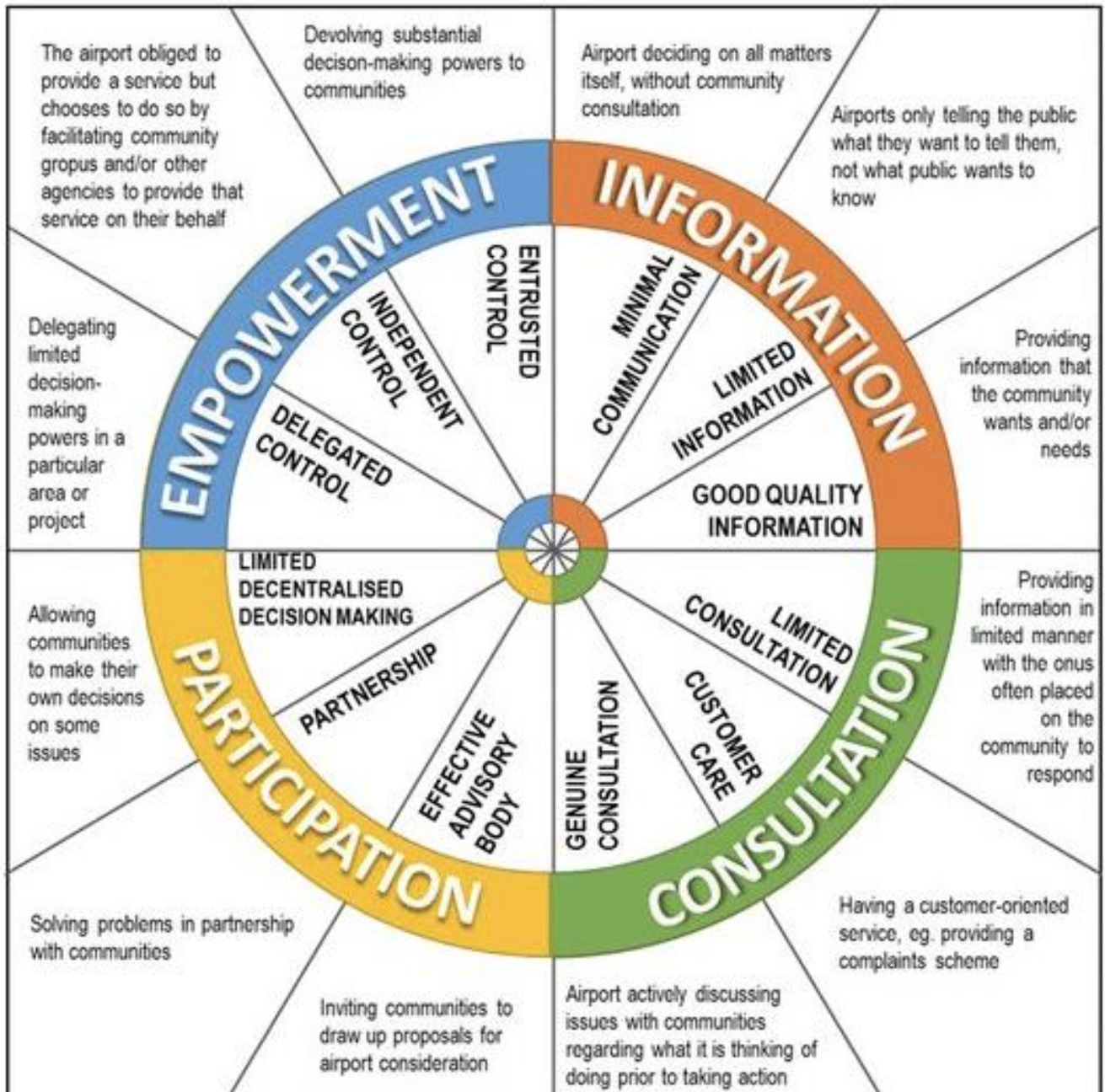


Figure 1: Asensio et al. (2017) – Wheel of Participation

Communication tools may still be used as part of engagement, but rather than as the primary output, they merely lay the framework on which a wider discussion can take place. At the same time, engagement with stakeholders does not imply that good levels of communication have taken place. It is entirely possible, for example, that an airport may be seeking to engage with residents, but communicating noise information to them poorly, or even dishonestly (such claims may be untrue, but if they are true in the eyes of residents they remain relevant). Likewise, processes of engagement do not necessarily mean success. Engagement

has to be meaningful and with an honest intent to listen to and learn from stakeholders. Failure to do this can result in mistrust, which once lost can be almost impossible to win back.

Building on findings from case study research conducted in ANIMA, some of the characteristics and key principles of communication and engagement are outlined below:

- Communication typically sets out to describe what is happening, or what has happened, or to perform basic consultation regarding a set of predetermined interventions. Engagement on the other hand, explains why things are happening, and seeks to obtain the input of stakeholders regarding decisions that have not yet been taken, the aim being to produce fair outcomes.
- Communication describes one-way dialogues between airports, speaking to residents. This means that communication methods more often than not include contour maps, noise reporting, noise action plans, or marketing information. Engagement on the other hand describes two-way flows of information, and therefore utilises methods such as consultation events, workshops, focus groups and Dialogue Forums. These require more effort and resources to operate but better reflect a more engaged and informative process that is more likely to lead to outcomes that are perceived to be successful in the eyes of stakeholders.
- Communication typically uses quantitative data to describe and communicate noise. This is useful in that it is an attempt to describe noise in the most accurate way possible. However, it is also beset with difficulties of describing a complex and highly technical concept (noise) through simple metrics. Engagement may also use the same information, but its two-way flow of information also concerns qualitative data, i.e. how residents feel about noise and how noise is likely to affect them.
- In pure communication, the actor that is leading the communication typically takes on the role of expert. This can lead to hierarchical stakeholder relationships that can make establishing trust difficult, and can cause the lead communicator to discount other sources of information. Engagement

on the other hand is typically based on levelled hierarchies in which all stakeholders are seen to have potentially valuable information to offer decision making processes. Empathy plays a key role and consensus is deemed more likely to be reached through understanding.

The above may suggest that engagement is a more comprehensive approach than communication, it should not be seen as necessarily being best practice in every scenario, as the level of activity undertaken by an airport should be determined by the desired output of the interaction. Hence, both communication and engagement approaches should be used with an awareness of the attributes and benefits of each, and importantly, the circumstances surrounding the area in which they are to be implemented, for instance what is the ultimate desired outcome of the interaction, the understanding of which may itself require some form of engagement. That said, best practice dictates that engagement should at the least be considered whenever an airport is looking to communicate something to its residents, or to make operational changes or other modifications to airport activity. Broadly speaking, the larger the change or impact on a community's health or wellbeing, the greater the effort to engage should be. The importance of this can be appreciated through the fact that noise management, at its fundamental core, exists for the benefit of airport residents, be it due to direct pressure to manage noise as demanded by communities, or in response to legislation designed to protect noise affected communities from the potentially significant noise impact caused by noise exposure. It is therefore important to not just develop noise management actions or general airport operations that are technically feasible or viable, but to also consider what actions are desirable in the eyes of those residents.

4.3 Previous knowledge gaps

Although research on non-acoustic factors has consistently highlighted the need for communication and engagement, there were still a number of unresolved issues that have been partially addressed by ANIMA.

- What form should communication and engagement efforts take?

- Are some forms of communication and engagement more effective than others?
- What aspects make up effective communication and engagement?
- What role does fairness play in communicating and engaging with residents?
- What is the difference between communication and engagement?
- What do residents need?
- What should we expect from 'successful' communication and engagement actions?
- How might success be evaluated?
- Why should airports even care about how they communicate and engage?

In the following part of this deliverable we address these questions. While we cannot answer some of them conclusively, new insights into fairness and resident consultations will answer some of these questions or shed new light on them.

4.4 Fairness as the overall goal

4.4.1. Fairness in the context of aircraft noise research

Having already described that communication and fairness is one of the key aspects that an airport should consider, not only to underpin interventions of the Balance Approach, but also as a stand-alone and permanent implementation, it is important to ask what aspects play a role in this.

Research in the field of social justice, mainly in the context of organisational psychology, has already shown that fairness plays a central role in creating a lasting, trusting relationship between the parties involved and establishing a positive perception and increased acceptance of an outcome resulting from negotiations or decisions.

Research on fairness and justice can provide an answer to the question what aspects are crucial for successful communication and engagement.

The distribution of aircraft noise can be seen as a fundamental injustice, as noise is not evenly distributed across all residents, but must be borne by a small number of residents living under flight paths.

From the point of view of the psychology of justice, the acceptance of this unfair distribution can at least be achieved if the framework conditions are designed in such a way that they are perceived as fair.

4.4.2. Why is fairness important?

An observation made since the 1980s was that people are more likely to accept and adopt unfavourable outcomes of decisions when the decisions were based on correct information, when the decision-making process was free from bias and applied consistently over time and people and, above all, when the affected people have been involved during the decision-making process (Leventhal, 1980). This so-called "fair process effect" is based on the observation that giving people "voice" makes them more likely to accept decisions (Lind & Tyler, 1988; Thibaut & Walker, 1975; Tyler & Lind, 1992). This means that airport management should apply procedures that are recognized as fair as possible by the public. The assumption that giving voice leads to increased perceived fairness and reduced annoyance due to noise exposure has already been shown in studies (Maris, Stallen, Vermunt, & Steensma, 2007), when people who could express their preference for a certain sound were significantly less annoyed than people who could not. However, annoyance was particularly high among people whose preference was actively ignored. A more recent study (Liebe, Preisendörfer, & Enzler, 2020) also showed that multiple opportunities to participate led to a higher acceptance of a fictitious airport expansion. However, this study also showed that the focus on the jobs created by the airport expansion had no effect on acceptance. In summary, procedural aspects of aircraft noise distribution have an enormous influence on how people perceive aviation, the airport and noise and to what extent they are annoyed by the noise. Communication and engagement are two ways in which aspects of procedural fairness can be established. Aspects of engagement can help residents feel listened to, that they are being taken seriously and that they can actively influence the decision-making process. Despite the positive effect of having voice or control in the decision-making process, fairness research has also shown the critical impact of providing information and justification of a decision for the perception of the outcome of this decision. From the perspective of so-called informational and interpersonal fairness aspects, people may perceive unfairness, even though they consider the procedure and its result as fair, just because of an improper treatment or a lack of justification by the decision-maker (Bies & Moag,

1986). But also, in case of a negative outcome, the decision process may be recognized as fairer when an adequate justification or causal account is given by the authority who made the decision (Bies & Shapiro, 1987, 1988). These findings point at the need for a good communication strategy of the airport management and we will come back to the lessons learned from this branch of fairness research when we define criteria for good communication and information (see page 64).

4.4.3. Theoretical background

To give an overview, research has identified a set of criteria and standards relating to the fairness aspects mentioned above, which, taken together, can create a perception of fair process and fair interaction with the parties concerned. Research distinguishes between several facets of fairness. A distinction can be made between procedural, interpersonal, and informational fairness. All of these main fairness standards comprise a number of criteria, seen in Table 1. With these criteria based on psychological theories, concrete recommendations can be derived on what constitutes good communication and engagement and how to build a neighbourly relationship with airport residents. But first, we want to give a bit of a psychological background on why fairness is capable of reducing annoyance.

Table 1: Rules taken from Thibaut & Walker; Leventhal, 1976; 1980; Adams, 1965; Bies & Moag, 1986; Greenberg, 1993 modified after Bartels, 2014)

	Fairness standards	
Procedural	Process control	procedures provide opportunities for voice
	Decision control	procedures provide influence over outcome
	Bias suppression	procedures are neutral and unbiased
	Representativeness	procedures take into account concerns of subgroups
	Consistency	procedures are consistent across persons and time
	Accuracy	procedures are based on accurate information
	Correctability	procedures offer opportunities for appeals of outcomes
Informational	Truthfulness	explanations about procedures are honest
	Justification	explanations about procedures are thorough
Interpersonal	Propriety	enactment of procedures refrains improper remarks
	Respect	enactment of procedures refrains improper remarks

4.4.4. Why do we care about fairness?

From an evolutionary point of view, there are several reasons why fairness is so important. The first reason is that of perceived control. When a process is fair, one can indirectly influence the outcome of that decision-making process (Thibaut & Walker, 1975, 1978). Another aspect introduced by Lind & Tyler (1988) is that of group membership. Fair treatment indirectly implies that one is a valued part of a group and, thus, conveys information about belonging and self-esteem, which are fundamental human needs. Humans have the need to make sense of the world as quickly as possible - sometimes by using heuristic cues in the environment. As (Kees, 2001) points out, oftentimes, we lack information about the trustworthiness of other people, so that we use cues, like if we are allowed voice to rate someone's trustworthiness, even though we lack other information. Suppose you meet a person of whom you do not know whether he or she is trustworthy or not. If one experiences that one is asked for one's opinion (that would be the procedural fairness aspect of voice), for example, the fairness heuristic theory states that this cue is sufficient to interpret the person as trustworthy. One often does not have enough time to acquire much information about the trustworthiness of others. Since one would naturally like to find out as quickly as possible whether the other person is a potential danger, aspects of fairness are used as a substitute for complete trustworthiness. That means that procedural fairness aspects convey information about whether the interacting party can be trusted and reduces uncertainty (Bobocel & Gosse, 2015).

4.4.5. How and why to measure fairness?

Up to now, there is no psychometric instrument to measure fairness aspects in the field of aircraft noise. Based on the latest research in the field of justice psychology and in accordance with findings that have emerged in the exchange with affected citizens, a questionnaire is being developed in the framework of ANIMA to empirically assess aspects of how the airport is perceived by residents. This questionnaire is going to be able to empirically capture the quality and success of airport management strategies via focusing on the perceived procedural, informational, and interpersonal aspects (see Table 1) of the residents' perception of the airport management's decision making. Thus, this questionnaire will not only be able to evaluate the current perception of the airport in the population, it will

additionally provide concrete starting points for future efforts the airport should make.

Summarizing, a way to measure fairness perception of aviation and airport management can

- ascertain current perceptions of the airport among residents,
- determine starting points for interventions after these perceptions have revealed points for improvement,
- review interventions that have been implemented in terms of their success, and
- gather further knowledge concerning fairness aspects in aviation research.

4.4.5.1. Scale development

The development of the FAIR questionnaire encompasses several phases.

First, the literature was searched for existing concepts. Existing questionnaires were collected. There are already questionnaires that measure fairness, especially in the field of organizational psychology. The latest scientific findings were collected (see for an overview Rupp, Shapiro, Folger, Skarlicki, & Shao (2017)).

Based on the current distinction between distributive, procedural, informational and interpersonal fairness and their subcategories, items were developed.

The development of the items is based on:

1. Focus groups conducted in the vicinity of Cologne-Bonn Airport. Residents affected by aircraft noise were interviewed about how a fair, neighbourly relationship to the airport would look like and questions regarding information provision (Hauptvogel et al., 2021).
2. Questions derived from questionnaires in other contexts were adapted to the topic of aircraft noise.
3. The theoretical definition was considered and experts designed questions that take up this definition in the context of aircraft noise.

In summary, 68 items were drafted at the beginning of the study, which can be subjected to initial psychometric tests on the basis of a pre-test.

The pre-test with 22 persons was conducted by employees of the German Aerospace Centre. This also provided the opportunity to give detailed feedback and identify difficulties in understanding individual items. With the help of the feedback and initial statistical analyses such as the determination of the discriminatory power and the item difficulty, the items were revised and a new version of the questionnaire was created.

The new version again comprises 68 items, which should now withstand psychometric quality criteria with the help of a larger number of test persons.

4.4.5.1.1 Pre-test

In the first phase, the items created are subjected to an initial test.

The aim is to test a small sample to see whether the items are understood and whether the wording and explanatory texts are unambiguous. For this purpose, a questionnaire was programmed in Lime Survey.

The fairness questionnaire was presented with a short introduction with a brief explanation of the research claim. It was explained to the subjects that this was a preliminary version. For this reason, a large field was left empty at the end of the questionnaire where the respondents could add comments to the individual questions.

Furthermore, the test persons were already asked to answer the additional questionnaires (see section 4.4.5.1.3c) to evaluate the validity.

Approx. 288 people were asked to answer the questions. A total of 22 people filled out the questionnaire completely.

4.4.5.1.2 Main study

To create a validated questionnaire, it is necessary to conduct a study with a larger number of subjects. For this reason, we are currently planning a study with about 2000 participants. The procedure of the study has already been approved by the Ethics Committee of Medical Association North Rhine.

a. Recruitment

Flyers are used to recruit people in areas around Cologne-Bonn and Dusseldorf airports. A link and QR code are printed on the flyer, which the participants can then use to access the survey.

To investigate potential differences between residents exposed to low and high levels of aircraft noise, two versions of the flyer with different links are used for the two noise exposure areas. In this way, the responses received can be directly assigned to the two groups without specifically asking for the address.

Subjects can request to receive a paper-pencil version of the questionnaire.

b. Incentives

Incentives and rewards are a useful way to increase the likelihood of participation (see Göritz (2006)). The researchers Pedersen & Nielsen (2016) were able to show that a prize draw leads to more response than offering donations. They also recommend formulating the cover letter according to selfish motives, which was done for this study. Further, there will be a raffle of 10 times 100€ among all participants.

c. Inclusion criteria

Of interest are all persons over 18 years of age in the vicinity of the German commercial airports (initially Cologne-Bonn and Dusseldorf).

The aircraft noise level to which people are exposed is determined on the basis of freely available environmental noise maps from the state of North Rhine Westphalia.

4.4.5.1.3 Quality criteria

When developing measurement instruments, it is helpful to assess the quality by means of quality criteria, i.e. objectivity, reliability, and validity.

a. Objectivity

Objectivity is the degree to which a measurement is independent of the investigator and refers to the process of carrying out the survey and the interpretation of its results (see Lienert & Ratz (1998)). Since this questionnaire

is produced in paper or electronic form with precise instructions for carrying it out, it can be objectively conducted. With regard to the interpretation of the results, recommendations can be made as to which consequences should be drawn from the various high or low perceived fairness aspects. However, since this study can only examine the general structure and usefulness of the questions, no statements can be made about which values of the fairness aspects are generally to be interpreted as high or low. Thus, it will not be possible to create a general evaluation table for the interpretation of the measured values.

b. Reliability

Calculations such as the split-half method are suitable for estimating reliability, whereby the test is divided into two tests when they are administered once. In this way, correlations of the raw score pairs of both test halves can be determined (Bühner, 2011). Coefficients of goodness can be calculated, e.g. using the Spearman-Brown formula to calculate reliability.

c. Validity

Factorial validity

Factorial validity can be regarded as given, if the assumptions about the factorial structure of the questionnaire can be tested and verified. The factorial structure of the fairness questionnaire can be examined within the framework of an exploratory factor analysis (EFA).

Construct validity

Construct validity can be seen as given when the scale is suitable as an indicator for the attribute that is to be measured with it. This suitability can be tested by assessing how well the scale has proved itself empirically with regard to postulated positive, negative or null relationships to other empirical indicators (Krohne & Hock, 2007). The scale is then embedded in an, so called, nomological network.

The relationship of the FAIR Questionnaire to other psychological characteristics can be summarized as follows.

Divergent validity

In order to determine divergent or discriminatory validity, constructs should be selected that have very little, or at best no relationship to the questionnaire measures.

We first decided to capture the construct of political cynicism (measured by the Kurzskala politischer Zynismus (KPZ), Aichholzer & Kritzing, 2016), which ideally has no connection with fairness. For example, a low perception of fairness could be due to the fact that people are generally cynical about political decisions and thus the perceived fairness is not actually recorded. Furthermore, the fairness questionnaire should have very little or no correlation with noise sensitivity. Noise sensitivity is measured by the LEF-K (Kurzfragebogen zur Erfassung der Lärmempfindlichkeit, Zimmer & Ellermeier (1998)). The perceived fairness should not result from the fact that people are very sensitive to noise, but from the fact that there really is a lack of establishment of fairness aspects by the airport management.

Convergent validity

Convergent validity assumes that the construct being measured is related to other constructs that measure similar aspects. Thus, it is assumed that there is a correlation between these aspects.

The following constructs were selected to determine convergent validation:

- Interpersonal trust: measured by the KUSIV-3 (Kurzskala Interpersonales Vertrauen, Beierlein, Kemper, Kovaleva, & Rammstedt (2012)), it is expected that people with a high score on the factor interpersonal fairness are more likely to consider the airport and its management as fair. A positive correlation is therefore expected.
- Political competence and influence beliefs (Aichholzer & Kritzing, 2016). Furthermore, it is assumed that people who perceive themselves as politically competent and assume that they can also exert influence here, also have a higher perceived fairness with regard to the airport.
- Sensitivity to injustice: Measured with the USS (Ungerechtigkeitssensibilität-Skalen-8), we assume that people who react particularly sensitive to injustice regarding the issue of aircraft noise and the distribution of noise often perceive enhanced unfairness. We assume here that persons with high values in this scale, if they react very sensitively to injustice, have lower values of perceived fairness.

- **Control beliefs:** The IE-4 (Internale-Externale-Kontrollüberzeugung-4) captures aspects of the locus of control. Thus, it is expected that people who have high scores in control beliefs will have higher scores in perceived fairness, i.e. there is a positive correlation (Kovaleva, Beierlein, Kemper, & Rammstedt, 2012).

Predictive validity

Predictive validity describes how well the questionnaire is able to predict certain aspects that it would like to predict.

- **Willingness to protest:** The fairness questionnaire, which is currently being developed, is intended to predict the willingness to participate in protests. For example, a high willingness to protest could be predicted by very low perceived fairness.
- **Noise annoyance (Schreckenber, Belke, & Spilski, 2018):** As a primary response to noise, annoyance responses may moderate the relationship between noise and adverse health reactions. Therefore, it is essential that the questionnaire can predict annoyance responses. The Multiple Item Annoyance Scale (MIAS) measures different facets of annoyance due to aircraft noise. The lower the perceived fairness, the higher the expected values of annoyance.
- **Acceptance of airport and air traffic:** an essential factor affecting the relationship with the airport is acceptance. It is assumed that if people perceive the airport and airport management to be fair, acceptance will also be higher. Thus, we expect that the perceived fairness can predict the acceptance of the residents.

4.4.5.2. FAIR - Questionnaire

4.4.5.2.1 Items of the Fair-Questionnaire in the draft version

As the questionnaire is still in the development phase, some items are now presented that will most probably be part of the final version of the questionnaire.

Please note that these are sample questions and the actual number of questions will probably be much higher.

Table 2: Draft example Items of the FAIR Questionnaire, designed to evaluate the perceived fairness of the airport management.

Fairness aspects	Fairness Standards	
Distributive	Equity	<i>The advantages that the airport brings for me personally outweigh the burden of aircraft noise.</i>
		<i>I am sufficiently compensated by the airport for the aircraft noise pollution at my home.</i>
	Equality	<i>Due to the different approach and departure directions of the aircraft, the noise pollution is evenly distributed among the residents.</i>
		<i>The airport distributes aircraft noise unfairly among residents.</i>
	Need	<i>The airport endeavours to distribute aircraft noise in such a way that local recreation areas are affected as little as possible by aircraft noise.</i>
		<i>The approach and departure directions are set in such a way that those in need of protection, such as children or sick people, are affected as little as possible by aircraft noise.</i>
Procedural	Process control	<i>Before decisions are made on aircraft noise, I have the opportunity to make my views known to those responsible.</i>

		<i>The airport actively approaches its residents in decision-making processes relevant to aircraft noise in order to listen to their views.</i>
Decision control		<i>As a local resident, I am presented with a fait accompli when decisions affecting the airport are made.</i>
		<i>The airport takes the views of its residents into account when making decisions about aircraft noise.</i>
Bias suppression		<i>The airport is primarily concerned with economic interests and not with protecting residents from noise.</i>
		<i>The airport tries to make decisions in an unbiased and neutral manner.</i>
Representativeness		<i>All parties who are affected are included in decisions relevant to aircraft noise.</i>
		<i>My views and needs are actively represented in decision-making processes relevant to aircraft noise.</i>
Consistency		<i>Residents do not understand why different rules apply at different airports, e.g. on night rest times or flight bans.</i>
		<i>When decisions are made at the airport, the interests of some residents are taken into account more than the interests of others.</i>
Accuracy		<i>Before decisions are made on aircraft noise, those responsible inform themselves sufficiently.</i>

		<i>In case of new scientific findings (e.g. on noise effects or noise abatement measures), decisions at the airport can be adjusted.</i>
	Correctability	<i>I have possibilities to act against decisions that I consider to be wrong.</i>
		<i>I can complain to the airport in connection with aircraft noise and air traffic.</i>
Informational	Truthfulness	<i>The airport tries to gloss over the negative consequences of air traffic.</i>
		<i>The airport is honest about its plans for the future.</i>
	Justification	<i>The airport explains and justifies decisions relevant to aircraft noise in detail.</i>
		<i>Irregularities in air traffic (e.g. flight times or arrival and departure routes) are adequately explained by the airport</i>
Interpersonal	Propriety	<i>The airport is interested in an open exchange with local residents.</i>
		<i>The airport's communication towards residents affected by noise seems condescending.</i>
	Respect	<i>Exchanges between the airport and residents are respectful.</i>
		<i>The airport has a sincere interest in communicating with affected residents.</i>
Overall fairness		<i>Overall, I feel that I have been treated fairly with regard to aircraft noise from the airport.</i>

In summary, the questionnaire currently under development has potential to find ways to improve communication and engagement, as well as to design future interventions and evaluate their usefulness.

In this section, aspects of fairness were discussed, such as distributive, procedural, and interactional fairness, which consists of interpersonal and informational fairness. However, research in the area of aviation noise is not yet available.

The following section presents data from a qualitative approach to examine how communication and engagement processes by airports are perceived by residents in airport regions.

5. Qualitative study on perceived communication and engagement processes around airports

This chapter presents results from a qualitative study conducted in the vicinity of various European airports. These airports are:

- Cologne-Bonn Airport, Germany
- Dusseldorf Airport, Germany
- East Midlands Airport, UK
- Paris Charles-de Gaulle Airport, France

Focus groups and in-depth interviews were conducted with residents living in areas highly affected by aircraft noise (defined as > 55 dBA L_{den}) or in areas with low noise exposure (< 50 dBA L_{den}). A discussion/interview guideline was developed covering the following topics:

- Quality of life and living environment
- Current view of the airport
- Desired information and communication
- Ideal relationship to the airport

All focus groups and in-depth interviews were audio-recorded and then analysed. A detailed description of the samples can be found in 10.2 and 10.3.1.

5.1 Results of the in-depth interviews around Dusseldorf Airport

The in-depth telephone interviews were conducted with residents from the Dusseldorf Airport region. In total, 22 interviews were conducted and considered for a qualitative analysis. A detailed description of the sample and the results can be found in Appendix 10.2.

Figure 2 and Figure 3 give a general overview of the interviews' results for each exposure group separately.

With respect to quality of life, nature is the most frequently mentioned positive aspect in both exposure groups. People from the high exposure group named aircraft noise and road traffic noise as negatively impacting quality of life (8 participants each). The most mentioned negative aspect in the low exposure group is road traffic noise (3 participants).

The next topic dealt with participants' current view of Dusseldorf Airport. Most participants associate *travel* with the airport. 50 % of the high exposure group associate *aircraft noise* with the airport (20 % of low exposure group).

Furthermore, participants wish for honest, transparent, and open communication from the airport operator. According to participants, a fair and neighbourly relationship with the airport encompasses an *adherence to the night-flight ban* and *improvements of the sound insulation scheme* on the part of the airport.

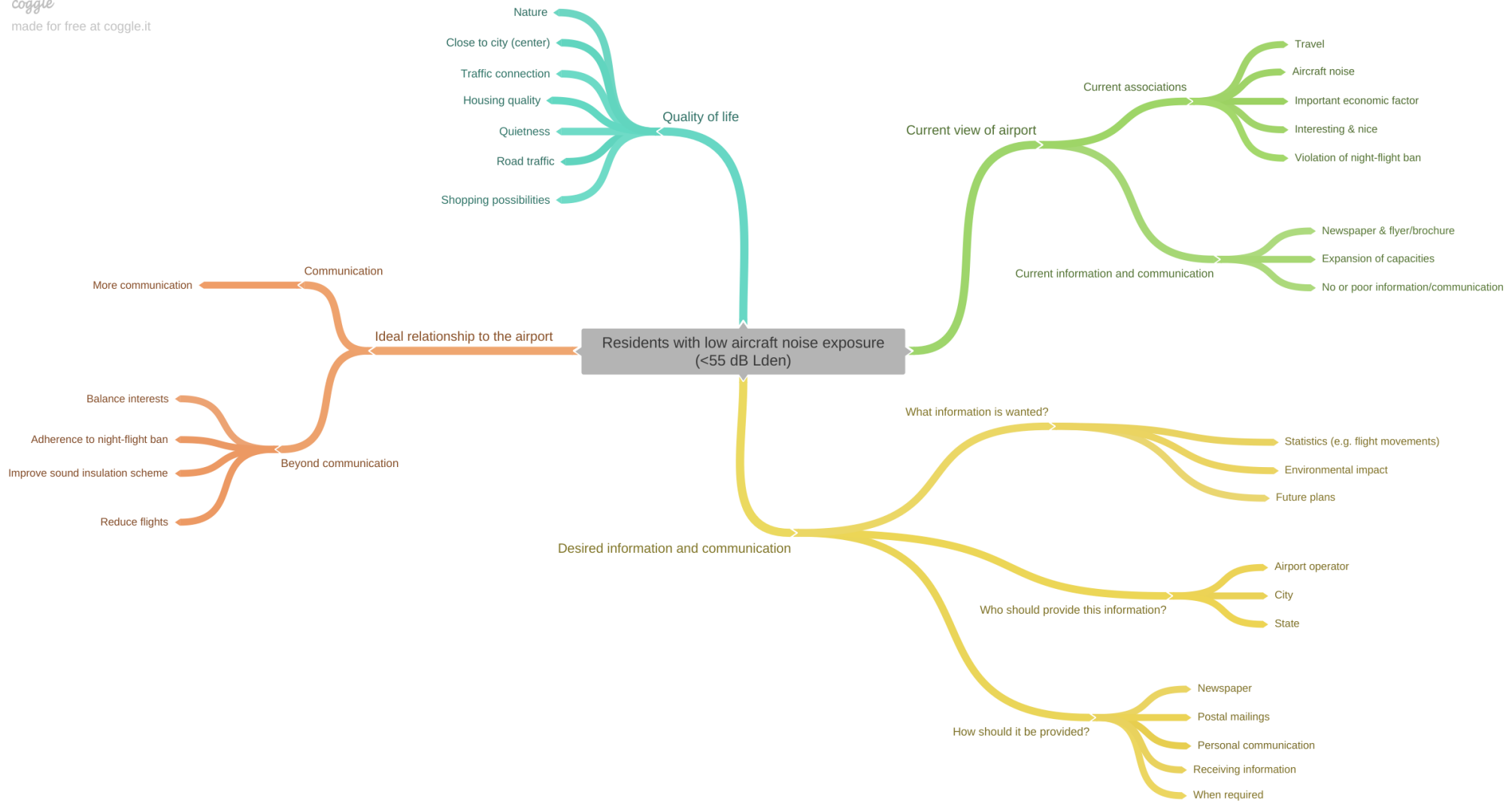


Figure 2: Mind map depicting main results of low exposure groups around Dusseldorf Airport

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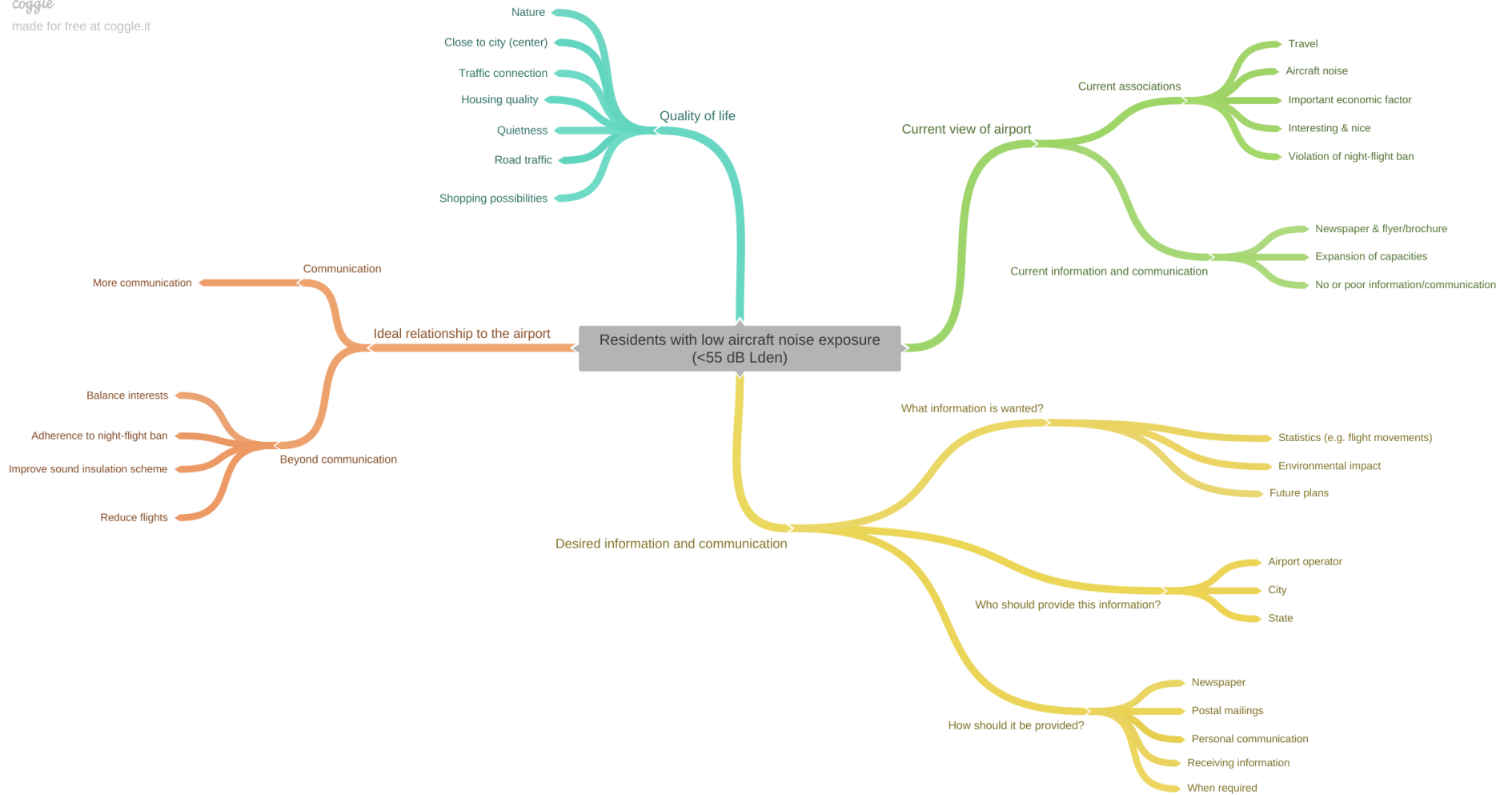


Figure 3: Mind map depicting main results of high exposure groups around Dusseldorf Airport

5.2 Results of the focus groups around Cologne-Bonn Airport

In summary, four focus groups were conducted in the vicinity of Cologne-Bonn Airport, two of them in regions highly affected by aircraft noise and two from less affected regions. The focus groups were audio-recorded and then subjected to a qualitative analysis. A detailed description of the sample and the results can be found in 10.3.1. Figures 8 and 9 give a rough overview of the results of the focus groups.

Summarizing with regard to the perception of factors that influence the **quality of life** of residents, all four groups report similar aspects. Positive aspects such as proximity to nature and good infrastructure were mentioned. In three out of four groups, noise was mentioned as the factor that most negatively affects their quality of life, in one group this was not being heard, closely followed by aircraft noise.

Regarding the **current view of the airport**, very different aspects came up in the different focus groups. Many positive aspects were mentioned, such as the connection to holidays or shopping opportunities. Negative aspects were sometimes the emissions, including noise, especially at night.

With regard to **desired information and communication**, it can be said that residents around Cologne-Bonn Airport would like an explanation as to why a ban on night flights cannot be established, as well as an explanation as to what effects air traffic has on the environment. In general, the airport could be considered as an information provider, provided that it is serious. Alternatively, neutral bodies would be desired. The channels of communication should be diverse and include radio, the internet, printed media, but also things like YouTube.

Residents see an **ideal relationship with the airport** on the one hand in that it tries to reduce noise as much as possible, and on the other hand in aspects that are similar to those of a real neighbour. They should be willing to actively approach the residents, be honest, open and respectful.

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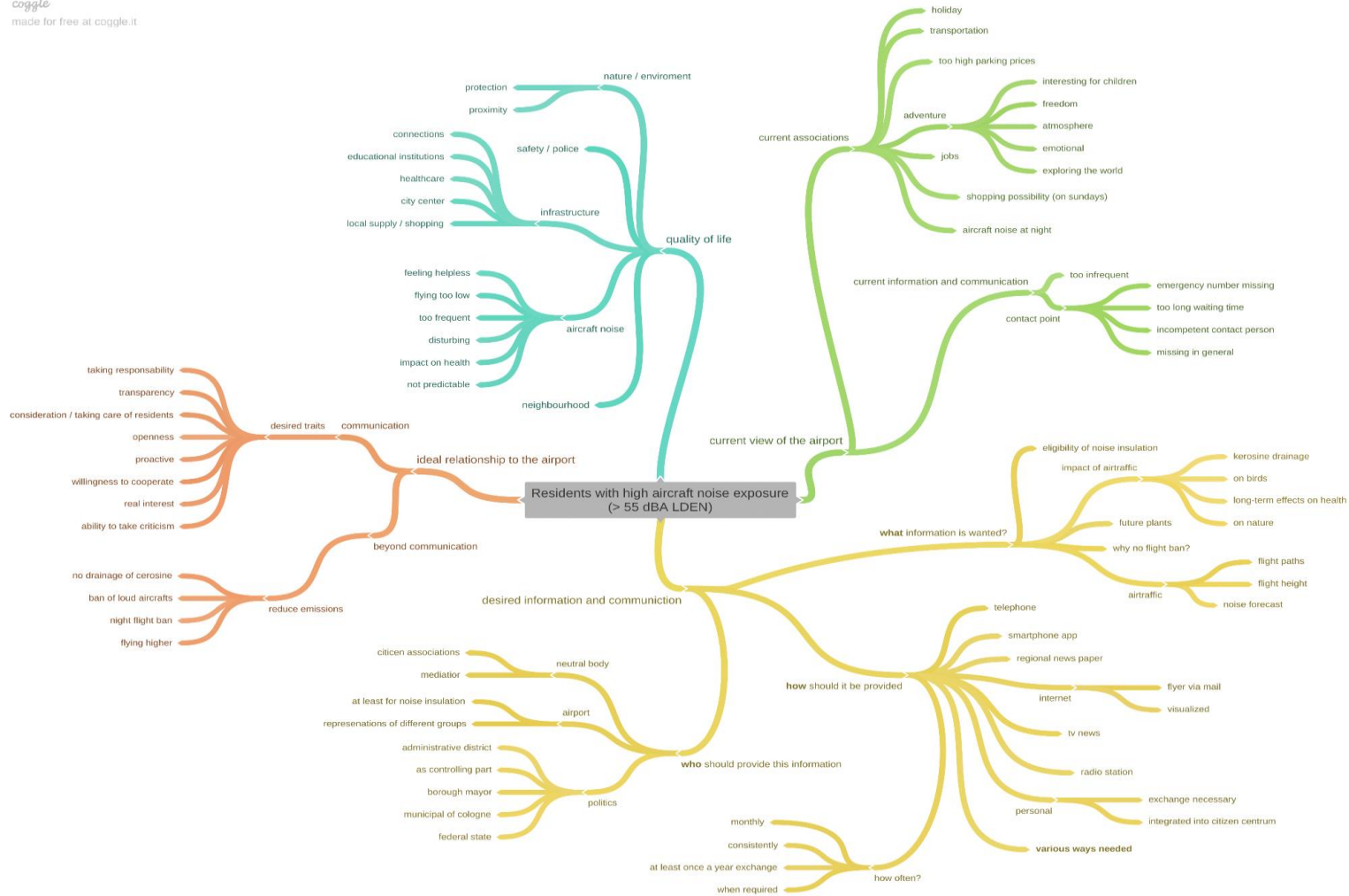


Figure 4 Mind map depicting main results of high exposure groups around Cologne-Bonn Airport

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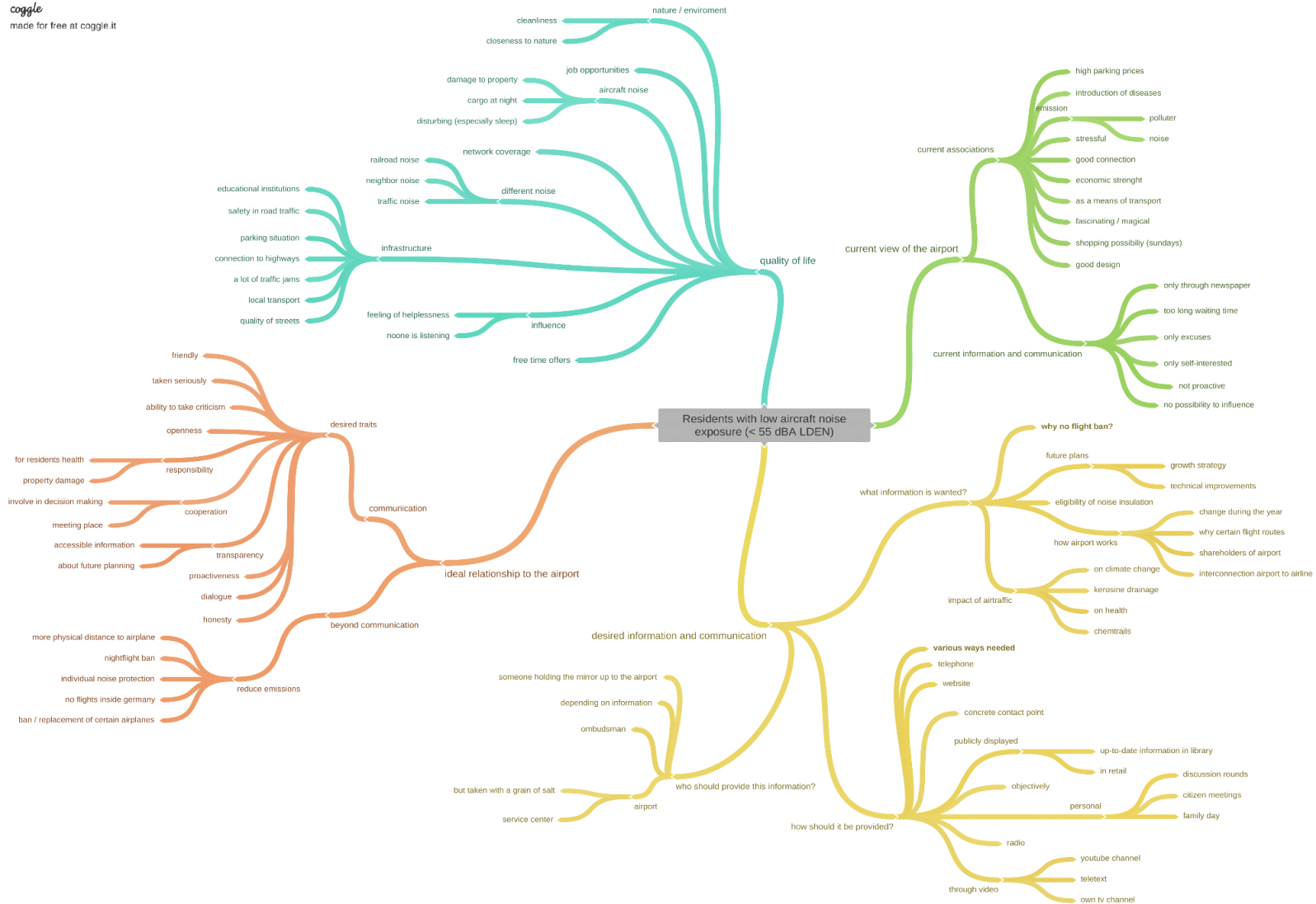


Figure 5: Mind map depicting main results of low exposure groups around Cologne-Bonn Airport

5.3 First round focus groups around Paris Charles de Gaulle Airport

A first round of focus groups was conducted in November 2019 around CDG airport using the same methodology as for the focus groups around Cologne-Bonn Airport. Two areas were investigated: one in a low exposure area with a sound exposure lower than 45 dB (Villepinte) in a rural area and one closer from the airport in an urban area, in a high exposure area up to 60 dB (Garges les Goneses).

Regarding participants' **quality of life**, there is not a big difference between both groups. Both mentioned that their town was well deserved for public transport and that it was convenient to have shops and cultural amenities in their neighbourhood. Nevertheless, they also regret the fact that their towns are very noisy (they both mentioned aircraft noise) and crowded.

Considering **the current view of the airport and the information disseminated**, on the one hand, both communities mentioned that it was convenient to have an airport close to their town as it provided job opportunities and it was easy for travelling. On the other hand, people of both towns revealed they were not well informed about aircraft noise management, especially for the sound insulation scheme grant. More than that, they both think that when information is given it is not going to change anything regarding their annoyance and that information without any action is neither sufficient nor acceptable. They reported a feeling of injustice and some mistrust when they were talking about the communication of the airport to surrounding communities.

Regarding **the desired information and communications**, both groups wanted to know how many overflights there are per day, how many people are impacted by that, how it affects their health and how to avoid that by adopting some coping strategies. Considering the desired source of the information, people of both communities mostly mentioned that information should be given by a neutral mediator using different media such as a town website, SMS, a mobile app, digital sign in the street or even by a mobile information point.

To finish, considering **the ideal relationship with airports**, it seems that the expectations of the two groups are different.

For instance, those who live in a highly impacted area (over 60 dB) would consider as a fair relationship a situation in which airports inform people about the impact of aircraft on their health, about the use of the money which comes from the penalties and about peak hours. An ideal relationship with the airport should admit a prohibition of flights for old aircrafts, a financial compensation for impacted households, and a way to prioritize jobs and training for people who live in the impacted areas. For those who live in a low impacted area (between 45 and 50 dB), a fair relationship includes communication from the airport based on an explanation of ongoing actions to lower the impact of aircraft on communities, more public meetings organised by Parisian Airport and a recognition from these latest of the provoked annoyance. According to participants, an ideal relationship with the airport should include a strong legal framework that protects them, should involve inhabitants in decision making and in a kind of participatory action (like sound recording for instance) and should think more about ecological impact instead of economical ones.



Figure 6 Mind map depicting main results of low exposure groups around Paris Charles de Gaulle Airport

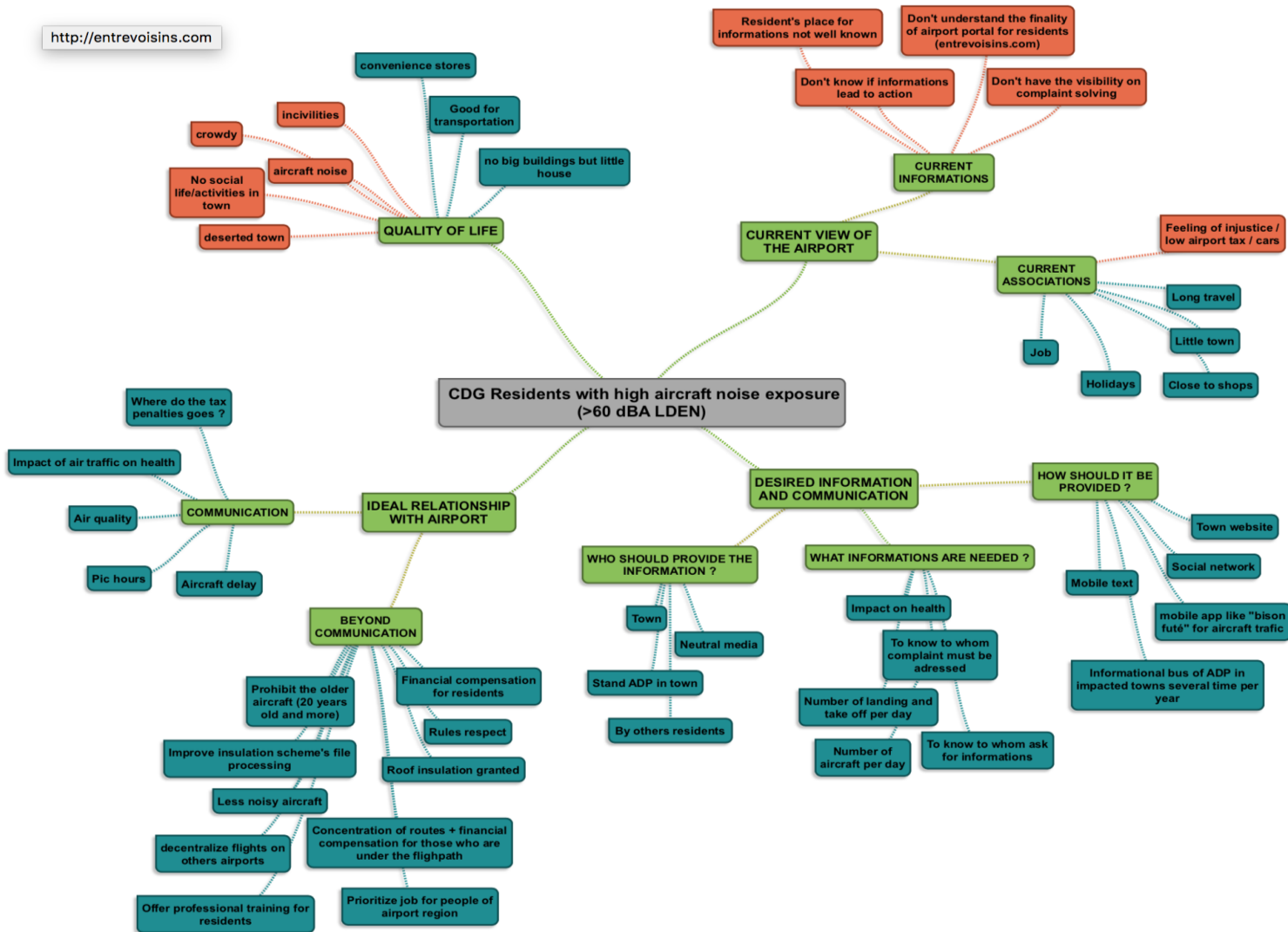


Figure 7 Mind map depicting main results of high exposure groups around Paris Charles de Gaulle Airport.

5.4 Feedback focus group around Paris Charles de Gaulle Airport

5.4.1. Goal and expectations

After a first round of focus-groups that aimed at understanding the need for information regarding air traffic and annoyance associated with that, we organised a second round of focus-groups with other people in the same areas as before, i.e. in low and high impacted areas in the vicinity of Paris Charles de Gaulle Airport. This time, we also compared rural versus urban areas to see whether the type of the residential area had an impact on participants' annoyance.

These focus groups aimed at:

- Design concepts for interventions (what does an optimal engagement and communication strategy for airport communities look like? How must a "fair" intervention be designed?)
- Create a baseline survey [from which base (what are the needs, expectations) an intervention starts?]
- Define framework conditions and rules (what rules must an intervention follow? Is there a need for an explanation of rules of fairness?)

5.4.2. Methodology

Residents interviewed for this study participated in a one hour and a half virtual focus group in the form of a discussion workshop. In total 5 virtual focus groups with 6 people each were carried out. Four focus groups involved inhabitants from rural versus urban areas and one involved members of a pressure group. A series of questions were proposed to them and they were invited to respond (see Appendix 10.3.3). The idea of the focus groups was to understand the social representation of fairness on the one hand and, on the other hand, to give the opportunity to inhabitants living under flight paths to design what they imagine a fair intervention and relationship with airport to look like.

Prior to the virtual workshop, a quality of life questionnaire was sent to participants. It was the same questionnaire as in the first focus group organised previously. The questions concerned different types of inconvenience such as air pollution, lack of green spaces, road traffic noise, aircraft noise, neighbours not sympathetic, delinquency or insecurity, population density, the cleanliness of the

neighbourhood, traffic jams, the quality of public transport and the visual appearance of the life place on which participants were asked to express their level of annoyance on a 5-point Likert scale from "1 not bothered at all" to "5 very strongly bothered". Information concerning their socio-demographic situation was also requested such as their age, profession, place of residence, length of residence, etc.

The focus-groups began with a round table for each participant to introduce his- or herself and a short game to make participants feel comfortable before starting questions about their relationship to the airport. After this brief introduction, the workshop followed the outline of the focus group grid.

The following part was organized in four sub-parts (see Focus Group Grid on p. 120). The first was to gain insight into the relationship participants had with the airport and what was an ideal relationship for them. The second consisted of presenting the results obtained in focus groups carried out a year earlier concerning quality of life and their perception of airport activity. We asked participants if they agreed with what was presented and if they had anything to add. Third, a brainstorming session was conducted to imagine how, in concrete terms, the relationship with the airport could be fairer. It was introduced by the Chinese portrait of justice (e.g. If justice was a place, it would be..."; (Magnen et al., 2019). The last questions have been imagined on the basis of the "chinese portrait" method (Magnen et al., 2019), i.e., they were based on the conditional structure "if it was a(n) X, it would be ...". This part was included because it remains important to us to better understand the notion of fairness before designing any kind of intervention based on this topic. By using the Chinese portrait, participants can describe more deeply their idea of what fairness should be in general. It gave insight on this notion to better design their own view of a fair intervention and a fair relationship with the airport in the next exercise of the workshop.

Then as the brainstorming progressed, the ideas raised more precisely and more concretely to the relationship with the airport. The aim was to generate ideas and concrete solutions to improve the relationship with the airport and involve residents in the decision-making process. In the final part, the participants were invited to use these ideas to imagine, by putting themselves in the shoes of an airport manager, an intervention to respond to residents' anger regarding their

quality of life. The intervention had to be built on temporality (in 5 years) by specifying the "where", "when", "how", and "with whom? ". At the end of the workshop, a question concerning their expectations regarding the resumption of post-containment traffic was addressed to them.

5.4.2.1. Sampling

The participants were recruited through the STEPHENSON design office, which was responsible for providing them with the necessary appointment and connection information.

5.4.3. Results from focus groups

The data collected during the focus groups allowed us to understand the current relationship that participants have with the airport as well as ways to improve this relationship to make it ideal. They were able to organize these ideas into a detailed and operational intervention proposal.

5.4.3.1. Actual relationship with airport

Regarding their current relationship with the airport, the majority of participants, all groups combined, seem to have a good relationship with the airport. They set out several advantages of living close to the airport, such as the practicality of proximity, the usefulness and the economic and tourist activity zone that the airport constitutes. They also indicate favourable contextual factors such as the fact that their house is well insulated for groups living in urban areas and that the countryside is a pleasant environment for participants living in rural areas. In addition, the vast majority of them seem very little disturbed by aircraft noise, expressing that the noise is not bothersome and that they are used to it. They do agree, however, that noise is more annoying outdoors and during summer when the windows are open. Some say they are more bothered by other airports such as the aerodrome and these leisurely planes, helicopters or Le Bourget airport.

However, some participants seem to be more bothered by the frequency of nuisance caused by aircrafts from CDG airport indoors, especially at night, where the noise is unbearable according to them.

The participants expressed other disadvantages related to the presence of the airport such as pollution (deposit of kerosene / oil on cars, balconies), insecurity around the airport (pickpockets), traffic jams, delays in public transport, and unsanitary roads and surrounding towns.

In general, we note that the most exposed participants and those who live in rural areas complain the most about aircraft noise.

5.4.3.2. Ideal relationship with airport

Regarding their ideal relationship, participants expressed several ideas which they then translated into more specific elements.

Their ideas evolve around relational concepts that would promote a good relationship with the airport such as sharing / exchange, fairness, mediation, trust as well as recognition. On a more practical level, there are things like communication, benefits, being involved, performance and compensation. They also express a whole bunch of ideas that refer to how these solutions should be implemented such as transparency, respect, proximity and recognition.

Concretely, these ideas translate into improvement solutions directly affecting noise reduction, noise compensation and communication.

At the noise level, they indicate the reduction in traffic or even a total reduction in noise as constituting an ideal relationship. Regarding compensation, we find solutions linked to advantages or compensation such as priority for employment for young residents, a preferential rate for airport parking, reductions for flights, a tax exemption and for isolation procedures to be simpler and accessible to more remote areas. They also suggest free medical visits related to the impact of noise and air quality. In terms of communication, participants would like more information about the health risks, pollution, and the efforts put in place. They recommend newsletters (mail and paper), websites, mobile applications and monthly public meetings as means of communication.

Other aspects related to the presence of the airport are also stated such as making efforts regarding traffic jams, the state of roads and public transport (cleanliness), insecurity (pickpockets) with a police presence apart from ADP and the development of tourism around the airport (for example, upgrading the Aeroville shopping centre and making it more attractive to tourists). Some groups offer more developed solutions, such as group 4 which proposes the creation of an intermediary mediation service for residents. These proposals had the opportunity to be developed when they had to consider a full intervention in the last part.

As forms of engaging residents, participants mention surveys and polls, as well as seminars and meetings with neutral stakeholders, followed by specific

improvements. From a practical point of view, they propose to organize tours of the various stations of the airport. They also suggest organizational elements such as the creation of a user's committee, the election of municipal representatives, participation in general assemblies and sitting alongside ADP to participate in decision-making.

They also recommend involving the city and being present in schools. For example, for middle and high schools, they offer the organization of a career forum for students which would present aeronautical jobs or parent-child workshops.

5.4.3.3. Interventions imagined by residents

5.4.3.3.1 On the organisation of the intervention

In general, the four interventions envisaged by the groups are based on the same structure. They first propose to collect residents' problems through questionnaires or surveys, then to bring them together to discuss the issues in the form of an exchange forum or public meeting made up of the various actors (ADP representatives, residents' associations, elected officials) in which an action plan would be discussed and formulated. Communication is very important at all stages of the intervention to keep residents informed of the progress of the action plan. Moreover, residents should be consulted very regularly regarding decisions. Once the action plan is in place, the participants insist on evaluating the consequences of the improvements implemented in the form of a satisfaction questionnaire which would include qualitative and quantitative data and would allow, once the results have been collected, to adjust the improvements or develop new ones.

Some groups recommend, upstream of the development of the action plan, to compare themselves with other airports (USA, Asia, Europe) and finally to extract good practices. Others also propose electing residents' representatives at the end of the meetings and establishing partnerships (communities of municipalities, cities, transport companies, etc.). Two groups are proposing organizational elements such as the fact that the airport sets up a service dedicated to intervention which would be made up of different poles depending on the improvements to be put in place. Some believe that it is necessary to monitor the implementation of the action plan, especially by independent bodies. One group is considering European expansion in the hope that European bodies could be formed after a certain time (5 years) and would develop directives and measures at European level.

5.4.3.3.2 On the interventions to be implemented

The main interventions, i.e. those on which the participants insisted the most, vary greatly between the groups. Some groups such as group 1 and 2 (rural areas) opt for independent improvement elements such as the creation of an exchange forum / round table (made up of health, pollution, legal experts) at the start of the process. Other interventions were mentioned as well such as the installation of window insulation on the territory, the upgrading and reform of aircrafts as well as a continuous communication campaign concerning risks and pollution or even the creation of a site in which all the necessary information could be found (traffic information, isolation procedures, information on risks and a place for complaints). Group 3 focused on cleanliness and safety and proposed in its action plan a system to take care of roads and cities and to make them safer. They offer an annual forum on aeronautical professions and interventions in schools. Group 4 opted for a more substantial and complete system, by proposing the establishment of a multidisciplinary reception and mediation centre made up of different poles to help residents (doctors, legal experts, experts in quality of life and environment, etc.).

Secondary interventions come in the form of benefits such as a preferential rate for parking and flights, free shuttles or compensation such as lower taxes, prioritizing young people for jobs and visits to local communities or various stations at the airport. Regarding noise directly, participants mentioned the reduction of noise and pollution, a better distribution of flights and the contour of certain noise corridors and choosing less noisy aircraft manufacturers. These noise reduction solutions are stated only by groups 1 and 2 (rural area).

5.4.3.4. Actors, functions and roles envisioned by residents

In general, all four groups propose the same stakeholders being involved in the different interventions. Paris Charles de Gaulles Airport is proposed to finance the intervention and the various mechanisms that make it up, take care of their implementation and participate in communication. The stakeholders should consider residents' problems, monitor and evaluate the implementation of the intervention and participate in meetings and in the development of the action plan. The city / town hall organizes the meetings / round tables, provides the premises, and participates in communication. Depending on the intervention, it can also intervene in the implementation of certain mechanisms (school intervention, forum organization, etc.). Group 1 also involves an independent body responsible for

monitoring the implementation of the intervention and carrying out risk studies. In all cases, ADP works alongside these actors at each stage.

5.5 Results from members of pressure groups of ADP (Aéroport de Paris)

Given the particular context in which members of the pressure group find themselves, its responses were treated independently of other groups.

5.5.1. Actual relationship with airport

The current relationship of pressure groups members with the airport is significantly less positive than that of the other groups. They express enormous stress and frustration related to the frequency of aircraft noise (indoor and outdoor), which they describe as untenable and unliveable. For them, double glazing of windows is insufficient. The noise exposure impacts their sleep and their state of health. They all report a decrease in quality of life. One participant was even forced to move twice to improve his quality of life. Indeed, by moving into their current home, all had several expectations in terms of quality of life that were disrupted by the arrival of planes.

5.5.2. Ideal relationship with airport

According to the pressure group members, an ideal relationship would encompass a recognition of their expert capacities, listening and real dialogue, accompanied by mutual trust. They want full information and to be involved in the decision-making process. They wish the airport would not be afraid of them.

Concretely, these ideas translate, for example, into a better legal framework and a right to vote on decisions. They challenge the omnipresence of ADP in decisions and demand an operation in the form of governance in which each actor has the same weight. Moreover, they would prefer to be better consulted and earlier in the decision-making process. They also recommend regularly calling on independent expertise (ACNUSA). Regarding communication, they ask for information on the results of short, medium- and long-term impact studies. They also consider it important to address other issues such as climate change and pollution beyond noise pollution.

It is necessary for them to involve residents by listening to them more, and by including as many communities as possible. They believe that they should be

educated about their rights and hold frequent public meetings. They also propose electing closer direct representatives to raise the profile.

When we presented them with the results of the previous focus groups, they made certain remarks in relation to the requests of the residents previously interviewed. They believe that compensating and informing is not enough, that the jobs offered by ADP are too qualified and do not correspond to the population overflow, that the fines are not dissuasive enough and that the decentralization of thefts is counterproductive because they favour the general interest. For them, insulation is necessary but not sufficient given the outside noise levels.

5.5.3. On the interventions to be implemented

The stages of the intervention imagined by the pressure group are relatively similar to those of other groups. They propose to start by collecting the problems (e.g. via telephone surveys), compare themselves with other airports as suggested by a group, evaluate the action plan once implemented, update the measures and develop new ones. Nevertheless, they add a central step at the start of the intervention which consists of making the context of the implementation of the action plan and restrictions favourable by legislating and revising the noise prevention plan in the environment, all of this in total transparency.

The main mechanisms developed consist of sanctioning arrivals without slots, legislating with the DGAC and revising the noise prevention plan in the environment as set out above. They also propose to implement a night-flight ban. Secondary devices are just as important and consist of putting in place other measures to reduce the number of people exposed to noise.

5.5.4. Actors, functions and roles imagined by pressure group

Regarding the actors, we find, as with other groups, ADP which collects the problems, finances, manages and evaluates the implementation of the intervention and adjusts and updates the measures at the end of the evaluation. The role of the associations is to control and validate the questionnaires intended for residents and participate in the evaluation of the intervention, which will be carried out with all the stakeholders and managed by a mediator.

5.5.5. Conclusion

Thus, we can notice that the different groups express other disadvantages related to the presence of the airport near their home, beyond the noise annoyance, which seems not to bother them very much for the most part. However, participants

residing in rural areas seem to be the most disturbed by aircraft noise. When settling in the countryside, expectations of living conditions can be disrupted by aircraft noise. This is what the members of local residents' associations are saying, who are very disturbed. Their relationship with the airport is also very negative unlike other groups. They are demanding more rights and recognition, and the reduction in air traffic is at the heart of the intervention they have devised. They also orient their intervention on an organizational aspect in order to make the context favourable (legislate, consult independent bodies, *etc.*). In the groups of residents, their intervention concerns the compensation of annoyance rather than the reduction of it (except for groups 1 and 2, some members of which mention elements of noise reduction). Their involvement in decisions is essential for them through public meetings or discussion forums. Communication is also very important, especially with regard to health risks. Association members, as well as residents, suggest the involvement of towns and communities of municipalities which would play a role in communication and the organization of meetings.

5.6 Results from the Focus Groups around East Midlands Airport, United Kingdom

Focus groups at Manchester East Midlands Airport followed the same methodological approach as at Cologne-Bonn and Charles de Gaulle airports. Participants were recruited via door-to-door recruitment by researchers from Manchester Metropolitan University over the course of two days in January 2020. Focus groups took place at three locations:

- **Melbourne:** A small town to the West of the airport with a population of approximately 4,800 people. This community is largely subjected to departing aircraft and most residences are situated between the 55 and 60 L_{den} noise contour. Hence this location was selected as a 'high exposure' focus group location.
- **Kegworth:** Kegworth is a small town of approximately 3,600 people situated close to the end of the runway to the East of the airport. Due to its location, residences are between 65-70 L_{den} and less than 55 L_{den} . Due to the proximity to the airport and the fact that the noise exposure level is around 60 L_{den} plus, this location was selected as a 'high exposure' focus group.
- **East Leake:** A small town of approximately 6,300 people, located several kilometres to the East of the airport, predominantly underneath arriving

aircraft. Most of East Leake falls under 55 L_{den} or below, and coupled with its distance from the airport, the area was selected as the location of a 'Low exposure' focus group.



Figure 8: Map showing East Midlands Airport and the surrounding conurbations, including the location of the selected focus groups in Melbourne, East Leake, and Kegworth.

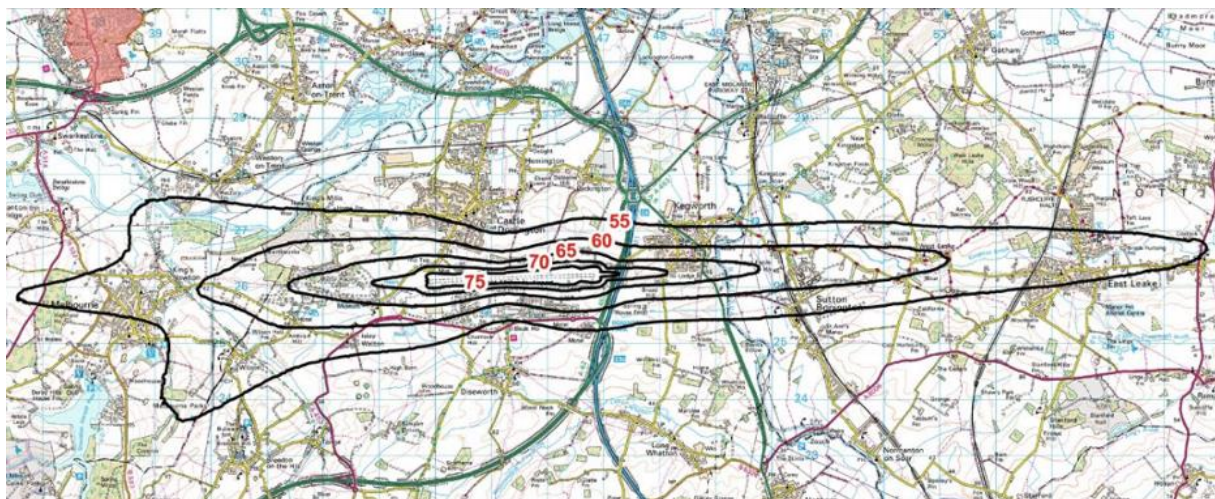


Figure 9: East Midlands Airport 2016 L_{den} Noise contour Map

Researchers over-subscribed for participants to attend the focus groups, and participant incentives were provided for all attendees, however all focus groups experienced a high attrition rate in terms of the number of people attended. In total, 11 people took part in the focus groups (3 from East Leake and Melbourne, and 5 from Kegworth). Although too small to be indicative of wider community views, the responses are useful in terms of understanding how residents feel about the airport and the communication they receive.

Responses from the high-exposure and low-exposure communities are summarised in Figure 10 and Figure 11, categorised by the four areas of investigation also conducted at Charles De Gaulle and Cologne-Bonn Airports:

quality of life, current view of the airport, desired information and communication, and the ideal relationship with the airport sought. Responses in each of these themes are presented in turn below.

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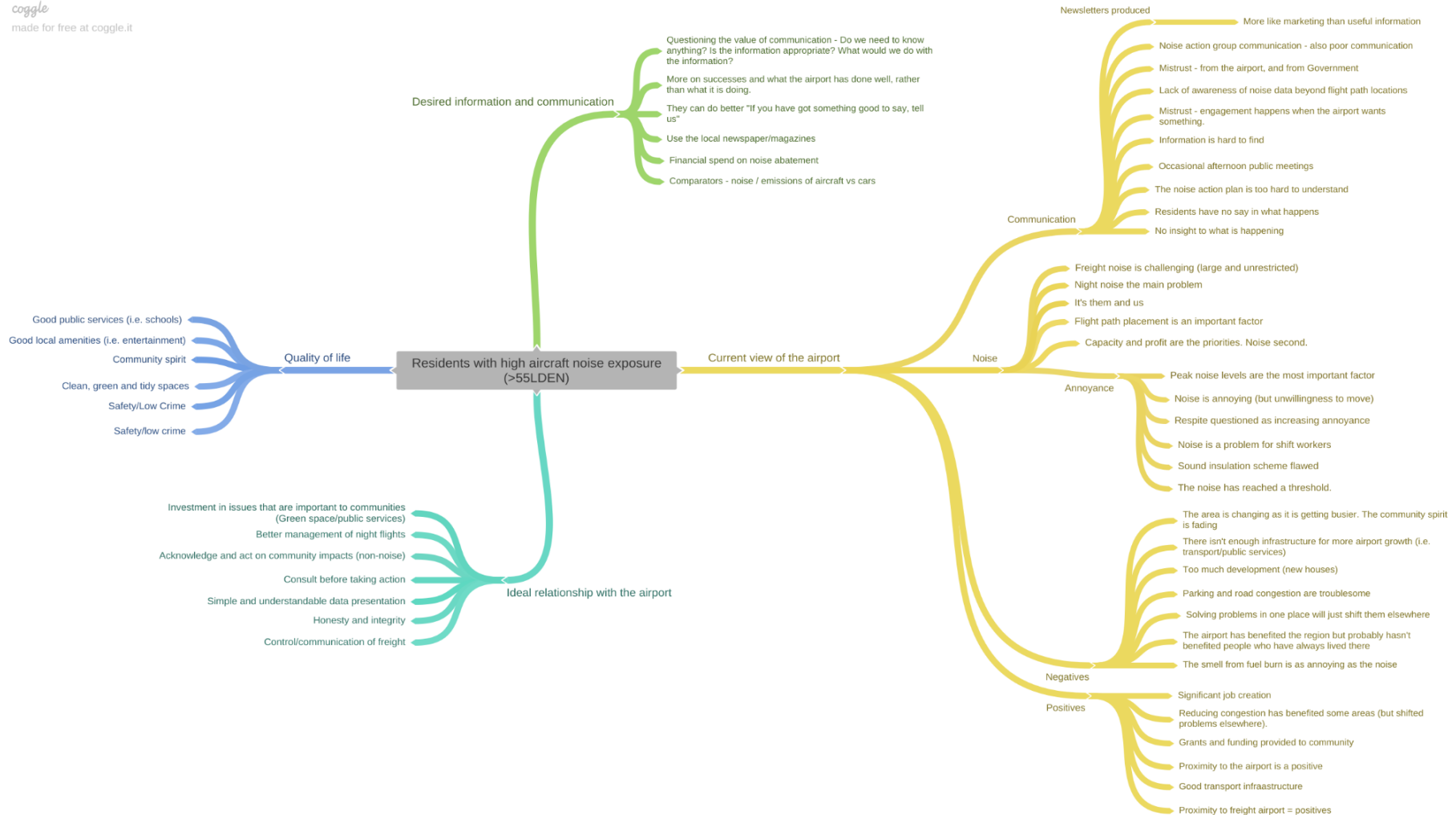


Figure 10: Illustration of the key messages from the participants classified as living in high exposure areas

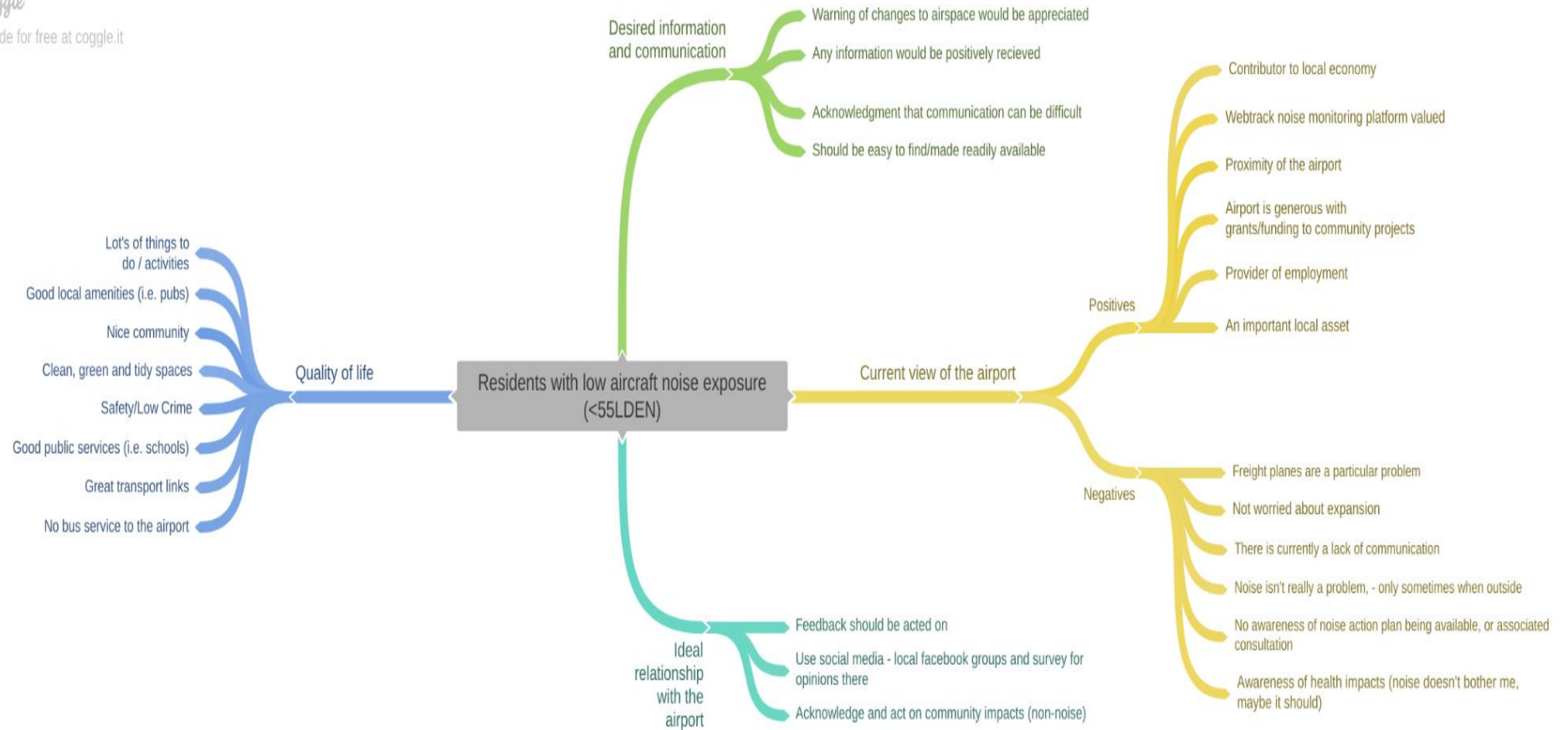


Figure 11: Illustration of the key messages from participants classified as living in low exposure area.

5.6.1. Quality of life

Residents in both high and low exposure communities all seemed to value the same sort of quality of life issues, both prioritising things like green space, a clean environment, low crime, and a plentiful supply of local amenities including access to pubs, and restaurants. That the responses were so similar is likely to be due to the fact that all the areas surrounding the airport were relatively similar. Melbourne and East Leake in particular being rural village-type towns typically based around a central high-street and surrounding residences, with countryside beyond that. Kegworth is a similar area, albeit somewhat larger and more densely populated, but with similar access to amenities and countryside. Several participants referenced what it was like in other areas, suggesting that transportation across the region to access different conurbations and towns was common. All communities cited good public services (schools/police) as something that they felt their areas had access to, but that such services were coming under stress as a result on the increasing population in the communities, driven by the creation of jobs by the airport, and the good transport links created by the airport turning the towns into 'commuter towns' from which people could reach larger cities. Despite all areas claiming that 'community spirit' was important to them, they also referred to the fact that this spirit and the 'village feel' of the area was being degraded by the airports existence and that this was a negative experience, even though the airport was increasing the number of jobs and investing into local community schemes.

5.6.2. Current view of the airport

It was notable that people in East Leake (the low exposure community), did not typically see noise as something that impacted their quality of life, seeing it only as a problem when spending significant amounts of time outside, for example during the summer. They were not worried about expansion and generally found it more difficult to respond to questions about noise and noise impact, beyond an awareness of larger, louder and freight aircraft often arriving at night. Instead, participants focused on positive aspects of the airport such as proximity (for holiday travel), good transport infrastructure, job creation, and funding provided by the airport to community projects. For residents in high exposure areas, there was the aforementioned worry that development was detrimental to the area, but also that parking and road congestion was a problem, and that the growth in the

area in terms of population was not being reflected by investments in infrastructure (i.e. public services). Smell from engine fumes was also cited as an issue – as much as noise for one participant. These residents were also much better equipped to talk about noise issues in the area and discussed a wide range of impacts and awareness of how the airport operates. Peak noise levels were cited as an important feature, as well as night noise. There was also a belief that noise had reached a threshold limit in the area where it had started to become a problem, participants also showed a general mistrust of the airport, seeing them almost as an enemy (“it’s them against us”). When asked about communication they were particularly critical, noting that information is often hard to find, or communicated inefficiently. They felt they had little or no say in decisions that happen at the airport, and mistrust information that they are able to find – although interestingly they also critiqued local noise campaign groups for similar problems. All participants found communication information shown to them that the airport had created in recent years relatively incomprehensible, even after it had been explained to them.

5.6.3. Desired information and communication

Although participants of the low-exposure group were less vocal regarding noise than the high-exposure groups, they did have opinions regarding how they would like to be communicated with, stating that they would like to be warned of any changes to airspace before changes are implemented. They were also of the opinion that the airport could do more to promote the work it does around the community and that this might help to influence perspectives about the noise that they are exposed to. They also felt that communicated material should be both easy to understand – and easy to find. Interestingly, they also acknowledged that communicating complex noise data is a difficult task, and had empathy for those tasked with doing so. The high-exposure groups were more critical of communication and engagement, questioning what the value of communication and engagement is and if knowing what was happening (measured noise levels) would actually serve them in any way as they would remain helpless and unable to do anything to make the situation better. They felt that attempts at communication that they had seen were often more of a marketing exercise than a genuine attempt to talk about noise, and that they would like to see more on what the airport is doing around the community, and success stories about things it had done well, rather than things it is doing. Generally, they thought that

communication should happen in places where they already have their attention (Facebook, community newspapers). They raised the idea of seeing how money was being spent on noise abatement as a metric to understand the airports management priorities.

5.6.4. Ideal relationship to the airport

Low-exposure focus group members felt that they would like a relationship with the airport where feedback provided to them would be acted upon, and that social media platforms such as Facebook would be a good way to do so as it is built in functionality for dialogues and is already where many of them spend their time. They also wanted the airport to spend more attention on local communities – acknowledging the impacts to their community as a result of the airport (noise/congestion/strain on public services), and to better contribute to enhancing these issues rather than spending resources on noise abatement. The high-exposure community groups also wanted to see greater attention on local environmental quality factors such as green spaces and public services, but they also wanted direct action on noise – notably regarding a reduction in night flights, and giving residents more communication and control over freight aircraft arriving during these sensitive hours. In terms of communication and engagement, they wanted to see the airport do so with honesty and integrity, i.e. through genuine processes of consultation, and taking care to communicate information in simple and understandable ways.

5.6.5. Summary

Participants of the low exposure group were less informed about noise they were exposed to, and indeed felt less impacted by the airport, despite being directly underneath the flight path. They tended to see the airport in a good light, although they had empathy for those who were exposed to more noise. As might be expected, the high-exposure groups felt more strongly about noise and had much more to say about its impact upon them and its potential management and communication. They felt more helpless than the low-exposure residents and although they acknowledged that the airport had contributed to the area in many ways, that this development was also having a negative impact in terms of how they felt about the place in which they lived.

5.7 Conclusion

The following conclusions can be drawn with regard to the results of the in-depth interviews and focus groups conducted around Dusseldorf, Cologne-Bonn, East Midlands and Paris airports.

5.7.1. Quality of life

In summary, nature is mentioned as the most important factor that positively influences quality of life. Aircraft noise was named as the factor most likely to negatively influence quality of life around Dusseldorf Airport. In Cologne, aircraft noise was also mentioned, but here the focus was particularly on night flights, which is possible due to the lack of night protection concepts. Residents also emphasise that there is little opportunity to get involved in the decision-making process.

In Paris, in addition to aircraft noise, it is especially noise from road traffic that has a negative impact. A similar tale is true for the East Midlands, where the airport was recognised as making both positive and negative contributions to local quality of life.

5.7.2. Current view of the airport

It is not only negative aspects that residents associate with the airport. Many associate the local airport with travel and see it as an important economic factor in the region. The airport as an employer is also mentioned in Paris and East Midlands. One factor that is often perceived as negative is the high parking costs, an aspect that could certainly be easily changed, at least for residents. This applies to residents of Cologne as well as Dusseldorf. In Cologne, however, it is rather the emissions that determine the primary perception of the airport.

5.7.3. Desired information

Regarding the desired information and communication, it can be summarised that affected residents attach particular importance to open, honest and transparent information.

It should be emphasised that residents in Cologne unanimously want information on why there is no night flight ban in Cologne-Bonn. In Paris, it is especially information about noise protection that is requested.

There were various wishes regarding the source of the information. However, the airport could be the appropriate source, provided it is honest. This shows that a

basis of trust has to be created first. Alternatively, the suggestion came up in Cologne to involve a neutral third party.

5.7.4. Ideal relationship to the airport

An ideal relationship with the airport is characterised by two aspects. First, the airport must do everything technically possible to reduce noise exposure. In doing so, it is perhaps necessary to demonstrate these efforts to affected citizens.

Secondly, affected residents described an ideal relationship with the airport as one based on transparency and honesty. In Cologne, other aspects are also emphasised, such as the desire to act like a 'real' neighbour. This means dealing honestly with citizens, involving them in decisions and processes, and taking residents seriously.

The results gathered can be used to derive specific recommendations on what ideal communication and engagement with affected residents looks like. This is discussed in the next section.

6. Guidance on communication & engagement

Noise managers increasingly understand the role of non-acoustic factors in contributing to annoyance. Addressing such factors is however complicated, and coupled with external pressure for absolute reductions in noise, has meant that the majority of noise management actions focus on addressing acoustic factors. Although such an approach is understandable, doing so has not always led to successful outcomes - hence why noise (as measured through metrics such as noise level equivalents) has remained stable or fallen at many airports, against a background of increased levels of reported annoyance.

Despite the continuing trend that communication and engagement are increasingly recognised by airports, there is a lack of clear recommendations on what constitutes successful communication, how to implement it and how to evaluate it. Therefore, what needs to be emphasized here is that any kind of communication and engagement should be underpinned by certain quality criteria and theoretical principles. For this purpose, we suggest focusing on principles derived from research on fairness in social exchanges. This is relevant for building up long-lasting trust and acceptance of the airport. Great progress in the ANIMA Project was achieved since not only theoretical recommendations were derived but their

application in practice was assessed as well. So how have airports been performing in terms of communication and engagement? This has been a key question throughout the ANIMA Project. Airports have been communicating about noise for many decades, with approaches moving over time from a purely dissemination of information approach, towards processes more aligned to consultation and engagement that can aid airport decision-making.

In a review of airport case studies across the European Union, ANIMA research (Deliverable 2.5), came to the following conclusions about communication and engagement:

- There has been an evolution from communication towards more participative forms of discourse, notably an increase in consultation and the development of airport-community noise dialogue forums or community programs.
- However, communication and engagement tend to happen in a relative ad-hoc manner with data provision often following guidance to produce quantitative noise data only, and with such data often being disseminated in ways that publics find hard to comprehend.
- Communication and engagement tend to remain largely about information provision rather than leveraging the potential benefits of engagement in light of the role of non-acoustic factors.
- Communication and engagement often happen without an intended outcome that seeks to address given challenges or needs.
- There is rarely any evaluation as to the impact of any communication and engagement.
- Communication and engagement are generally seen as ancillary noise management activities, rather than as playing a key informing role in the success of other interventions, or as a management tool in their own right.

As with all aspects of noise management, it is important that airports do not follow prescribed advice based on 'best practices' from elsewhere, but rather base their actions on their own definitions of 'good practice' as appropriate for their own circumstances. That said, there are some core guidelines that can help to ensure

that good communication and engagement is taking place between airports and their surrounding communities. In the table below, we set out a range of recommendations that airports should consider when looking to conduct 'ideal' communication and engagement with residents. The recommendations below are based on aspects of fairness psychology, findings from the previously described focus groups and in-depth interviews with airport residents, as well as findings from previous studies on aircraft noise research.

In the next chapter, concepts of communication and engagement are extended to include evaluation, an important component of noise management that can empower airports to discover important data about noise, to design effective noise management measures, and to assess practice.

6.1 The 'IDEAL' characteristics of communication and engagement

I	Inclusive and diverse: No communities or hard to reach groups should be left behind. This can include those who do not have a history of complaints, difficult to manage groups, those in deprived areas or those consisting of different nationalities.
	Information provision: Residents should be provided with data relevant to them. This means taking the time to understand what those data are, how they can be illustrated or described, and what appropriate communication channels might be.
	Impartial: Advanced communication and engagement is not an easy task as it can involve having difficult conversations with conflicting voices. Independent facilitation can help overcome these challenges whilst also providing access to experts, e.g. for conducting focus groups and workshops. Data provided by impartial experts can also help to build trust.
	Interrogate: It is important to ask questions about any pre-held perceptions about noise problems and their likely solutions as what may appear to be a challenge to be solved (i.e. reducing complaints), may actually be triggered by something at a deeper level. Assessing such perceptions and gaining insight from residents can be a useful way to understand how core challenges can be addressed, to identify targeted outcomes, and to establish potential criteria on which such outcomes can be evaluated.
D	Decisions: All stakeholders may have expert knowledge that has the potential to inform decision-making, or to influence the potential success of a given intervention. Therefore, it can be helpful to perform stakeholder analysis or stakeholder

	<p>mapping when performing any activities that are likely to influence noise to identify two factors: who has interest in the issue, and who can have influence over the issue. With this information it is possible to determine who should be engaged about noise - although it should be considered that sometimes there can be unintended and unexpected consequences that could affect groups. Hence, it can be helpful to include all groups in engagements in order to develop well rounded understanding.</p>
	<p>Direct: Airports should be honest with the citizens. This means that airports should start communicating honestly, directly and transparently from the beginning of a decision process. Additionally, it should be directly communicated about the consequences decisions have on local citizens.</p>
<p>E</p>	<p>Early: Communities should be communicated with early and often throughout any changes that may affect them. This is important to make them aware of what is happening, but also to understand their needs, preferences, fears and so on, and to communicate any potential changes to the noise they may be exposed to (be it on a trial or temporary basis).</p>
	<p>Easy: It is important that data is communicated and explained as clearly as possible and that it is easy to understand without any previous knowledge or expertise. Presenting complex information that people find difficult to grasp can lead to airports being accused of hiding data by purposely putting up barriers. Communication and engagement should be tailored to the characteristics of each airport and community group and what the interaction sets out to achieve. This includes using appropriate language and data, both in terms of relevance to the subject of the communication or engagement, but also to the expertise and comprehension of the recipient.</p>

	<p>Explain: Airports should not just be explaining what has happened and what the results of any changes have been. They should also clearly articulate, why decisions have been made, whether other options were considered, why other options may not have been selected. Noise action plans can be a great way to demonstrate that noise has been addressed at a strategic level.</p>
	<p>Empathy: Effective communication and engagement means going beyond numbers and thinking in qualitative terms by developing stories of the lived experiences of residents and developing and acknowledging empathy for those stories. Airports can also tell their own stories to help articulate the significant difficulties that they have in managing noise, thus helping to foster empathy for their own situation.</p>
<p>A</p>	<p>Accessible: Information should be easy to find and not hidden in technical reports, or multiple clicks into a website. For communication to be received effectively its intended audience should be able to access that information as easily as possible. Hard to find information gives the impression of mis-intent, which can be harmful to trust in airport-stakeholder relationships.</p>
	<p>Authentic: Communication that does not set out to convey a certain message or has some intended outcome should generally be avoided as it can be considered as communication for communication's sake. Rather any communication should have some targeted outcome or rationale for taking place. Meanwhile, engagement should be based on concepts of empowerment, trust and learning - engagement without these factors is less likely to lead to socially-optimal outcomes.</p>
	<p>Accurate: It is easy to begin any decision-making process with perceptions of the challenge and any likely solutions. It is no different for noise. What can be perceived by an airport to be an issue that needs to be solved by obvious operational</p>

	<p>solutions may not actually be the core issue that needs to be addressed. For instance, setting out merely to reduce complaints is not likely to be as effective as setting out to solve the 'triggers' to those complaints. Management interventions that seek to address challenges without going to these deeper levels can result in money and time being wasted, or worse – damaging a situation yet further. It can be important to spend time listening and speaking to stakeholders to try to better understand a given noise problem.</p> <p>Amenable: If decisions are made that are wrong from the citizens' point of view or there is new knowledge, then there are possibilities to amend these decisions.</p>
L	<p>Legitimacy: We all have our own internal maps about what the world looks like, and to each of us those maps are reality. It is important to respect those views. Treating stakeholders and their views with respect and dignity is important in building trust and building effective relationships with residents and campaign groups.</p>
	<p>Locality: Take local considerations into account. There is no "single solution" that fits every local situation around an airport. Factors such as demographics, legislation, local concerns and noise environments are different, as well as aircraft operations for the considered location that also need to be taken into account.</p>

7. Evaluation as a part of any intervention

Evaluation can be considered as a key instrument for a successful implementation of any intervention. The general purpose of an evaluation is to assess, validate and rate the success of an intervention, enabling planners to reflect and optimise each step of the process. Besides assessing the impact of the intervention on the target group and the effectiveness in terms of a cost-benefit analysis, a further benefit is to receive an overview of the implementation process as a whole. As a consequence, implications for beneficial adjustments can be drawn.

When noise and noise impact mitigation interventions are implemented, they are never introduced in an independent „black box“ but embedded in a local or political context in which this implementation takes place. That is, there are many influencing social, situational or personal factors that, in addition to the intervention itself, can directly or indirectly influence the outcome as well as the potential success of an intervention. An intervention can appear to be successful with regard to the outcome measure. However, an evaluation is a way to observe whether the success is a result of this intervention or whether there are any other influencing factors. It may turn out that the positive effects are caused by factors other than the intervention. Thus, controlling for relevant factors such as the context or other societal issues makes it possible to detect effects resulting from other factors than the intervention. An accompanying evaluation enables one to keep track of any intended and unintended outcomes during the whole implementation process, including the designing, implementation and postprocessing phase of an intervention.

Essential elements of an evaluation are to define a clear aim of an intervention (i.e. what should be achieved with the intervention), determine a target group (i.e. who is to be addressed), specify measurable success criteria (i.e. when is an intervention considered as successful). For instance, criteria could be a reduction in complaints, promotion of quality of life, or increase in perceived fairness. Further, setting multiple milestones can facilitate the evaluation and make the defined goals more achievable. A monitoring of the implementation process according to the criteria is recommended to be able to alter the intervention, adjust or adaptations during the process.

Finally, an important consideration is who should be responsible for the evaluation. To avoid conflicts of interests the institution conducting the evaluation should be independent of the institution that implements the intervention. A neutral and independent institution conducting the evaluation process can establish and even promote trust in the institution in charge of the interventions.

7.1 . Benefits of evaluation for the airport and noise authorities as well as for the affected residents

Evaluation has five general purposes (see Bortz & Döring, 2006; Stockmann, 2007) that are also applicable to the evaluation of interventions in the context of aircraft noise exposure and its related communication campaigns.

- 1) Knowledge function: Evaluation generates new knowledge on the characteristics and efficacy of intervention measures.
- 2) Optimization function: Evaluation describes the strengths and weaknesses of the intervention with regard to the intervention goals as well as potential for improvement.
- 3) Control function: Evaluation estimates whether and to what extent the project/intervention is being implemented correctly. To what extent (effectiveness) and with what efficiency (cost-benefit balance) are the intended effects of the measure (intervention goals) achieved? Which unintended positive and negative side effects occur?
- 4) Decision-making function: Evaluation decides whether a certain intervention should be promoted, implemented, further developed, used, etc. or not?
- 5) Legitimation function: Evaluation helps to justify and legitimize the development and implementation of an intervention as well as the use of (public) funds for it to all affected parties.

Evaluation offers the possibility to assess the actual state before an intervention is carried out. From this, tailor-made and meaningful interventions can be planned and implemented. Continuous evaluation, which takes place during interventions, offers the possibility to adjust and fine-tune an intervention that has been

implemented. An evaluation after the intervention has been completed can assess its success in relation to certain criteria, such as: Has the intervention led to a certain success (e.g. is the nuisance lower than before the intervention? Has the number of complaints decreased? Has the perception of the airport as a fair neighbour increased? Are the costs and benefits in proportion? Do further interventions need to be planned?)

The benefit for the affected citizens is that no hypocritical interventions are carried out without effect that means that only measures are undertaken by the airport management to calm the affected communities, such as consultations or complaint services for affected residents with the possibility to voice their needs, complaints and perspective, but not considering them in subsequent decisions and communication. Citizens can then ensure that efforts that have proven to be effective are carried out. Furthermore, continuous evaluation in itself provides an opportunity for citizens to share views, expectations and concerns.

7.2 Different methods for evaluation

In principle, one can discriminate between two different types of evaluation: Summative and formative evaluation (Bortz & Döring, 2006).

Summative or outcome evaluation frequently uses quantitative methods, such as surveys, standardized observations and epidemiological studies. The prevalence and incidence of an outcome, which can be annoyance or sleep disturbance in the context of aircraft noise exposure, are examined. Prevalence describes the spread of an outcome in the population whilst incidence describes the new occurrence of an outcome (Bortz & Döring, 2006).

Data collection may be based on pre-post comparisons in a single group or comparisons between a treatment group, who received an intervention measure, and a matched control group (quasi-experimental design) or between a treatment group and a randomized control group (experimental design). The extent to which these designs can attribute an observed change to the specific intervention, i.e. determine causality in the effectiveness of an intervention, varies considerably from low (pre-post-comparison in a single group) to high (experimental design) (Abraham et al., 2018).

In contrast, **formative** evaluation or process evaluation is conducted accompanying the intervention measure with the purpose to modify or improve a running intervention campaign. It assesses whether an intervention is being implemented as intended, which aspects are working to what extent and why they are working. Process evaluations are usually used to evaluate complex interventions including several components and subjectives. Process evaluations collect data on different aspects of a specific intervention and, thus, often use mixed methods (Abraham et al., 2018). However, the focus of the methods used is on qualitative and exploratory methods (Bortz & Döring, 2006), such as qualitative interviews and discussions (e.g. focus group discussions) and qualitative observations as well as qualitative case studies.

One could also propose that a third evaluative phase “front end evaluation” also takes place. Here, research into the needs of stakeholders takes place to understand things like what their perceptions are regarding noise? What do they think of proposed measures? Where do they find out information? What information do they know? What would they like to know? Evaluation at this stage also helps to inform on potential pathways to communication and engagement, for instance understanding key issues of residents, and locations and formats through which engagement activities might take place. Front-end evaluation can therefore be seen as less about evaluating impact, but more about evaluating what can inform on something that is about to take place, and establishing a baseline against which impact or some other outcome can be determined.

7.3 Different stages of evaluation

In a sense, evaluation is a process of the analysis of questions such as whether something has achieved the aims it set out to, if not, why not? If so, what worked? What did not work? Why?

Evaluation therefore be a very powerful management tool, either for use by those leading an activity, or to stakeholders with an interest in that activity, by demonstrating what has worked, what has not worked, and how activities may be enhanced over time.

Evaluation can, however, be intimidating as it requires an additional level of thinking and application by noise managers, for instance understanding what is to be evaluated, what success looks like in those terms, and the design and delivery of methodologies that can collect data on which evaluation can take place – be it quantitative noise data, or qualitative data pertaining to non-acoustic factors.

Since it generates information based on the results of an activity, evaluation is something that is often thought about only happening at the end of a project. The important message from the three phases of evaluation (front-end, formative and summative) introduced previously however is that evaluation is an important consideration throughout the process of developing any noise management measure, or as a process that sits across noise management in more general terms. It is notable that, as illustrated in Figure 12, these three phases of evaluation are also reflected in the ANIMA Methodology (Heyes, Raje, Hooper, Hudson, & Dimitriu, 2019), and Design Thinking (Nessler, 2018); something that has been advocated for use in noise management (Heyes, Hooper, Raje, & Sheppard, 2021), and that has been introduced previously in national airspace design legislation (Civil Aviation Authority, 2021; Federal Aviation Authority, 2015). For instance, in design thinking, a baseline analysis in the discovery phase identifies a range of important information that helps to define the core challenges on a given problem, this information then forms the basis of a range of selection criteria that are used in the design phase to determine which options hold the most potential to deliver desired impacts, with the same criteria later informing the evaluation of selected options during predictive modelling, trialling, and post-implementation evaluation.

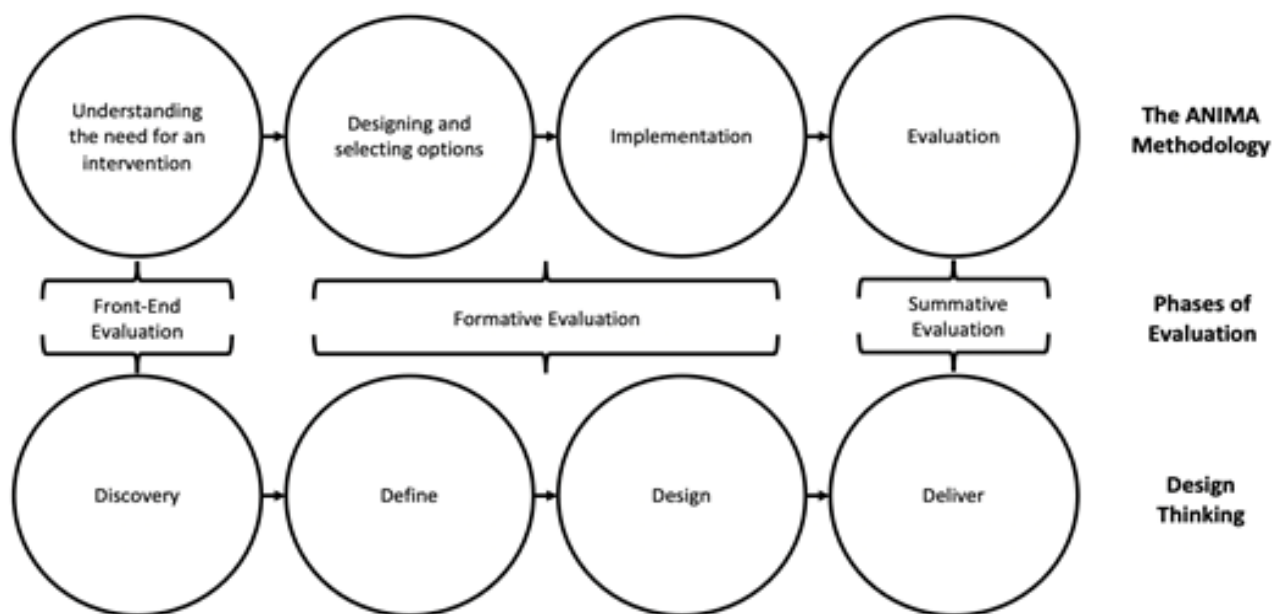


Figure 12: Illustration of how different phases of evaluation sit across the development and delivery of noise management measures.

7.4 Metrics of success

The process of defining success can be rather complicated, in that it depends on the objectives of a given intervention and the characteristics of where it is being applied, and these can differ significantly on a case-by-case basis, and can be influenced from the strategic, down to the actions and tools level. (Broman & Robèrt, 2017) provide a useful framework to articulate this through their 'Five-Level Model' (Table 3), which illustrates how the high-level vision of an organisation can influence the individual tools that ensure that actions are designed to deliver on strategy, and ultimately that high-level corporate or business unit vision, is successful.

Table 3: Broman and Robert's Five Level Model (2017)

The Five-Level Model	Description
System	The global/system level world in which an organisation or business unit lives, and the rules it must abide by. This level of thinking helps to identify and understand the core principles that underpin what success might look like.
Success	Defines a broad vision of success within the context of the system by describing the world that the organisation or business unit wants to see (typically articulated through a 'Vision Statement') and its role within that world (usually via the creation of a 'Mission Statement'). This level may include the articulation of specific goals and objectives.
Strategic Guidelines	Guidelines are created for how to approach the principle-framed vision strategically. This level includes core design principles that have to be adhered to in order to be effective and to stay true to the vision.
Actions	Concrete actions that have been prioritized are identified and implemented following the strategic guidelines.
Tools and principles	Methods, tools and other forms of support that ensure that <i>actions</i> are conducted in a way that is consistent with <i>strategic guidelines</i> , and that will help the organisation arrive at its definitions of <i>success</i> , in the <i>system</i> .

Successful management sits across, and has synergies with all of these levels. The same is true for noise from the identification and application of individual tools and principles (i.e. noise monitoring systems, communication and engagement protocols and so on), through to individual actions that are implemented (i.e. Balanced Approach interventions), the guidelines, principles and targeted outcomes that those actions seek to deliver (i.e. as articulated through Noise

Action Planning), and to overarching visions of success that sit within the context of the wider airport, community and local, national, and regional economies.

In Table 4 below, a proposed change in a departure route from an airport is presented as an example where a range of potential objectives and their implications for the process of designing, implementing and evaluating change are outlined. This helps to illustrate the importance of engaging with those potentially affected by a change (i.e. through front-end and formative evaluation) to establish desired outcomes and thus the means by which to assess the efficacy of the intervention (via summative evaluation). There are a number of considerations:

1. Clarifying aims and objectives

The overarching aims and objectives of the thing being evaluated should be identified. This information arises from front-end evaluation, and is intrinsically tied to the wider organisation or business unit vision, as aims and objectives should help an organisation move towards that vision. Visioning of successful outcomes is an essential part of strategy development and organisational problem solving, and is a core phase of a wide range of strategic management frameworks (Boardman et al., 2004; Broman & Robèrt, 2017; David, 2009; Mendoza et al., 2017; Rothaermel, 2012; Thompson & Martin, 2010). Such visions can help to mobilise action and commitment across an organisation and its stakeholders, and help to inform important objective information such as: overall aims and goals, time frames, and the principles to which those objectives must adhere.

2. Choosing indicators

With vision, aims and objectives understood, appropriate indicators can then be selected against which evaluation can take place. This is a rather complicated subject for noise owing to the complex nature of noise exposure, the fact that many metrics are hard for the public to understand (Hooper & Flindell, 2013), the wide range of metrics available (see D2.6), and the emerging role of non-acoustic factors in noise management, which suggests a new role for qualitative assessment, as outlined in this document and elsewhere in the ANIMA project (D2.4/D3.3).

3. Identifying intended outcomes

At this point chosen metrics can be used to identify outcome targets – that is quantified agreed measures of success. These are best captured in SMART targets, namely; those quantified outcomes that are Specific, Measurable, Achievable, Realistic and Timebound (Doran, 1981). Such specific outcomes can be used to test individual forecast scenarios for the likelihood of delivery before embarking on a particular course of action. In the case of noise management interventions this may include modelling potential changes for their impact on ground noise exposure to establish whether they are capable of delivering on the SMART outcomes associated with achieving defined objectives.

4. Decision point

Here forecast outcomes for intervention options are compared with the SMART target linked to defined metrics. This comparison may help in identifying a preferred course of action (i.e one that delivers on agreed objectives) or require re-visiting the SMART parameters to ensure agreement on their appropriateness in the light of what could be achieved.

5. Implementation and monitoring

Assuming the decision is to proceed with an agreed course of action this stage may involve trialling before full implementation to establish whether modelled/forecast outcomes can be achieved in reality. If successful, this will be followed by full implementation accompanied by a monitoring regime designed to demonstrate achievement, or otherwise, against the SMART targets.

6. Review

After an agreed period, those responsible for the intervention/change and the stakeholders involved in defining objectives and the SMART targets associated with successful outcomes, should review actual performance against these benchmarks. This should confirm whether targets have been achieved and/or identify options to refine the intervention to deliver on the desired objectives.

Table 4: From objectives to evaluation. An example of a proposed change in departure route.

Potential Intervention Objectives	Measurement Options –to quantify exposure, relief and significance	Intended outcomes – demonstrated through performance against SMART targets	Decision-point – how do forecast outcomes compare with desired objectives and associated	Implementation & Monitoring – with trials as required	Review – summative evaluation
To relieve noise in an area of high exposure	Reduction in the average L _{max} of single noise events by >5 dB in target community	Pattern of single event L _{max} reduction at target location from existing and proposed new routes	Modelled outcomes for L _{max} compared with >5 dB targeted average reduction	Monitoring of pattern of single event L _{max} at agreed locations in target community	Actual change in single event noise levels compared with agreed >5 dB L _{max} average
To avoid significant increases in exposure elsewhere	Increases in average single event noise levels of no more than 3 dB (onset of discernibility)	Before and after pattern of single event L _{max} at other locations potentially affected by route change	Modelled outcomes for single event L _{max} compared with <3 dB targeted average threshold for any increases	Monitoring of pattern of single event L _{max} at agreed locations in other communities	Actual change in single event noise levels compared with agreed <3 dB L _{max} increase at other locations
To involve affected communities in decision-making	Defined features of engagement including list of stakeholders involved and agreed means of engagement (focus groups, surveys, etc.)	Feedback to communities regarding the nature and outcomes of engagement activities	Demonstrable involvement of communities in assessing modelled outcomes against measures of success. SH validation of decision to proceed or abandon change	Community involvement in determining monitoring locations	Feedback to communities on performance against SMART targets associated with achievement of objectives. Formal acceptance of successful delivery and/or refinement options

7.5 Evaluation Process

7.5.1. Who evaluates?

For every evaluation process, it is necessary to consider who should be responsible for conducting the evaluation. Considering the results of our study as well scientific literature on previous social psychological noise intervention studies (e.g. Haugg, Kastner, & Vogt, 2003), the best option seems to be having a neutral mediator that evaluates the intervention. Indeed, considering variables like “trust in authorities” and “credibility of the source”, but also to avoid conflict of interest, it appears crucial to separate those who evaluate the intervention from those who design the intervention.

Moreover, it could be interesting to include different people that are able to evaluate:

- The “expert of the daily life” that is to say the inhabitant who experiences the intervention’s impact
- Technical experts that are used to measure this kind of change or this type of intervention.

With these two types of evaluators, it could be interesting to link social norms and technical norms. For example, there are some technical indicators or standards for measuring noise, and in this case, it could be interesting to measure social norms or social acceptability of noise (different situations for instance) and try to link both.

7.5.2. Communicating the results

Results must be processed so that they are comprehensible to all stakeholders including lay people. Moreover, the results must suggest a clear decision e.g. whether an intervention was successful, whether an intervention should be continued or aborted (Bortz & Döring, 2006).

For the communication of the results of an evaluation, the same criteria should be regarded as recommended for fair communication and information (such as truthfulness, comprehensibility, justification, in a timely manner).

7.6 Limitations of evaluation

Even though the need for an evaluation of interventions is undisputable, depending on the context of the evaluation process and the applied evaluation methods, some limitations should be acknowledged.

Each evaluation method carries both benefits and drawbacks. While qualitative methods allow in-depth analyses, such as a deeper understanding of how an intervention works, and are adaptable and flexible, it may not represent the whole picture. According to (Denford, Smith, Morgan, Abraham, & Warmoth, 2018), the limitations of qualitative methods can be summarized as follows:

- a) they are generally time-consuming to apply (e.g. in-depth interviews, focus groups)
- b) as a result, the data is usually collected and analysed on a small-scale level. Generalizability may not be given as views and perspectives of all subgroups of a population may not be ascertained
- c) the quality of the analysis of the data and the resulting findings may rely on the necessary knowledge and skills of the involved researcher(s) collecting, analysing and interpreting the data
- d) anonymity and confidentiality of participants is more difficult to maintain

In contrast, quantitative methods (e.g. surveys) can be administered to a higher number of persons within a relevant population, are less expensive, and ensure anonymity more easily, however, depending on the way of administration (e.g. personal vs. online), they may suffer from low response rates and are less flexible (Denford et al., 2018). As a result, underlying views, attitudes or expectations of the respondent may not be ascertained and the understanding why an intervention is working may not be gained.

Besides the specific drawbacks of the different evaluation methods, the lack of an adequate control group is a major limitation that holds true for evaluations of noise mitigation measures which are technological and operational in nature but also social measures such as communication and engagement campaigns. Comparing a randomly selected treatment group with a randomly selected control group from the same area is hardly feasible. Implemented (operational and technological) interventions affect all residents within an area. But also, interventions including technical measures as well as accompanying social interventions such as

communication and engagement can hardly be realized in some residents but not in their neighbours. Thus, a matched control group in a different area surrounding an airport may be preferred. A matched control group means that the residents included in the treatment group are compared to other residents whose exposure but also demographical and ideally also socio-economic characteristics match with those of the treatment group. A matched control group seems advisable since the effect of interventions on health outcomes can differ between subgroups of an area, e.g. groups with varying socio-economic status (Brown & Van Kamp, 2017).

However, noise interventions with or without accompanying activities of communication and engagement, easily become a subject of media coverage and discussions among residents of different areas around an airport. Therefore, a matched control group cannot be set-up and the effectiveness of an intervention has to be assessed via pre-post comparisons within only one group. In contrast to (quasi-) experimental designs including a control group, these pre-post comparisons cannot fully prove causality in the effect of an intervention as it cannot be ruled out that the desired effect (e.g., reduction in annoyance) is actually caused by a completely different factor. For this reason, whenever the application of a control group is not possible, attention must be given to the control and monitoring of potentially affecting factors besides the intervention. However, control groups might be indirectly part of the study design in cases where a noise intervention, e.g. the shift in a flight route in order to relief densely populated residential areas, has different effects on different areas (positive, negative, or no effect) in the airport region. In these cases, each area is a control group for the other areas.

But even when a random control group is considered, a limitation might result from unforeseeable changes or events that affect both the treatment and control group and that mask or blur the conclusion of the effectiveness of an intervention. For example, the assessment of the effect of a communication campaign accompanying operational changes may be hard to assess when they coincide with drastic unforeseeable changes in the number of operations, for instance due to flight restrictions in the framework of a pandemic.

For annoyance, but in particular with regard to health effects occurring after a long period of exposure, there may be a long lag time between the implementation of the intervention and a measurable effect (Brown & Van Kamp, 2017).

In particular operational changes, e.g. with regard to departure or landing procedures or paths, may result in unintended displacement outcomes of increased exposure in areas outside the focussed area (Brown & Van Kamp, 2017). A comprehensive evaluation of an intervention must consider these effects.

8. Conclusions and important lessons for engagement of communities

In summary, the following points can be taken from this deliverable.

The in-depth interviews and focus groups conducted in this subtask and more broadly in ANIMA (ST2.1, 2.2, 2.3.1 and 2.5) reveal a wide range of different perspectives on aircraft noise management. Our qualitative research conducted with residents living in different noise contours around Paris Airport, Dusseldorf Airport, Cologne-Bonn Airport and East Midlands Airport demonstrate that residents have different needs, expectations and perspectives. However, considering residents' needs is feasible when integrating communication and intervention on the basis of fairness standards. This means, for example, that aspects like honest information provision about the impact of noise, thoroughly explaining decisions, providing residents participation opportunities should be naturally applied when designing an exchange based on procedural, informational and interpersonal fairness standards.

Considering that noise management measures ultimately exist to serve communities (either to reduce complaints, constraints to growth or as a legal requirement to protect health), it is essential that these varied perspectives, expectations and needs are considered.

Doing so is not only a key way to address non-acoustic factors, but also a core activity of effective strategic and operational management.

Not integrating residents' needs effectively will be unlikely to ever lead to optimal noise management scenarios, and may be more likely to lead to problems in the future. The important role of communication and engagement is no longer a novel

or emerging concept - the idea of 'people issues' being part of the Balanced Approach is over a decade old.

Failure to include such thinking into management practice could be seen as practice that lacks integrity, or worse that could be accused of bad intent, which could lead to even more annoyance. It is important to understand that 'people issues', i.e. activities of communication and engagement, should not be understood as a '5th pillar' of the Balanced Approach being an intervention independent from other noise management activities that stands on its own. Instead, 'people issues' should be part of any noise management activity across all 'classical' four technical Balanced Approach pillars of noise reduction at the source, land-use planning, operational measures and operational restrictions. The described criteria of IDEAL communication and engagement can be seen as fundamental elements that should be considered when doing an engagement.

That way, airport managers and national institutes that are regulating air traffic must consider the importance of empowered people and recognise this as a win-win solution. Indeed, including people in the decision-making process improves the appropriation and acceptance of interventions. People are more likely to perceive a decision as fair, if they were involved in the process.

Another conclusion that we can draw from findings of the media analysis is that media coverage about certain aircraft noise-related topics can negatively affect residents' responses to noise. An assumption is that in triggering expectations, media reports about noise topics can contribute to noise annoyance. Media alone thereby does not lead to annoyance, but it (Van den Bos, 2018) can be considered as a further non-acoustic factor that may influence the effect of aircraft noise on noise responses.

The last main topic of this deliverable is evaluation as an integral part of management. Evaluation is well established in the fields of environmental management, with the phrase 'you can't manage what you don't measure' being a key mantra. Evaluation is an important part of noise management as well and needs increasing focus in research, policy and practice. It is not sufficient to consider evaluation as an afterthought to an implemented intervention. Evaluation needs to be addressed and integrated into every step of noise impact management through front-end, formative and summative evaluative processes. As this

deliverable has shown, evaluation is thus rather complex and requires consideration throughout the process of developing a noise management measure. Practice can be enhanced by embedding evaluation not just into the development of noise management measures, but also into the creation of overarching noise strategies - such as those articulated in the noise action plans required by the Environmental Noise Directive, which offers airports the opportunity to review practice at five-yearly intervals and re-align strategies accordingly. The FAIR questionnaire which is being developed in the frame of this subtask measuring fairness aspects of airport management can be a very valuable tool in this regard, as it allows to capture the current prevailing perceptions among airport residents, to find starting points that can be taken up in interventions, and to evaluate implemented interventions in terms of their effectiveness.

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10. Annexes

10.1 Annex 1 - Aircraft noise annoyance and media coverage

10.1.1. Methodology of the press monitoring in the NORAH study

Three qualitative steps are necessary as preparation for any electronic analysis:

- 1) Consideration of context,
- 2) selection of terms which should be included, and
- 3) attribution of those terms to categories, e.g. noise exposure, airport expansion etc.

Regarding the consideration of context, the focus was on reports concerning the Frankfurt Airport or Fraport AG, whereas reports concerning other German airports were excluded. Further exclusion criteria were articles in another language (than German), articles that did not belong to the identified 30 most read newspapers and articles that concentrated on sport in the region of Frankfurt or noise outside of the study area.

In a first attempt to select the terms from the articles and attribute those to categories, two independent raters assessed the articles from daily press reviews. This procedure turned out to be too elaborate and time consuming. It became apparent that the relevance of occasionally used terms or even categories changed

within this process. This would have implied to start step 2) and 3) again with all the previous material (including the articles). Therefore, the focus was shifted to the headlines and subheadings of the articles. Those, together with the newspaper name and date of release, were summarized into separate text files, one for each day ("day-file"). In the end, there were 1,461 day-files, one for every calendar day from 2011 – 2014 (the press review of 1st January 2011 contained articles from the 31st December 2010; those were shifted to their own day-file).

The development of the category system was kept flexible, so that new terms and categories that have not been defined before, could be added. At the end of 2014, the category system contained 1,342 terms and 19 categories. For the attribution of the terms to the categories, the terms were rated independently by 3 team members regarding their clarity and fit on a 5-point scale (1 = *not* to 5 = *very*). Only those terms were considered for further analysis that received an interrater consensus of 93 %. Thus, 731 terms were assigned to the following 19 categories:

1. noise exposure Frankfurt Airport
2. increase in noise exposure
3. expansion of Frankfurt Airport
4. flight routes
5. night flight
6. noise insulation
7. flight safety and wake turbulence
8. effects of noise on quality of life
9. effects of noise on health
10. decreasing value of properties
11. protests against noise
12. (mis-)trust in those responsible for noise

13. "Job engine" airport

14. Airport-dialogue

15. Fraport promotes

16. Noise study NORAH

17. "Gemeinnützige Umwelthaus GmbH" ("Centre of Environment and Neighbourhood" – self-reported neutral observer and communicator of development around airport-related topics)

18. Airport Rhein-Main

19. Fraport AG

10.1.2. Results

10.1.2.1. Descriptives of sample

Table 5: Descriptives of participants by study years 2011 to 2013

	2011				2012				2013			
	%	N	M	SD	%	N	M	SD	%	N	M	SD
Gender												
female	53.5	1.876										
male	46.5	1.632										
Age			52.6	14.6								
< 30 years	6.9	242										
30-50 years	35.9	1.258										
50-70 years	42.3	1.483										
over 70 years	15.0	525										
SWI	3.471		13.8	4.4	3.405		14.0	4.2	3.411		14.2	4.2
	M	SD	min	max	M	SD	min	max	M	SD	min	max
L_{den}	51.8	6.2	39.2	65.2	51.2	6.4	37.9	74.8	50.5	6.5	38.1	73.8
L_{night}	42.4	6.3	35.0	56.7	41.8	6.0	35.0	65.4	41.6	5.9	35.0	64.2
Aircraft noise annoyance	3.3	1.3	1	5	3.4	1.3	1	5	3.2	1.3	1	5

sleep disturbance	2.3	1.3	1	5	2.2	1.2	1	5	2.2	1.2	1	5
Noise sensitivity	1.5	1.0	0	3	1.5	1.0	0	3	1.4	1.0	0	3
Perceived coping capacity	2.5	1.1	1	5	2.5	1.1	1	5	2.6	1.1	1	5
Fairness Scale	2.2	0.9	1	5								
Trust in Authorities	2.4	0.9	1	5	2.4	0.9	1	5	2.4	0.9	1	5
Media variables	<i>M</i>	<i>SD</i>	min	max	<i>M</i>	<i>SD</i>	min	max	<i>M</i>	<i>SD</i>	min	max
Sound insulation	1.6	0.2	1.3	1.8	2.4	0.1	1.9	2.6	1.5	0.2	1.2	2.0
Protest	3.7	0.2	3.3	4.1	6.5	0.2	6.0	6.9	4.5	0.4	3.7	5.7
Night flight	1.3	0.1	1.2	1.7	4.6	0.8	2.5	5.5	1.0	0.2	0.5	1.3
Mistrust /Trust in Authorities	0.2	0.02	0.2	0.2	0.3	0.03	0.2	0.4	0.2	0.1	0.1	0.4
Noise exposure	6.1	0.3	5.6	6.6	9.1	0.3	8.5	9.9	7.1	0.2	5.7	7.5
Increase exposure	1.1	0.04	1.1	1.2	0.5	0.1	0.3	0.6	0.4	0.1	0.3	0.5
Flight path	3.5	0.2	3.3	4.0	1.7	0.1	1.5	1.9	2.2	0.4	1.7	2.8

N = number of participants, M = mean, SD = standard deviation, min = minimum, max = maximum.

10.1.2.2. Correlation tables

Table 6: Correlations between impact variables, noise metrics and other determinants for the three study years 2011 – 2013

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
1. Lden 2011	1																					
2. Lden 2012	.95***	1																				
3. Lden 2013	.94***	.98***	1																			
4. Lnight 2011	.93***	.87***	.91***	1																		
5. Lnight 2012	.89***	.92***	.95***	.95***	1																	
6. Lnight 2013	.91***	.93***	.96***	.95***	.99***	1																
7. Noise annoyance Air 2011	.48***	.46***	.44***	.42***	.4***	.41***	1															
8. Noise annoyance Air 2012	.42***	.47***	.46***	.36***	.4***	.41***	.69***	1														
9. Noise annoyance Air 2013	.42***	.46***	.46***	.38***	.42***	.43***	.68***	.8***	1													
10. Sleep disturbance 2011	.41***	.4***	.41***	.41***	.4***	.4***	.7***	.59***	.61***	1												
11. Sleep disturbance 2012	.33***	.38***	.39***	.31***	.36***	.36***	.56***	.7***	.67***	.69***	1											
12. Sleep disturbance 2013	.34***	.38***	.39***	.31***	.36***	.36***	.56***	.66***	.74***	.69***	.79***	1										
13. Noise sensitivity 2011	.04*	.03	.03	.04*	.03	.03	.3***	.28***	.28***	.33***	.27***	.28***	1									
14. Noise sensitivity 2012	.02	.02	.02	.01	.02	.02	.21***	.25***	.24***	.24***	.27***	.26***	.55***	1								
15. Noise sensitivity 2013	0,0	.01	0,0	-.01	0,0	0,0	.22***	.24***	.26***	.25***	.27***	.29***	.57***	.62***	1							
16. Perceived coping capacity 2011	-.17***	-.17***	-.16***	-.14***	-.14***	-.14***	.55***	.49***	.50***	.59***	.49***	.50***	.43***	.34***	.35***	1						
17. Perceived coping capacity 2012	-.19***	-.23***	-.23***	-.16***	-.19***	-.2***	-.5***	.62***	-.6***	.51***	.59***	.58***	.38***	.36***	.35***	.65***	1					
18. Perceived coping capacity 2013	-.19***	-.22***	-.22***	-.15***	-.18***	-.19***	.49***	.57***	.62***	.52***	.57***	.61***	-.4***	.38***	-.4***	.66***	.73***	1				

19. Fairness	Score	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
2011		-.1***	-.1***	-.1***	.08***	.09***	.09***	.33***	.32***	.32***	.32***	.31***	-.3***	.18***	.13***	.13***	.38***	.34***	.34***		
20. Mistrust/ Trust in		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Authorities 2011		.13***	.14***	.14***	.11***	.11***	.11***	.39***	-.4***	-.4***	.39***	.38***	.38***	.21***	.17***	.18***	.43***	.39***	.39***	.48***	
21. Mistrust/ Trust in		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Authorities 2012		.09***	.13***	.12***	.06***	.09***	.09***	.33***	.43***	.41***	.33***	.41***	.39***	.18***	.17***	.18***	.39***	.46***	.4***	.38***	
22. Mistrust/ Trust in		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Authorities 2013		.11***	.15***	.14***	.08***	.11***	.11***	.35***	.43***	.44***	.34***	.42***	.42***	-.2***	.18***	-.2***	.4***	.44***	.46***	.39***	
																				.57***	
																					.64***

Table 7: Correlations between impact variables, noise metrics and media variables for the three study years 2011 - 2013

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
1. Noise annoyance Air 2011	1																							
2. Noise annoyance Air 2012	.69***	1																						
3. Noise annoyance Air 2013	.68***	.8***	1																					
4. Sleep disturbance 2011	.7***	.59***	.61***	1																				
5. Sleep disturbance 2012	.56***	.7***	.67***	.69***	1																			
6. Sleep disturbance 2013	.56***	.66***	.74***	.69***	.79***	1																		
7. Media Sound Insulation 2011	-.04*	.01	0,0	-.02	.02	.01	1																	
8. Media Sound Insulation 2012	.05**	.05**	.04*	0,0	0,0	0,0	-.03	1																
9. Media Sound Insulation 2013	-.02	-.03	-.03*	-.01	-.01	-.04*	.03	.36***	1															
10. Media Protest 2011	-.05**	.01	0,0	-.03	.01	0,0	.96***	-.04*	.03	1														
11. Media Protest 2012	.03	.02	.05**	.01	.01	.01	-.02	.59***	.24***	-.02	1													
12. Media Protest 2013	-.01	-.03	-.03	-.01	-.03	-.04*	.01	-.3***	.62***	0,0	.24***	1												
13. Media Night flight 2011	-.03	.03	.01	-.01	.02	0,0	.54***	.02	0,0	.67***	.04*	-.01	1											
14. Media Night flight 2012	.07***	.06***	.04*	-.01	-.02	-.01	-.01	.82***	.38***	-.03	.56***	.34***	.01	1										
15. Media Night flight 2013	.03*	.02	.03	-.01	-.02	-.02	-.07	.19	.1	.08***	.11***	.5	-.05**	.2***	1									
16. Media Mistrust 2011	-.02	.02	.01	0,0	.01	0,0	.52***	.06***	0,0	.6***	.08***	-.01	.84***	.06***	0,0	1								
17. Media Mistrust 2012	.03	.01	.03	.04*	.03	0,0	.03*	.13***	.09***	.03*	.42***	.04*	.08***	.11***	.02	.12***	1							
18. Media Mistrust 2013	0,0	-.02	-.03	-.01	-.03	-.04*	0,0	.23***	.58***	0,0	.18***	.88***	0,0	.25***	.55***	.01	.05**	1						
19. Media Noise Exposure 2011	-.04*	.01	0,0	-.03	.01	.01	.97***	-.02	.02	.9***	-.01	0,0	.62***	-.01	-.0***	.62***	.04*	0,0	1					
20. Media Noise Exposure 2012	.04**	.04**	.06**	.02	.03	.01	-.03	.79***	.36***	-.03	.85***	.37***	.04**	.73***	.1***	.09***	.48***	-.3***	-.02	1				

21. Media Noise Exposure 2013	.05**	.02	.03*	0,0	-0.03	-0.02	-.05**	.33***	.11***	.06***	.18***	.35***	-.05**	.35***	.72***	-.01	-.05**	.27***	-.04*	.21***	1		
22. Media Increase Exposure 2011	.03	-.01	0,0	.03	-.01	-.01	-.79***	.01	-.02	-.8***	.01	-.01	-.37***	-.01	.06**	.21***	-.03	0,00	.71***	.02	.03	1	
23. Media Increase Exposure 2012	.04*	.05**	.04*	0,0	0,0	-.01	-.04*	.89***	.33***	-.05**	.61***	.29***	.02	.83***	.17***	.06***	.26***	.22***	-.04*	.86***	.3***	.03	1
24. Media Increase Exposure 2013	-.02	0,0	0,0	.01	.03	.04*	.04*	0,0	.44***	.049**	0,0	.59***	.03	-.05**	.78***	0,0	.12***	-.6***	.03*	.06***	.41***	-.03	.01
25. Media Flightpath 2011	.05**	0,0	.01	.03*	-.01	0,0	-.83***	.08***	-.03	-.87***	.08***	0,0	.45***	.08***	.1	-.26	.02	.01	.76***	.09***	.07***	.84***	.1***
26. Media Flightpath 2012	-.05**	-.03*	-.05**	-.01	-.01*	-.01	-.01	.57***	.29***	.01	.68***	.30***	-.02	.59***	.09***	.06***	.36***	.23***	-.01	.69***	.18***	.02	-.5***
27. Media Flightpath 2013	-.03	-.01	-.02	.01	.02	.03	.06***	.10***	.39***	.07***	.08***	.40***	.03*	.12***	.83***	-.01	.08***	.51***	.05**	.06***	.36***	.06***	-.1***



10.1.2.3. Regression models

Table 8: Regression results for the influence of media reports on "sound insulation" and L_{DEN} on annoyance ratings 2011 to 2013

	B	SE	p	Exp(B)	CI - (2.5%)	CI + (97.5%)
Intercept	-1.31	0.34	0.00	0.27	0.14	0.52
log10Media_Sound Insulation	-1.22	1.78	0.49	0.29	0.01	9.57
Lden	0.09	0.01	0.00	1.10	1.08	1.11
Year 2011	-0.42	0.18	0.02	0.66	0.47	0.93
Year 2012	-0.61	0.58	0.29	0.54	0.17	1.70
Year 2013	0 ^a			1.00		
Lden * log10Media_Sound Insulation	0.01	0.03	0.79	1.01	0.94	1.08
Year2011 * Lden	0.01	0.00	0.00	1.01	1.00	1.01
Year2012 * Lden	0.00	0.01	0.85	1.00	0.98	1.01
Year2013 * Lden	0 ^a			1.00		
Year2011 * log10Media_Sound Insulation	-0.29	0.52	0.57	0.75	0.27	2.05
Year2012 * log10Media_Sound Insulation	2.49	1.23	0.04	12.11	1.10	133.92
Year2013 * log10Media_Sound Insulation	0 ^a			1.00		

a. Reference category, B: regression coefficient, SE: standard error, p: significance level, Exp(B): odds ratio, CI - : lower confidence level, CI + : upper confidence level. Media variables are logarithmized due to their right-skewedness.

Table 9: Regression results for the influence of media reports on "protest" and L_{DEN} on annoyance ratings 2011 to 2013

	B	SE	p	Exp(B)	CI - (2.5%)	CI + (97.5%)
Intercept	1.30	1.84	0.48	3.68	0.10	134.52
log10Media_Protest	-4.32	2.80	0.12	0.01	0.00	3.18
Lden	0.05	0.04	0.15	1.05	0.98	1.13
Year 2011	-0.04	0.61	0.95	0.96	0.29	3.18
Year 2012	0.63	1.22	0.61	1.88	0.17	20.64
Year 2013	0 ^a			1.00		
Lden * log10Media_Protest	0.07	0.05	0.23	1.07	0.96	1.19
Year2011 * Lden	0.01	0.01	0.01	1.01	1.00	1.02
Year2012 * Lden	-0.01	0.01	0.28	0.99	0.97	1.01
Year2013 * Lden	0 ^a			1.00		
Year2011 * log10Media_Protest	-1.47	0.97	0.13	0.23	0.03	1.55
Year2012 * log10Media_Protest	0.14	1.41	0.92	1.15	0.07	18.10
Year2013 * log10Media_Protest	0 ^a			1.00		

a. Reference category, B: regression coefficient, SE: standard error, p: significance level, Exp(B): odds ratio, CI - : lower confidence level, CI + : upper confidence level. Media variables are logarithmized due to their right-skewedness.

Table 10 Regression results for the influence of media reports on "flight path" and LDEN on annoyance ratings 2011 to 2013

	B	SE	p	Exp(B)	CI - (2.5%)	CI + (97.5%)
Intercept	-1.13	0.62	0.07	0.32	0.09	1.09
log10Media_Flightpath	-1.17	1.85	0.53	0.31	0.01	11.57
LDEN	0.09	0.01	0.00	1.09	1.06	1.12
Year 2011	-1.43	0.66	0.03	0.24	0.07	0.88
Year 2012	0.06	0.35	0.85	1.07	0.54	2.12
Year 2013	0 ^a			1.00		
LDEN * log10Media_Flightpath	0.02	0.04	0.50	1.02	0.95	1.10
Year2011 * LDEN	0.00	0.01	0.72	1.00	0.99	1.02
Year2012 * LDEN	0.00	0.00	0.47	1.00	0.99	1.01
Year2013 * LDEN	0 ^a			1.00		
Year2011 * log10Media_Flightpath	2.21	0.93	0.02	9.10	1.47	56.33
Year2012 * log10Media_Flightpath	-0.59	1.14	0.61	0.56	0.06	5.19
Year2013 * log10Media_Flightpath	0 ^a			1.00		

a. Reference category, B: regression coefficient, SE: standard error, p: significance level, Exp(B): odds ratio, CI - : lower confidence level, CI + : upper confidence level. Media variables are logarithmized due to their right-skewedness.

Table 11: Regression results for the influence of media reports on "mistrust" and LDEN on annoyance ratings 2011 to 2013

	B	SE	p	Exp(B)	CI - (2.5%)	CI + (97.5%)
Intercept	-1.78	0.71	0.01	0.17	0.04	0.68
log10Media_Mistrust	-0.41	1.10	0.71	0.66	0.08	5.76
Lden	0.10	0.01	0.00	1.10	1.07	1.13
Year 2011	-0.97	0.43	0.02	0.38	0.16	0.88
Year 2012	-0.07	0.29	0.81	0.93	0.53	1.64
Year 2013	0 ^a			1.00		
Lden * log10Media_Mistrust	0.00	0.02	0.95	1.00	0.96	1.05
Year2011 * Lden	0.01	0.00	0.01	1.01	1.00	1.01
Year2012 * Lden	0.00	0.00	0.72	1.00	1.00	1.01
Year2013 * Lden	0 ^a			1.00		
Year2011 * log10Media_Mistrust	-0.62	0.55	0.26	0.54	0.18	1.58
Year2012 * log10Media_Mistrust	-0.23	0.43	0.59	0.80	0.34	1.84
Year2013 * log10Media_Mistrust	0 ^a			1.00		

a. Reference category, B: regression coefficient, SE: standard error, p: significance level, Exp(B): odds ratio, CI - : lower confidence level, CI + : upper confidence level. Media variables are logarithmized due to their right-skewedness.

Table 12 Regression results for the influence of media reports on "noise exposure" and LDEN on annoyance ratings 2011 to 2013

	B	SE	p	Exp(B)	CI - (2.5%)	CI + (97.5%)
Intercept	-11.56	4.72	0.01	0.00	0.00	0.10
log10Media_NoiseExposure	11.85	5.58	0.03	140273.39	2.52	7822988813,2
Lden	0.27	0.09	0.00	1.32	1.10	1.57
Year 2011	2.66	1.45	0.07	14.24	0.82	246.13
Year 2012	-0.94	1.74	0.59	0.39	0.01	11.88
Year 2013	0 ^a			1.00		
Lden * log10Media_NoiseExposure	-0.21	0.11	0.05	0.81	0.65	1.00
Year2011 * Lden	-0.01	0.01	0.48	0.99	0.98	1.01
Year2012 * Lden	0.02	0.01	0.04	1.02	1.00	1.05
Year2013 * Lden	0 ^a			1.00		
Year2011 * log10Media_NoiseExposure	-3.08	1.76	0.08	0.05	0.00	1.45
Year2012 * log10Media_NoiseExposure	-0.34	1.76	0.85	0.71	0.02	22.31
Year2013 * log10Media_NoiseExposure	0 ^a			1.00		

a. Reference category, B: regression coefficient, SE: standard error, p: significance level, Exp(B): odds ratio, CI - : lower confidence level, CI + : upper confidence level. Media variables are logarithmized due to their right-skewedness.

Table 13 Regression results for the influence of media reports on "increase noise exposure" and LDEN on annoyance ratings 2011 to 2013

	B	SE	p	Exp(B)	CI - (2.5%)	CI + (97.5%)
Intercept	-0.88	0.78	0.26	0.42	0.09	1.93
log10Media_IncreaseExposure	1.55	1.83	0.40	4.72	0.13	171.01
Lden	0.09	0.02	0.00	1.09	1.06	1.12
Year 2011	-1.37	0.88	0.12	0.25	0.05	1.42
Year 2012	-0.13	0.29	0.65	0.88	0.50	1.54
Year 2013	0 ^a			1.00		
Lden * log10Media_IncreaseExposure	-0.02	0.04	0.55	0.98	0.91	1.05
Year2011 * Lden	0.02	0.02	0.28	1.02	0.98	1.05
Year2012 * Lden	0.00	0.00	0.53	1.00	0.99	1.01
Year2013 * Lden	0 ^a			1.00		
Year2011 * log10Media_IncreaseExposure	2.72	1.46	0.06	15.13	0.86	267.26
Year2012 * log10Media_IncreaseExposure	-0.04	0.50	0.94	0.96	0.36	2.59
Year2013 * log10Media_IncreaseExposure	0 ^a			1.00		

a. Reference category, B: regression coefficient, SE: standard error, p: significance level, Exp(B): odds ratio, CI - : lower confidence level, CI + : upper confidence level. Media variables are logarithmized due to their right-skewedness.

Table 14 Regression results for the influence of media reports on "night flight" and LDEN on annoyance ratings 2011 to 2013

	B	SE	p	Exp(B)	CI - (2.5%)	CI + (97.5%)
Intercept	-1.47	0.15	0.00	0.23	0.17	0.31
log10Media_Nightflight	2.18	1.07	0.04	8.88	1.10	71.90
Lden	0.09	0.00	0.00	1.10	1.09	1.10
Year 2011	-0.68	0.22	0.00	0.51	0.33	0.77
Year 2012	-1.61	0.75	0.03	0.20	0.05	0.87
Year 2013	0 ^a			1.00		
Lden * log10Media_Nightflight	-0.04	0.02	0.05	0.96	0.92	1.00
Year2011 * Lden	0.01	0.00	0.00	1.01	1.01	1.02
Year2012 * Lden	0.03	0.01	0.05	1.03	1.00	1.06
Year2013 * Lden	0 ^a			1.00		
Year2011 * log10Media_Nightflight	-1.15	0.54	0.03	0.32	0.11	0.92
Year2012 * log10Media_Nightflight	0.32	0.27	0.24	1.38	0.81	2.34
Year2013 * log10Media_Nightflight	0 ^a			1.00		

a. Reference category, B: regression coefficient, SE: standard error, p: significance level, Exp(B): odds ratio, CI - : lower confidence level, CI + : upper confidence level. Media variables are logarithmized due to their right-skewedness.

Table 15 Regression results for the influence of media reports on "night flight" and Lnight on sleep disturbance ratings 2011 to 2013

	B	SE	p	Exp(B)	CI - (2.5%)	CI + (97.5%)
Intercept	-0.86	0.13	0.00	0.42	0.33	0.55
log10Media_Nightflight	2.55	0.96	0.01	12.77	1.93	84.54
Lnight	0.07	0.00	0.00	1.08	1.07	1.08
Year 2011	-0.80	0.18	0.00	0.45	0.31	0.64
Year 2012	-1.43	0.66	0.03	0.24	0.07	0.87
Year 2013	0 ^a			1.00		
Lnight * log10Media_Nightflight	-0.07	0.02	0.00	0.93	0.89	0.98
Year2011 * Lnight	0.02	0.00	0.00	1.02	1.01	1.03
Year2012 * Lnight	0.05	0.02	0.00	1.05	1.02	1.08
Year2013 * Lnight	0 ^a			1.00		
Year2011 * log10Media_Nightflight	0.05	0.55	0.93	1.05	0.35	3.10
Year2012 * log10Media_Nightflight	-0.28	0.26	0.28	0.75	0.45	1.26
Year2013 * log10Media_Nightflight	0 ^a			1.00		

a. Reference category, B: regression coefficient, SE: standard error, p: significance level, Exp(B): odds ratio, CI - : lower confidence level, CI + : upper confidence level. Media variables are logarithmized due to their right-skewedness.

10.2 Annex 2: In-depth interviews around Dusseldorf Airport

10.2.1. Methodology

To take potential differences with respect to sound exposure levels into consideration, residents from two different area types were recruited: from a low

exposure area, which is defined by an aircraft noise level of less than 55 dB, and a high exposure area with more than 55 dB. The study area confined different postal codes, belonging to the cities of Dusseldorf and Ratingen.

The recruitment was done by a company that contacted adult residents (18 years and older) by phone to ask for participation. A screening questionnaire was administered with those residents, who were willing to participate. The screening assessed aspects such as year of birth, gender, duration of residence, residential satisfaction, disturbance and annoyance due to different factors (availability of parking space, lack of green areas and playgrounds, road traffic and aircraft noise), and membership in a citizen group.

An appointment for the in-depth telephone interviews was arranged between the participants and the research-team. An incentive of € 30 was offered for participation. To facilitate data analysis, participants were asked for permission to audio record the interviews. After the recordings were transcribed, the data were analysed in line with Mayring's qualitative content analysis (2015).

There were four main topics covered in the interviews and the focus groups:

1. Quality of life and living environment
2. Current view of the airport
3. Desired information and communication
4. Ideal relationship to the airport

10.2.2. Results

In total, 23 in-depth telephone interviews were conducted. One participant was excluded as the person lived outside the study area. The sample description of the remaining 22 participants is shown in Table 16: Sample description. None of the participants was a member in a citizen group related to topics such as aircraft noise or the airport.

Table 16: Sample description

	Low exposure (<55 dB)	High exposure (>55 dB)	Total
n	9	13	22

Age	<i>m(SD)</i>	68.78 (12.4)	60.38 (10.85)	63.82 (11.99)
Gender	male	6	6	12
	female	3	7	10
Duration of residence	<i>m(SD)</i>	26.09 (18.65)	24.08 (15.75)	24.9 (16.59)

The following sections briefly describe the results of the screening questionnaire and depict results of the in-depth interviews in detail comparing the low exposure group with the high exposure group.

10.2.3. Screening questionnaire

As mentioned above, the screening questionnaire assessed various measures. The residential satisfaction was measured on a scale from 1 (*very dissatisfied*) to 5 (*very satisfied*). The average residential satisfaction amounts to 3.86 ($SD= 1.08$) meaning the residential satisfaction was on average perceived as *neither dissatisfying nor satisfying to moderately satisfying*. In the low exposure group, the average residential satisfaction is higher ($M= 4.11$, $SD= 1.54$) compared to the high exposure group ($M=3.69$, $SD= 0.63$). This difference is visually depicted in Figure 13 and Figure 14.

Residential satisfaction in the low exposure group

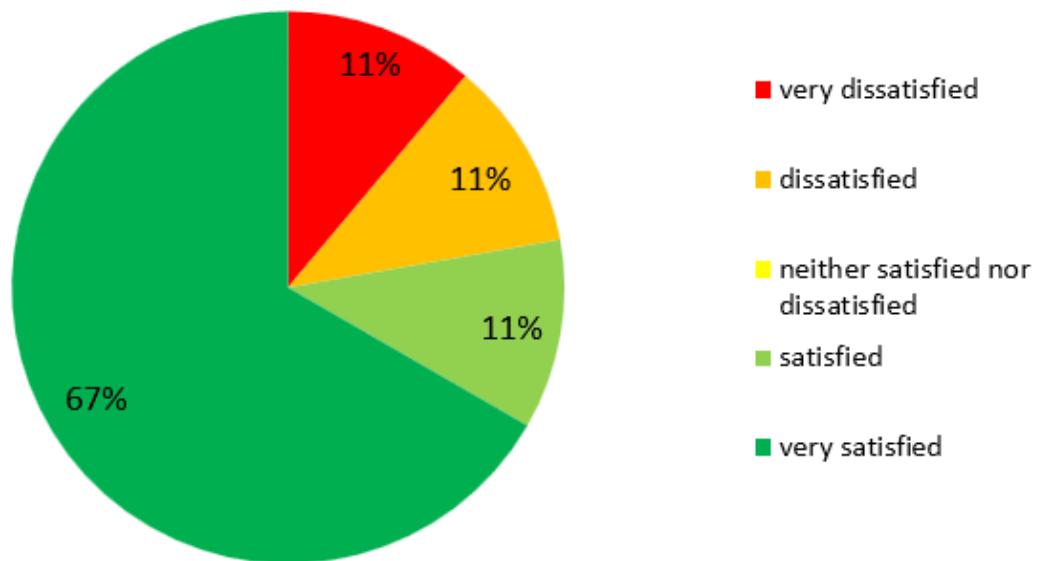


Figure 13: Percentage distribution of residential satisfaction in low exposure group

Residential satisfaction in the high exposure group

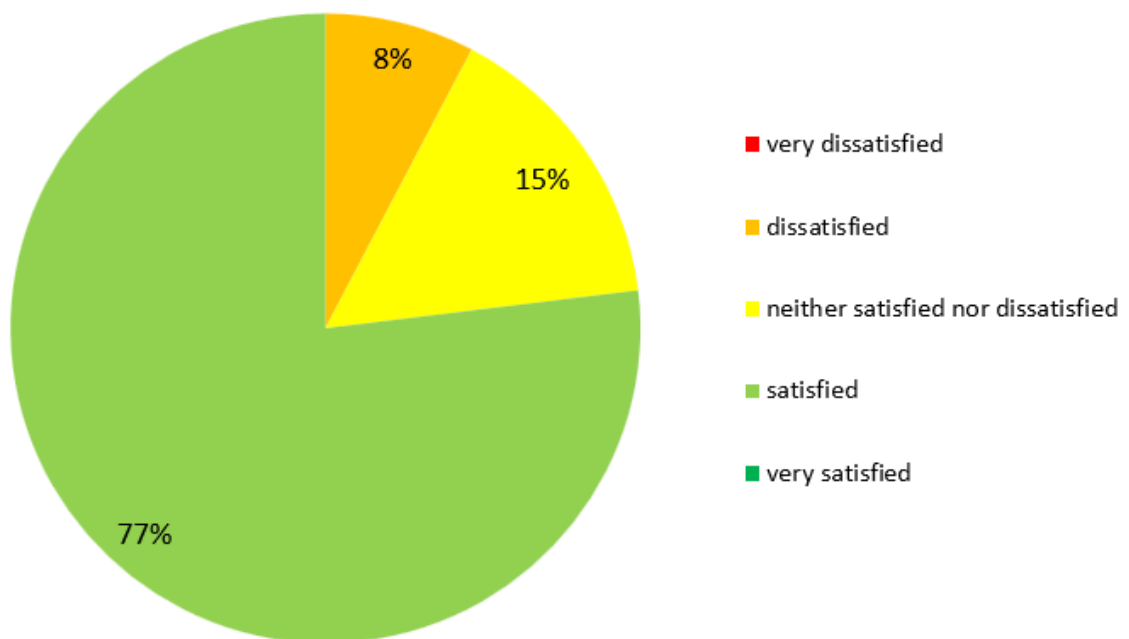


Figure 14: Percentage distribution of residential satisfaction in high exposure group.

Further, the degree of annoyance and disturbance due to different factors in the living environment was also assessed. These factors include aircraft noise, road traffic noise, lack of playgrounds, lack of green areas as well as available parking

possibilities. The degree of annoyance and disturbance was measured on a 5-point scale (1= *not at all* to 5= *extremely*).

Figure 15 presents the percentage of participants per annoyance/disturbance degree for each of the five factors. As can be seen, *aircraft noise* is the most annoying of the five listed aspects ($M= 3.27$, $SD= 1.2$), followed by *road traffic noise* ($M= 2.68$, $SD= 1.21$). It is important to note that the average aircraft noise annoyance rating across the sample indicates a moderate degree of annoyance. However, looking at the two groups separately, the mean aircraft annoyance ratings differ by 1-point on the scale (low exposure: $M= 2.67$, $SD= 1.5$; high exposure: $M= 3.69$, $SD= 0.75$). The same is valid for the other factors as well: participants in the high exposure group rate their annoyance and disturbance due to the five factors, on average, 1-point higher than participants from the low exposure group (see Table 17). This is also shown in Figure 16 and Figure 17

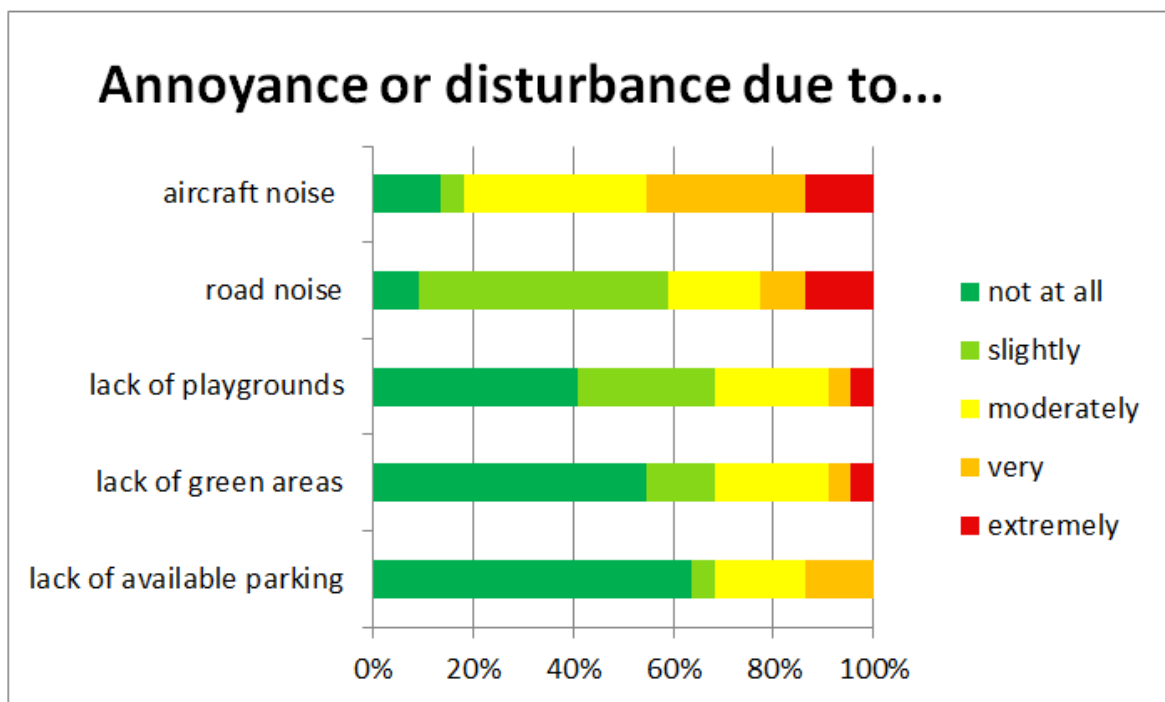


Figure 15: Annoyance or disturbance due to different factors across the two groups (in percent).

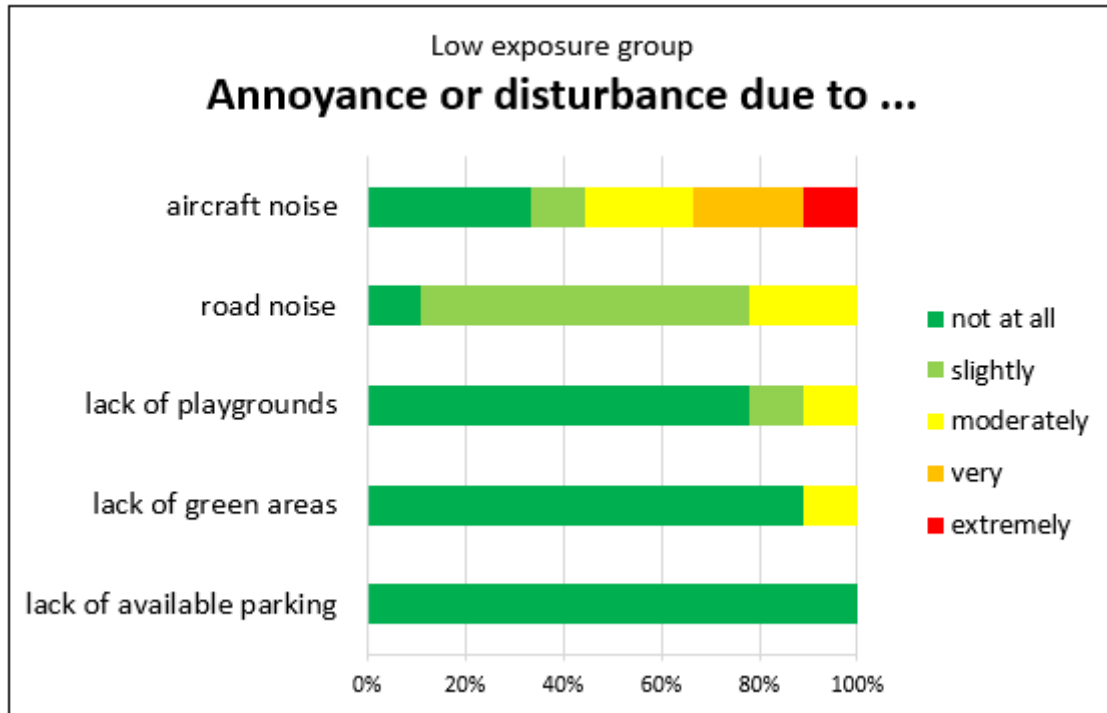


Figure 16: Annoyance/disturbance due to different factors in the low exposure group (in percent).

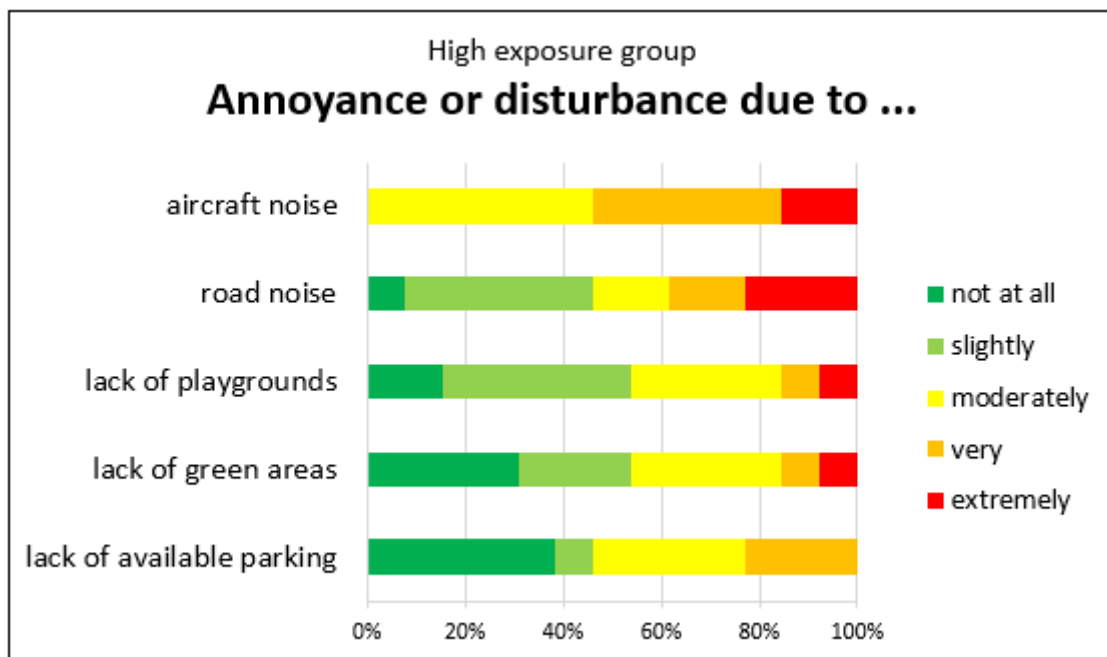


Figure 17: Annoyance/disturbance due to different factors in the high exposure group (in percent).

Table 17: Variable overview comparing the low and high exposure group.

	Scale	Low exposure (<55 dB)	High exposure (>55 dB)	Total
N		9	13	22
Residential satisfaction	very dissatisfied	1	0	1
	dissatisfied	1	1	2
	neither satisfied nor dissatisfied	0	2	2
	satisfied	1	10	11
	very satisfied	6	0	6
	<i>m(SD)</i>		4.11 (1.54)	3.69 (0.63)
Annoyance and disturbance due to...				
Availability of parking space	not at all	9	5	14
	slightly	0	1	1
	moderately	0	4	4
	very	0	3	3
	extremely	0	0	/
	<i>m(SD)</i>		1 (0)	2.38 (1.26)
Lack of green areas	not at all	8	4	12
	slightly	0	3	3

	moderately	1	4	5
	very	0	1	1
	extremely	0	1	1
	<i>m(SD)</i>	1.22 (0.67)	2.38 (1.26)	1.91 (1.19)
Lack of playgrounds	not at all	7	2	9
	slightly	1	5	6
	moderately	1	4	5
	very	0	1	1
	extremely	0	1	1
	<i>m(SD)</i>	1.33 (0.71)	2.54 (1.13)	2.05 (1.13)
Road traffic noise	not at all	1	1	2
	slightly	6	5	11
	moderately	2	2	4
	very	0	2	2
	extremely	0	3	3
	<i>m(SD)</i>	2.11 (0.6)	3.08 (1.38)	2.68 (1.21)
Aircraft noise	not at all	3	0	3
	slightly	1	0	1

moderately	2	6	8
very	2	5	7
extremely	1	2	3
<i>m(SD)</i>	2.67 (1.5)	3.69 (0.75)	3.27 (1.2)

In the following sections, the similarities and differences between the two groups are described with respect to each main topic.

10.2.3.1. Quality of life

First, participants were asked which aspects they consider to influence the quality of life in their region. Participants could name any number of aspects. The most frequently given answer was *nature* (72 %). In second and third were *road traffic* (50 %) and *traffic connection* (50 %), respectively.

Overall, there is a lot of overlap between the groups. Figure 8 and Figure 9 depict the number of quality of life aspects mentioned in both groups, with a green bar indicating a positive influence and a red bar indicating a negative influence on quality of life.

Nature is the most frequently mentioned aspect in both groups, whereas – not surprisingly – *aircraft noise* as a negative influence on quality of life is by far more often mentioned in the high exposure group (8 participants, 62 %) compared to the low exposure group [1 participant, 11 %; *Others (negative)*]. Two participants also mention air pollution as an airport-related negative influence affecting their quality of life (high exposure group).

Other aspects of participants' living environment affecting their quality of life in both groups are, for example, the traffic connection, living close to the city centre and having a variety of shopping possibilities.

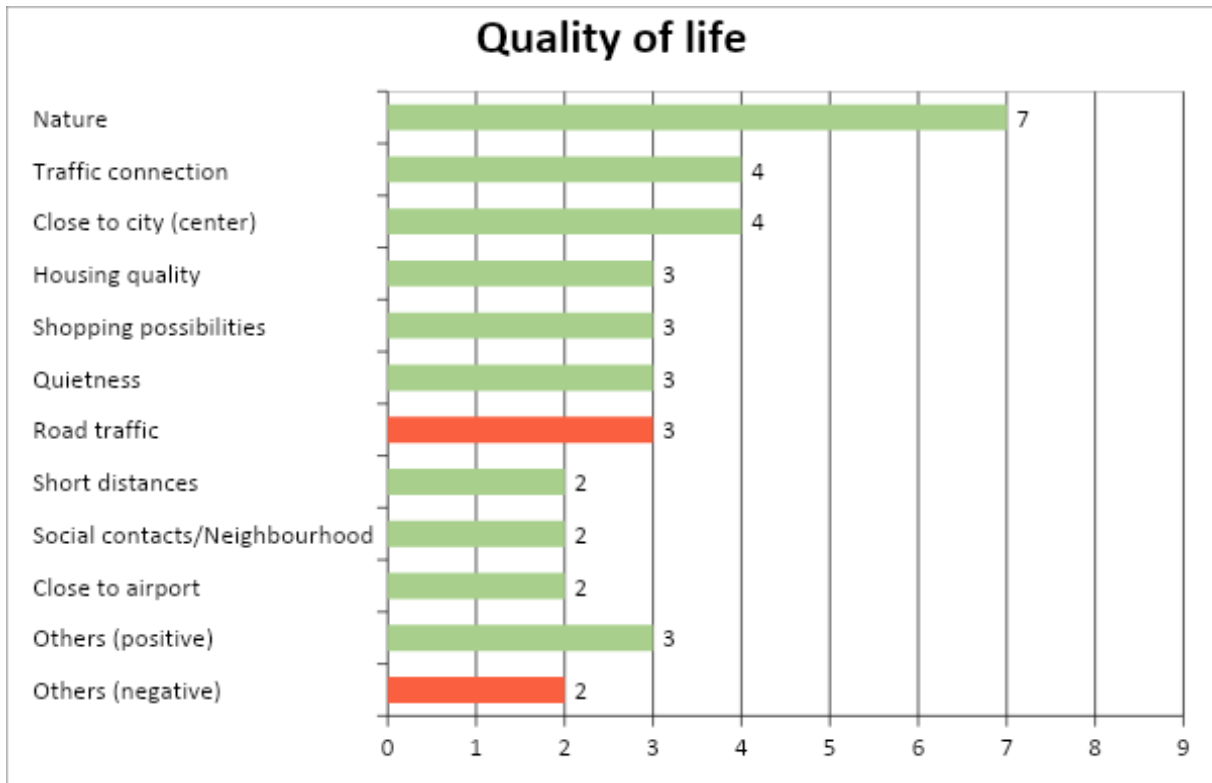


Figure 18: Quality of life aspects mentioned by participants in the low exposure group

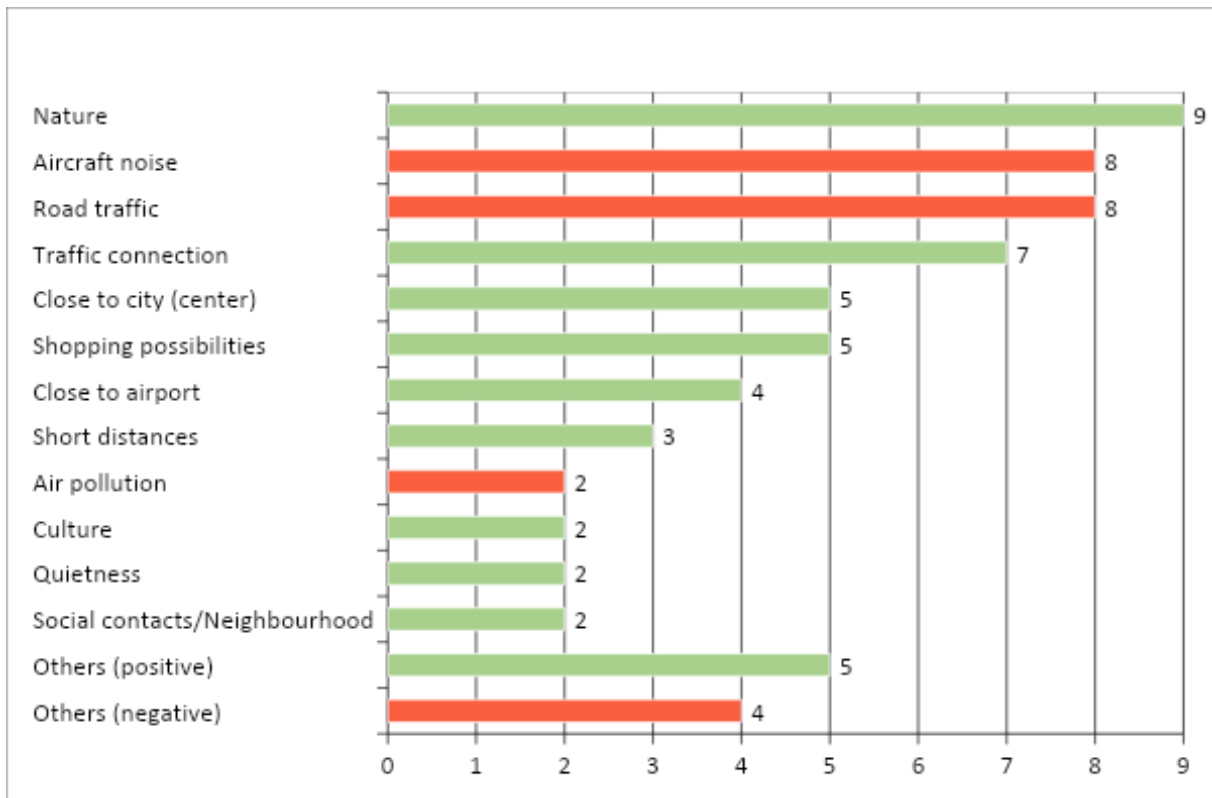


Figure 19: Quality of life aspects mentioned by participants in the high exposure group.

10.2.3.2. Current view of the airport

The majority of participants in both groups associate the possibility to *travel* with the Dusseldorf Airport. Two participants from each group stress out that the airport presents an *important economic factor* for the region. Half of the participants from the high exposure group (7 participants, 54 %) associate *aircraft noise* with the airport compared to approx. one fifth of the participants from the low exposure group.

Three participants from the high exposure group criticize the parking situation: as the airport's parking fee is rather expensive, a vast number of travellers park their cars in the surrounding communities, causing a lack of parking spaces for the locals. Further, the solely economic focus of the airport is viewed negatively.

With respect to information participants currently receive from the airport, information about the expansion of capacities is most common (23 %). 27 % state that they receive no information at the moment. This lack of information from the airport could, however, be ascribable to the Corona-pandemic. Almost half of the participants obtained the information from the local newspaper. There is no difference between the two groups.

10.2.3.3. Desired information and communication

The next topic dealt with the information participants would like to receive and how the communication should look like. In general, participants wish for an open, honest and transparent communication. In both groups, the majority of participants wish for communication and information from the airport operator. A few participants would also welcome information that is provided by the city. The most preferred channels for communication are the internet and newspaper. Table 18 gives an overview of the most frequently given answers by each group.

Table 18: Desired information and communication depicted for the low and high exposure group

	Low exposure (<55 dB)	High exposure (>55 dB)
n	9	13
Channels	Newspaper (4)	Internet (8)

	Postal mailings (4)	Flyer/Brochure (4)
	Internet (2)	Newspaper (2)
		Information events (2)
Messenger	Airport operator (7)	Airport operator (6)
	City (2)	City (3)
	State (2)	
Type of contact	Receiving information (5)	Receiving information (9)
	Personal communication (5)	Personal communication (4)
Information about...	Environmental impact (2)	Statistics (e.g. number flight movements; 4)
	Future plans (2)	General information (e.g. history and development, 3)
	Statistics (e.g. number flight movements; 2)	Environmental impact (2)
		Explaining night-flight ban (2)
		News and improvements (2)
		Sound insulation scheme (2)
Frequency of receiving information	When required (3)	When required (4)
	Once to twice a year (2)	Once to twice a year (3)
General aspects	Poor communication (2)	More community engagement (2)
	More community engagement (1)	Correct information (2)
	Correct information (1)	More understanding (2)

Note: Participants could name more than one channel, topic, messenger etc. The number in brackets indicates the number of participants that mentioned this aspect.

10.2.3.4. Ideal relationship to the airport

With respect to a fair, neighbourly relationship with the airport, the most frequently mentioned relevant aspects concern those that go beyond communication such as *adherence to the night-flight ban* (8 participants, 36 %) and *improvement of sound insulation scheme* (8 participants, 36 %). Both aspects are more often mentioned by participants in the high exposure group. Further, this group also named a limit to airport growth, quieter aircrafts, the distribution of flights to other airports, as well as the reduction of parking issues as other relevant aspects that should be addressed. Additionally, participants from the low exposure group prefer creating a balance between the residents' and airport's needs as well as a reduction of the number of flights.

According to participants, there should be more transparent and honest communication and information to foster a fair, neighbourly relationship.

Slightly more than half of participants do not think that a fair and neighbourly relationship with the airport can affect one's perception of aircraft noise annoyance (12 participants, 55 %), while the others believe it could have a positive effect (10 participants, 45 %). There is also a difference between the two groups: while 56 % of participants from the low exposure group think that one's noise annoyance perception can be affected, only 38 % of participants from the high exposure group state the same.

10.3 Annex 3 - Focus groups

Focus groups as a way to obtain information about an unexplored area is becoming increasingly popular. Focus groups in general can be seen as a carefully planned series of discussions designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment (Krueger, 2014). Focus groups are distinct to other data collecting methods and have typically five features or characteristics. (1) Focus groups are made up of a small group of people, who (2) possess certain characteristics and (3) provide qualitative data. The data derives from a (4) focused discussion and (5) helps to understand a topic of interest (Krueger, 2014). Markovà and colleagues (2017) describe the focus group methodology as a dialogue process saying that "humans live in the world of others and that their existence, thought and language are thoroughly interdependent with the existence, thought and language of others" (p. 1). Therefore, the group

process in focus groups reveals information not achievable with interviews or other qualitative methods alone (Kitzinger, 1995). Focus groups provide opinions, perceptions and help uncover underlying factors and motivations.

In general, the setting of a typical focus group discussion can be described as a situation where beside the participants two people from the research team are attendant. One is the moderator, also called "facilitator", because they do not lead the discussion per se but rather facilitate the flow of the discussion. Respect for the participants may be one of the most influential factors affecting the quality of focus group results, in addition to empathy and positive regard. According to Krueger (2014), the moderator of the focus groups must truly believe that the participants have wisdom, no matter what their level of education, experience, or background. The moderator is primarily concerned with directing the discussion and keeping it flowing, while the other person, the assistant, is responsible for the audio recorder, handles the environmental conditions and logistics (refreshments, lightning, and seating), responds to unexpected interruptions, and takes comprehensive notes.

The questions asked in the focus groups are, in general, very clear, open-ended, one-dimensional and include unambiguous, well-thought-out directions. They follow the route from introductory questions to transition questions to the key questions which drive the discussion (Krueger, 2014). Sometimes the topics, which are only discussed for a short time, are seen as more important from the subjects' view than topics talked about extensively. In so determining, we can discern what was, from the subjects' perspective, the most important message said in this discussion.

10.3.1. Focus Groups around Cologne-Bonn Airport

The focus groups around Cologne-Bonn airport were conducted between January and February 2020. The areas were, similar to the in-depth interviews, either highly or slightly affected by aircraft noise. Residents were recruited via mail shot, but also, e.g. via displaying the flyers in hairdressers, barbers or doctoral offices in the areas of interest. In total, almost 12.000 flyers were sent out.

Most important information was printed on the flyers with a link and QR code, which led to an online survey to gather additional information about the applicants.

When enough participants had expressed interest from one area, they were invited via mail and telephone two weeks prior, with an additional reminder call two days before the focus group.

In total, the focus groups lasted 90 minutes to a maximum of 2h and were audio-recorded. Every participant had given consent. Participants received € 50 as incentives.

Table 19: Description of participants of Focus Groups around Cologne-Bonn Airport

		Group 1 (high exposure)	Group 2 (low exposure)	Group 3 (high exposure)	Group 4 (low exposure)	Total
n		7	9	5	8	29
Age		44 (28,47)	45,11 (23,32)	55,2 (21)	50,25 (17,19)	48 (21,98)
Gender	male	2	7	2	4	15
	female	5	2	3	4	14
Annoyance from aircraft noise		2,83 (1,47)	2,67 (1,12)	2,4 (1,14)	2,5 (0,93)	2,61 (1,1)

Five to nine residents, which were either highly (> 55 dBA L_{den}) or slightly (< 50 dBA L_{den}) exposed to aircraft noise made up a focus group. To allow a variety of different experiences and perspectives, groups were mixed in age, gender and long-term annoyance due to aircraft noise.

10.3.1.1. Quality of life

Participants of the focus groups were asked after a short round of introduction what aspects impact their quality of life. At this point, an attempt was made not

to bring up the subject of airports or aircraft noise, so that the respondents were free to answer. This should make it possible to assess how strongly they actually perceive aircraft noise as a factor influencing their quality of life before it becomes obvious that it will be the main topic of the discussion.

After giving respondents enough time to discuss various aspects of their quality of life, they were asked to choose three factors that had the greatest impact on their quality of life, both positively and negatively.

Group 1 ranked annoyance through night-time aircraft noise and air pollution through aircrafts and cars in the first place, followed by too little police presence, as well as low traffic safety due to e.g. uneven roads. The third factor mentioned was poor infrastructure, such as a lack of shopping facilities or playgrounds.

The ranking of factors that most positively influence the quality of life is a good infrastructure, but this time in regard to the number of schools, kindergartens and general practitioners in the region, followed by good transport connections. The third factor mentioned was the relationship with the family.

In Group 2, lack of being heard and lack of decision-making power voiced by the residents and was voted the most negative factors affecting quality of life. The respondents were concerned that needs are not recognized by authorities. This factor was followed by aircraft noise and traffic noise in general. In third place were building defects and the lack of infrastructure.

Factors that positively influence the quality of life are the surrounding nature, local recreation areas and good air quality (the group's region is somewhat rural). The good location and good infrastructure were cited second, followed in third place by proximity to cultural offers.

In Group 3, the ranking of the factors that most negatively affect quality of life is as follows: 1) traffic noise (aircraft, cars), 2) lack of cleanliness and pollution, and 3) lack of road safety and crime.

Factors that most positively influence the quality of life are green spaces and nature, followed by infrastructure and, thirdly, the social environment.

In group 4, aircraft noise was voted the most negative factor affecting the quality of life, followed by the lack of a bicycle network and the lack of parking facilities in the city centre.

The factors with a positive influence were the proximity to nature, the infrastructure and mobility in the region, and lastly the good social network.

What can be concluded here is that noise, both from aircraft and traffic in general, was voted in 3 out of 4 groups as the factor that most impacts their quality of life negatively.

10.3.1.2. Current view of the airport

In the focus groups, very different themes came up when respondents were asked what they associate with the airport in the region.

The emissions of the airport, specifically the noise during night-time, but also the impact on the environment were mentioned in all groups.

Other negative factors that were mentioned are, specifically for Cologne-Bonn Airport, the parking fees which were reason for anger.

However, the general associations with Cologne-Bonn Airport were also very positive to a large extent. The associations that were mentioned included holidays, networking and internationality. Furthermore, the airport was also associated with shopping opportunities.

Another association that 3 out of 4 groups had with Cologne- Bonn Airport was that it is an experience. Specifically, it means that the airport itself is a destination for many people, where you see celebrities and that has something magical. It was also seen as an emotional place and a "gateway to the world". Freedom was also an association. In two groups, the economic benefits were also noted, such as jobs.

Thus, participants mentioned a number of negative as well as positive associations with Cologne-Bonn Airport.

10.3.1.3. Desired information and communication

Participants would like information on various topics.

The question why there is no ban on night flights at Cologne-Bonn Airport was raised in all four focus groups. Participants wanted detailed and honest information on this. Furthermore, information on the effects of aviation and aircraft noise was requested. This is related to people, animals, but also to nature and the environment, specifically climate change. This information should be scientific and

up-to-date. In general, the participants also wanted general information on the functioning of the airport, such as flight route distribution, how measurements work, but also on changes in the summer months. Another topic dealt with future plans of the airport. What technical improvements are to be expected, what changes are planned and what the general growth strategy of the airport is. This was about predictability for the citizens. Last but not least, residents would like information on noise protection and noise protection claims.

Both high and low aircraft noise exposed participants could generally envisage the airport as an information provider, given that the airport would mean it seriously. However, some residents would rather have a neutral body as information provider, such as a mediator or an ombudsman, someone who is not in charge for the airport. A major issue was the provision of information by politicians. A wide variety of bodies were mentioned: the city of Cologne, the individual municipalities, but also at the level of state policy, the federal government or, more globally, the EU.

In general, information should be communicated by various means, for instance via radio, Internet or flyers. The airport's own YouTube or radio channel were mentioned as well. An important topic was the personal exchange with the airport. Communication in the form of a citizens' information centre, general information events, discussion rounds such as focus groups or an open citizens' dialogue were addressed. The participants emphasized that the information should be presented in a factual and comprehensible way. The time interval should depend on the subject area. Of course, communication should take place when changes occur, but there should also be a continuous and regular exchange of information.

10.3.1.4. Ideal relationship to the airport

What would be necessary to accept Cologne-Bonn airport as a neighbour can be grouped into two categories.

First, participants named the reduction of emissions as a building block. Specifically, they mentioned a ban on night flights, or a ban on short-haul aircraft. In addition, the replacement of old aircrafts or a different flight altitude were suggested. Finally, they also mentioned price reduction mechanisms so that it is no longer profitable for airlines to use old aircraft.

The second category relates to information and communication. The descriptions of characteristics that the airport should have in order to be accepted as a fair neighbour can be described as follows:

The airport should demonstrate a willingness to reach out to residents. It should be reliable, and adhere to agreements. The airport should take responsibility for the residents. The characteristic of respect was also mentioned, just as a real neighbour would do. They would like the airport to take the initiative and approach the affected residents. The airport should be open, open to criticism and, above all, transparent.

An airport that acts fairly should treat residents with care, cooperate with them and communicate honestly.

The notion of fairness appears, in this last line, as a key concept to raise confidence between inhabitants and airports. It also appeared in the discourse of people who live around Charles de Gaulle airport. The results are described in the following section.

10.3.2. First step focus group around Paris

10.3.2.1. Sample information

Focus-group in Villepinte, near Paris (>45 dB)

The sample is made up of 9 participants: 4 men and 5 women. The median age is 44 years. 4 participants live in an apartment and 5 in a house, 4 owners and 5 tenants. All the participants were in professional activity including two people who were working at the airport and a former flight attendant at the airport. 7 participants have children and 4 people work full time at home. The respondents declared to be mainly bothered by road traffic noise, aircraft noise and the quality of public transport. They were not members of local residents' associations.

Focus-group in Garges les Gonesses, near Paris (<60 dB)

The sample is made up of 8 participants - 4 men and 4 women - The median age is 45 years. 5 in a couple and 3 singles - 6 in an apartment and 2 in a house - 5 owners - 3 tenants - all in professional activity including two working at the airport and a former flight attendant at the airport - 4 households have children - 2 people work full time at home. Participants were mainly bothered by road traffic noise, the cleanliness of the neighbourhood and traffic jams. They are not members of local residents' associations.

10.3.2.2. Quality of life

As a preamble to this workshop, we proposed to discuss the quality of life of the participants in their area.

In Villepinte, participants mentioned the increase in noise pollution linked to road traffic and air traffic, which they associated with health issues. The participants speak of "land congestion". A woman says "It's not just airports, it's also the road! We build too much, there are too many people." It is indeed this question of the densification of the population in the suburbs that is first highlighted by the participants. The participants from Villepinte and its surroundings also share problems of cleanliness in municipal parks or in the street, indeed some companies deposit rubble and pollute the quality of life. However, some participants also highlight more positive amenities like green parks or the proximity to cultural and shopping services.

In Garges les Gonesses, some positive things show up as the fact to have convenient stores in their close area, to have access to good transport infrastructure and to have little houses instead of big buildings. However, residents quickly express criticism of their residential environment, which they see as "dormitory suburbs" in which they observe a lack of sociability and civic participation. The inhabitants also criticize the noise pollution linked to the neighbourhood but also to aircraft. Participants adapt their behaviour to aircraft noise, for example, they stop a conversation in the middle of it when a plane passes, they pause, whether this conversation takes place in the garden or in the housing.

10.3.2.3. Current view of the airport

After talking about the quality of life we broached the issue of the airport residents' representation. The idea was to highlight beyond the discussion, the current view of the airport whether it is the current associations or the information currently known.

In Villepinte, they are annoyed by aircraft noise, aircraft light and traffic associated with the airport. While they are very sceptical about the notion of "informing" on the part of the Parisian airport, they regret being informed and not consulted in the case of Parisian airport projects. They also seem very suspicious of the latter. The participants of the Villepinte focus group denounced the lack of information,

the lack of public meetings, and consultations. "We do not take the population into account enough in spatial planning," said one participant. Parisian airport planned and carried out projects without consulting the residents of surrounding communities. The Parisian airport does not inform, does not project, they inform at the last minute". They also have the feeling that communication from the airport is not followed by actions.

However, the airport is also linked to opportunities for jobs and for travelling. People feel convenient to live close to the airport as they partly work in it or take the plane for work or leisure time.

In Garges les Gonesses, they see the airport as an opportunity for travelling, for jobs and also to have more shops accessible in their town. They consider the airport as "a little town" itself. However, when we talked about communication, few of them knew where to find any information about airport activities for reducing noise impact. More than that, they do not understand how the information leads to concrete action and they regret not having any visibility on complaint solving. They also mention a feeling of injustice regarding the difference between the absence of taxes on carbon for the aviation field and the high amount of taxes they have to pay to use their car. As people in Villepinte they do not know if information from Parisian Airport leads to actions.

10.3.2.4. Desired information and communication

Referring to the previous answers regarding the information known about air traffic management, we asked the participants about the information they would like to have to enhance their comprehension in this field. When analysing the data, we split the data into three main topics: who should provide the information, how it should be provided and what information is needed.

Regarding the information needed in Villepinte, participants mentioned that they would like to have more information about: how to get the grant for insulation scheme, the localisation of their dwelling in the noise map, information about air pollution emission from aircrafts and about the number of impacted people. They also asked for contact information of the residents association. Regarding air pollution they mentioned that they would be glad to be informed by digital signs in the street and for the other requests with the help of a website. All

participants from this group agreed that the information should be given by a neutral mediator like the state for instance, and not from Parisian Airport.

Considering the answer for Garges les Gonesses, people would like to have more information on impact or risk of air traffic on their health. They would like to know where they can complain, to whom they can address their complaint, whom to ask for information regarding air traffic, for instance, on the number of aircraft per day, number of take-offs and landing per day, on the peak hours, etc. To them, this information should be provided by the town, by neutral media, by other residents or by the Parisian Airport during an event in the town.

This information could be provided on different media such as the town website, social networks, by SMS, by a specific mobile app like "Bison futé" in France but dedicated to air traffic. They also proposed to set up an information bus run by Parisian airports which would operate in cities impacted by air traffic nuisances.

10.3.2.5. Ideal relationship to the airport

After addressing questions regarding information and communication we asked questions about their perception of an ideal relationship with the airport. The idea was to better understand how the airport could better contribute to improving the residents' quality of life. Again, we split the data into two topics that were the communication and actions that should be set up beyond the communication.

In Villepinte, people ask for more explanation regarding the ongoing actions to lower the noise. They also mentioned that they would like to have more public meetings that follow concrete actions and that the Parisian Airport recognizes the inconvenience it causes.

Beyond communication, this group proposes to invite residents in doing sound recordings, to involve residents in the decision of future projects, to promote the environmental aspect instead of the economic aspect, and a better legal framework around annoyance. Moreover, they said that the Parisian Airport needs an opposition.

In Garges les Gonesses, an ideal relationship with the airport would consist of communication about the impact of air traffic on health, to know more about where the tax penalties of airline companies go, to have more information on air traffic in general (how many planes per day, pic hours, etc.).

Beyond communication, an ideal relationship with the airport would be to have financial compensations for residents, the airport adhering to regulations, to

prohibit use of older aircrafts (20 years old and more), to improve insulation scheme procedures and to include the insulation of the roof, to build less noisy aircraft, to decentralize some flights on other airports or to concentrate the routes, but with a financial compensation for those who are under the flight path. Ideal relationships should also be possible if the Parisian Airport offered professional training for residents and if they prioritize jobs for people of the airport region.

10.3.3. Second Step Focus Groups around Paris

Introduction 15 minutes

- 1) What is it like to live near an airport?
- 2) Do you maintain a good relationship with the airport? If yes why, if not why?
- 3) According to you, what is an ideal relationship with the airport?

Part 1: Results 20 minutes

Five-minute presentation of previous results – (ideal relationship and desired information and communication)

- 1) Do you agree or not with what has been said during previous focus groups?
- 2) Do you want to add something to what has been declared by previous participants?

Part 2: Brainstorming 25 minutes

Definition of fairness

- 1) Chinese portrait of fairness
 - If fairness were a place, it would be:
 - If fairness were an object, it would be:
 - If fairness were an action, it would be:
 - If fairness were an adjective, it would be:

- If fairness were a person, it would be:
- If fairness were a feeling/emotion, it would be:

2) What does « fair relationship with the airport » make you think about?

3) In your opinion, what can the airport do to improve this relationship?

- It can either be communicational or operational.

Part 3: Action scheme 30 minutes

1) If you had to put these ideas into practice, what would the intervention look like?

This part consists in articulating the ideas formulated in the brainstorming session to create an intervention, while specifying when, where, with whom and how do the stages of the intervention take place.

2) In your opinion, what could be done to make sure residents are part of the decision making?

3) Imagine you are an airport manager, and you have to respond to residents' complaints about noise annoyance. They demand more fairness and attention to their needs/lives. While precising where, when, how and with whom, design your action plan and how to implement it. Identify potential difficulties and ways to deal with them.

4) What are your expectations concerning the traffic recovery after the lockdown?

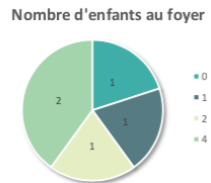
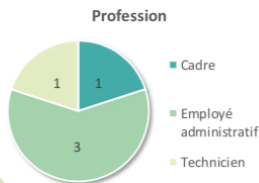
- How would you like to be consulted?

GROUPE 1 – RURAL > 60 DB

DONNÉES DÉMOGRAPHIQUES

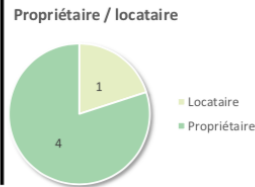
Description du groupe

Le groupe est composé de 5 participants dont 3 femmes et 2 hommes âgés en moyenne de 48 ans (max = 59, min=27).



Logement

Tous les participants habitent dans une maison depuis en moyenne 12 ans (max=20, min=7).



Objets de désagrément

Bruit des avions
Pollution de l'air
Voisins pas sympatiques

RÉSULTATS

Relation à l'aéroport

Points positifs

- Pas si gêné à l'intérieur
- Habitude
- Proximité pratique
- C'est un choix de vivre ici
- Campagne agréable
- Très utile l'aéroport

Points négatifs

- Très bruyant l'été et en extérieur
- Fréquence du bruit
- Pollution dépôts de kérosène/huile
- Il faut faire savoir les problèmes même si c'est un choix de vie

Relation idéale

Idées

- Sérénité
- Partage/ échange
- Conciliation
- Médiation
- Équité
- Vérité
- Information
- Solutions
- Confiance
- Performance
- Compensation
- Acceptation

Concret

Avantages/compensation

- Compensation financière
- Priorité pour l'emploi
- Carte résident SNCF, RER

Communication

- Santé, écologie, efforts, nouveauté, avenir CT, MT..
- Par email/ avec transparence

Impliquer les résidents

- Colloques/ réunions avec intervenants neutres
- Sondages
- Impliquer l'école et la ville
- Atelier parent-enfant

Intervention envisagées par les riverains

Éléments de l'intervention

- Recueillir les problèmes (sondage, questionnaire)
- Réunir
- Communiquer régulièrement
- Mettre en place
- Contrôler
- Évaluer
- Mettre à niveau

Dispositifs principaux

- **Forum d'échange** (experts divers et neutres : santé, pollution, juridiques)
- > Puis mise en place plan d'action
- **Isolation** vitres
- **Infos** risques et pollution
- **Mise aux normes**
- **Réformer** les avions

Dispositifs secondaires

- **Répartition** des vols
- **Priorité** aux jeunes pour l'emploi
- Choisir **constructeurs** moins bruyant
- **Ajouter** des couloirs
- **Contourner** les couloirs gênants

Acteurs, rôles et fonctions

- **ADP** = supervise, finance et gère la mise en place de l'intervention
- **ASSO** = recueille les problèmes et évalue
- **Organisme indépendant** = contrôle la mise en œuvre et réalise des études d'experts sur les risques
- **Ville** = aide la communication et la réunion

Figure 20: Example of the French valuation of data collected.