In association with

RESPITE FROM AIRCRAFT NOISE: OVERVIEW OF RECENT RESEARCH

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REPORT ON RESPITE FROM AIRCRAFT NOISE:
OVERVIEW OF RECENT RESEARCH WORK

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CONTENTS

1 INTRODUCTION

The aviation industry is undergoing a period of airspace change, and Heathrow Airport Ltd wishes to take the opportunity to maximise operational efficiencies whilst continuing to manage the consequences of its operations on neighbouring communities.

The development of satellite navigation technology means that aircraft can now be flown much more consistently on specified paths giving the airport greater control over the noise impacts of aircraft. In particular, it gives added impetus to assessing the value to residents of sharing aircraft noise between communities so that, at any given time, some communities experience respite (i.e. airport-managed perceptible relief from aircraft noise).

The concept of providing respite from aircraft noise has taken on increasing importance in recent years, as a useful and effective strategy for providing a break from aviation noise. However, there are no specific guidelines to explain what *respite from aircraft noise* means and how it should be implemented.

Heathrow Airport Ltd identified a need to improve its understanding of respite from aviation noise and in October 2014 set up a Respite Working Group (RWG) to investigate and advise. The RWG identified some knowledge gaps and recommended a laboratory and field based research project. That research commenced in February 2016 to address the key objectives identified by the RWG.

This aim of this report is to consolidate and provide an overview of the learning gathered through this journey to improve understanding of the concept of "respite". It presents the story so far from the formation of the Respite Working Group to the recent research work. A separate report was provided by the RWG on the "State of the Art of respite" and a detailed Technical Report on the recent lab and fieldwork research has been developed. These can be found at [1],[2] and both should be read in conjunction with this overview report for full details.

Section 2 of this report sets the context of the problem being addressed, and describes the formation of and recommendations from the Respite Working Group.
Section 3 restates the work objectives for the subsequent technical laboratory and fieldwork and outlines the approach taken by the Research Team to deliver them.
Section 4 summarises the key lessons learnt from the technical work.
Section 5 provides a Statement on the Work prepared by the Peer Review Group on the recent technical work.
Section 6 considers recommendations for future follow on work towards delivering an effective respite strategy.

[1] http://www.heathrow.com/file_source/HeathrowNoise/Static/Respite_Review_June_2016.pdf
[2] attached to the end of this overview report

2 UNDERSTANDING RESPITE – THE RESPITE WORKING GROUP

2.1 The need to better understand the concept of respite

The aviation industry is undergoing a period of airspace change, and Heathrow Airport Ltd wishes to take the opportunity to maximise operational efficiencies whilst continuing to manage the consequences of its operations on neighbouring communities.

The development of satellite navigation technology means that aircraft can now be flown much more consistently on specified paths giving the airport greater control over the noise impacts of aircraft. In particular, it gives added impetus to assessing the value to residents of sharing aircraft noise between communities so that, at any given time, some communities experience respite (i.e. airport-managed perceptible relief from aircraft noise).

There are three main drivers in the push for a better understanding of what respite from aircraft noise means and how to deliver it:

Community demand for respite: There is a consistent call from residents living under flightpaths for a break from aircraft noise. This has intensified due to the negative reaction towards trials of revised airspace design. It is important to understand what the communities themselves (both those currently overflown and those not) consider effective respite to be and how that could be achieved in reality.

Future Airspace Strategy: The implementation of Performance Based Navigation (PBN) as part of the Future Airspace Strategy will may result in the concentration of noise over fewer specific locations. This improved accuracy also generates an opportunity for the pattern of flightpaths to deliver shared concentration[3] but raises a question as to whether respite can be provided through rotation of flightpaths within the complexity/interaction with other airfields and procedures.

The UK policy context: The UK Aviation Policy Framework [4]cites the principle of respite as a measure for reducing the impact of aircraft noise. However, there is currently no guidance on its definition, implementation or delivery. The member states of ICAO have adopted a "Balanced Approach" to noise management and while not explicitly mentioned in the Balanced Approach, respite is one of the operational measures which should considered in that context

2.2 The Respite Working Group

Heathrow Airport Ltd (HAL) acknowledged the importance of understanding how to deliver effective respite in the context of developing its noise management strategy. In October 2014, the Respite Working Group (RWG) was set up to review current state of the art on respite from aircraft noise. Its role was to provide advice to the Heathrow Strategic Noise Advisory Group (formerly Heathrow Noise Forum) on the management and assessment of respite from aircraft noise. The RWG considered a review of the evidence on the 'current state of the art of respite' and reported on its findings, as well as a proposal for future research[5].

2.2.1 Key conclusions

Overall, the following key conclusions were drawn by the RWG based on the review evidence:

[3] Shared concentration is a term that has been used to describe the use of multiple PBN Standard Instrument Departure routes (SIDs) within a Noise Preferential Route (NPR swathe) – or indeed beyond. This could result in the concentration of noise along several different PBN SIDS which can be alternated so that noise is shared. In theory this concept may also be applied to arrivals.

[4] https://www.gov.uk/government/publications/aviation-policy-framework

[5] The report can be found at http://www.heathrow.com/file_source/HeathrowNoise/Static/Respite_Review_June_2016.pdf.

› **There is currently no clear, consistent or universally accepted definition of respite.**
The RWG agreed on working definitions for the purposes of their project – see Box 1. There are many factors affecting the perception of respite and additional work is required to further define 'a period of time', 'break' and 'reduction' in terms of community perception.

Box 1: Working Definitions used by the RWG for the purposes of this work

Relief can be defined as a break from or a reduction in aircraft noise.

Respite can be defined as a scheduled relief from aircraft noise for a period of time.

› **What the community values as respite is not fully understood.**
Despite a number of related studies and implementation examples, there is at present no clear understanding of what the community values as effective respite[6]. Effective provision of respite depends not only on operational features but also specifically on how the community perceives and values respite. Community-level understanding is therefore a priority in developing an effective respite strategy for Heathrow Airport.

› **There is no universal formula for the successful implementation of an effective respite strategy. Operational design for respite needs to consider operating conditions at an airport.**
The effective provision of respite depends on the relative position of the local community to the different flight paths that might be used, and how often each flight path is actually used. The operational conditions at an airport will determine which options may be feasible in terms of delivering respite. These could include factors such as safety, efficiency, aircraft and avionic capabilities and controllers' workload, amongst others.

› **There is currently no single acoustic metric that can adequately describe respite.**
Review work has shown that only a few metrics have been used to objectively describe respite. Since it is not clear what the community deems as effective respite, and therefore which parameters are useful in describing its key elements, it is not possible to choose a suitable metric that is fit for purpose at this time. Instead, the Group has suggested a list of guiding principles and a candidate list of metrics to describe the noise environment in terms of offering respite.

› **Further work is needed to develop a clearer understanding of which parameters are useful in describing respite, in a way that is valued by the community.**
Using this information we can then test the suitability of our candidate measures. We also need to understand the relative importance of acoustic and non-acoustic metrics in evaluating respite, so that we can put the usefulness and limitations of any acoustic metric in context.

› **A strong and effective communication strategy and good community engagement is essential for the successful implementation of respite.**
From the cases analysed, two conclusions were drawn: multi-stakeholder engagement is fundamental and more efforts in communication are needed. It is key to engage *all* stakeholders during *all* phases of respite design and implementation. Communication should ensure that those involved understand the likely implications and associated trade-offs of respite implementation.

Once we have a clearer understanding of how the community values respite, research can then focus on the selection of the most suitable engagement method for cross-sector involvement,

[6] Although the term community refers to the population of overflown residents, it is worth noting that the opinions may not be entirely unanimous and that residents may have differing opinions on effective respite.

how to identify the key information to share, how best to describe and present that information and the most effective combinations of media to use to disseminate the information.

› **There is currently insufficient information on the benefits of respite to health and on the economic value of the effects of respite.**

There is clearly no one-size-fits-all solution, every end solution will vary - there is a need for further research.

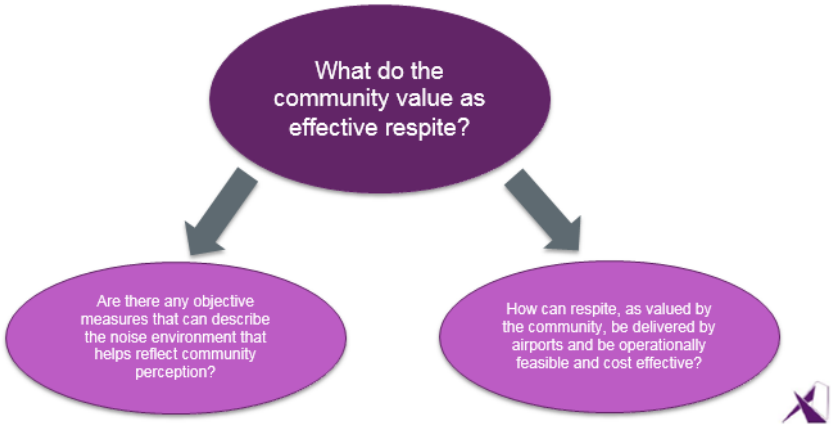
2.2.3 Research priorities recommended by the Respite Working Group

The RWG identified the following next steps to improve understanding and priorities for research:

Understand what the community values as effective respite.
Clarify the definitions for: 'a period of time', 'break', 'reduction' in terms of community perception.
Determine how far routes need to be changed to make a perceived difference and be of potential benefit in terms of height and position, for arrivals and departures.
Understand more clearly which parameters are useful to describe respite in a way that is valued by the community.
Test the list of candidate measures after further research is completed.
Identify the relative importance of acoustic metrics and non-acoustic metrics.
With a clearer understanding of how the community values respite, conduct further research, focussing on:

- Selecting the most suitable engagement process with all stakeholders (community, industry, regulator, etc.)
- Identifying the key information to share.
- Describing and presenting that information in the most suitable way for all parties.
- Identifying the most effective combinations of media to use.
- Selecting the optimum temporal separations or patterns required.

The RWG identified the three priority areas where greater understanding is required in order to implement effective respite from aircraft noise:



The RWG Group agreed that priority must be given to the first item - gaining a better understanding of how the community values respite, before considering operational feasibility, cost-effectiveness and the development of metrics. The following **key research objective** was identified for Heathrow:

To better understand the key characteristics of an effective respite strategy for Heathrow Airport and its local communities, consistent with efficient operations.

Two research stages were proposed:

› **Stage 1:** To develop a set of principles for providing effective respite from aviation noise at Heathrow. Two key questions have emerged. The first is what spatial variation in routes is required to make a perceived difference and benefit, in terms of height and position for both arrivals and departures; the second, what are the optimum temporal separations or patterns required in order for the community to value it as effective respite?

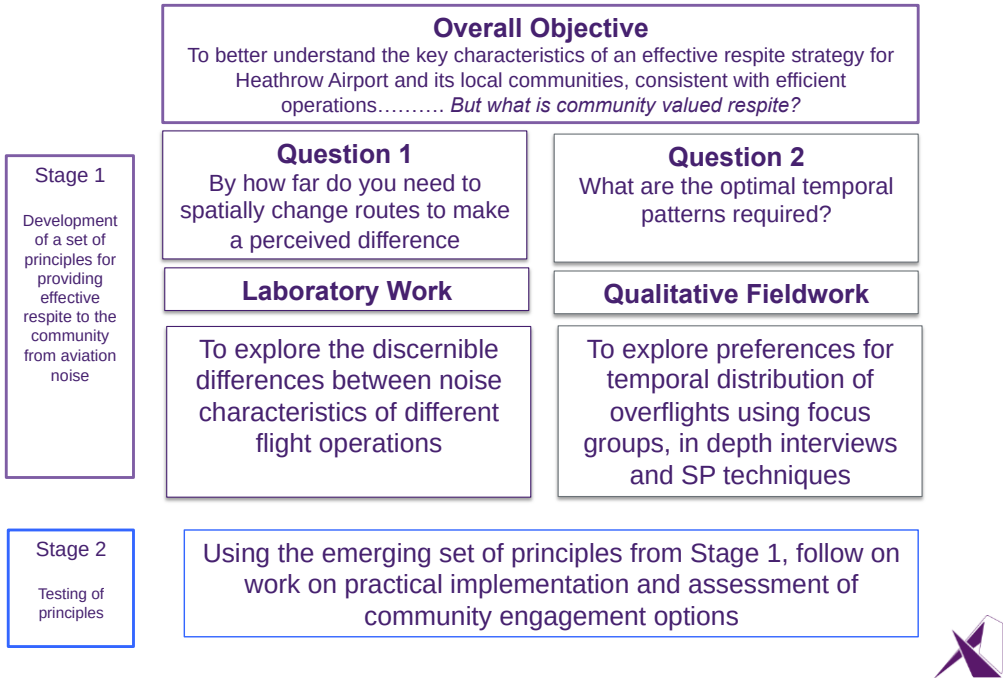
› **Stage 2:** Test practical implications for airspace design of the emerging principles from Stage 1 above. This would involve community subjective response research and operational testing of options.

A research project programme was set up to start to address the questions raised in Stage 1. This is described in the following sections of this overview and forms part of the developing programme of work in the journey from understanding effective respite to developing a strategy to delivering it to the communities around Heathrow Airport.

3 RESEARCH: OBJECTIVES AND APPROACH – STAGE 1

3.1 Research Objectives and Questions

Following on from the recommendations of the RWG, the overall objective for the work programme and the key questions for the first part of the recommended work were defined as presented in the figure below:



Stage 1 considers primarily community attitudes and focuses on some key underlying principles based on perceived differences and temporal preferences associated with Questions 1 and 2. This work is therefore aimed at determining information on community attitudes with a focus on ***perceived differences*** and ***temporal preferences.***

› **Question1: By how far do you need to spatially change routes in terms of height and track, and for arrivals and departures) to make a perceived difference to the community (in terms of discernibility and, ultimately to be of perceived 'benefit')?.** For example, to provide effective respite through route alternation, the routes must be spatially separated to a sufficient extent to make meaningful differences in sound levels as perceived on the ground. This was to be investigated through laboratory work.

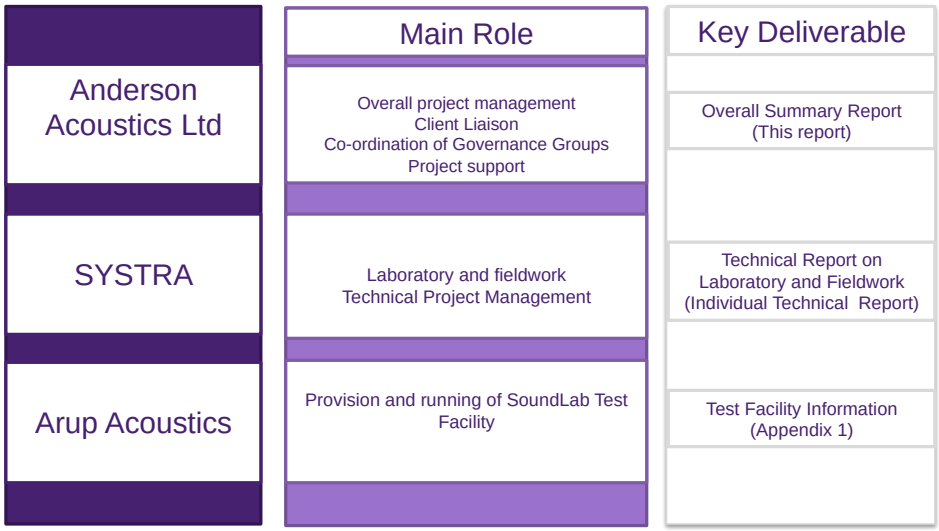
› **Question 2: What are the optimum temporal distribution patterns**? In other words, are quieter periods resulting from managed route alternation more/less beneficial at different times of day; and is alternation of flight-path more/less beneficial than a block of time when one flight-path is used, followed by a block of time when the other flight-path is used? This was to be investigated through fieldwork.

This is a new piece of research, it is looking at underlying relationships to underpin any developing recommendations – it is not a solution but part of an evolving process in understanding and developing effective principles for delivering respite.

3.2 Overall Project Approach

3.2.1 The Research Team

The research work was undertaken by an integrated team comprising Anderson Acoustics, SYSTRA and Arup. The overall key roles and deliverables for the work are presented in the figure below. The team met on a regular basis either in part or as a whole.



3.2.2 Project phases

The project was conducted between February 2016 and March 2017 with the following work phases:

- Set up and inception.
- Laboratory work – design, piloting, main tests, data analysis – Arup SoundLab.
- Fieldwork – design, piloting, main tests, data analysis.
- Reporting.

A full description of the methodology adopted for the technical work is presented in the Technical Report. A description of Arup's SoundLab facility is provided in **Appendix 1**. It is noted that participants were all people who are exposed to aircraft noise today to varying degrees.

Progress updates were provided to HAL and to a variety of Governance groups including Heathrow's Noise and Emissions Steering Group (NESG), Heathrow's Strategic Noise Advisory Group (HSNAG, formerly Heathrow's Noise Forum (HNF), and Heathrow's Community Noise Forum (HCNF).

3.2.3 Peer Review Group (PRG)

A Peer Review Group (PRG) was set up to oversee the scientific robustness of the work and comment on the technical aspects of the research. The PRG's Terms of Reference are provided in **Appendix 2**. The PRG met in person on 3 occasions - in April 2016, October 2016 and January 2017, and worked remotely on the final preparation of their Statement.

Membership of the PRG is provided in the Acknowledgement section at the start this report.

4 CONCLUSIONS FROM STAGE 1 RESEARCH (LABORATORY AND FIELDWORK)

The detailed findings are described in the Technical Report and are not reproduced here. The main conclusions are reproduced below. Where the findings relate directly to the two key questions the text is given in ***bold***.

1. By how far do you need to spatially change **routes** to make both a discernible difference and a difference which is perceived of benefit or indeed worthwhile?
2. What are the optimum **temporal distribution patterns** preferred?

4.1 Summary outcomes

4.1.1 Discernible differences – in the laboratory

› While some correct responses were obtained for 3 dB differences between the test sounds of each pair, larger differences (6 dB and 9 dB) were required for statistically reliable discrimination. Discrimination was not perfect (i.e. less than 100%) even at 9 dB difference. ***In practical terms, the results suggest that 5 to 6 dB differences between successive sounds would be required for reliable discrimination between the first and second sounds of a pair of sounds differing only in sound level, and auditioned under active listening conditions.***

› On average, and across the whole sample, the most recently heard sound appears to be the equivalent of around 2 dB louder than the first sound. Averaging out the effect of whether the second sound was quieter, or louder than the first, ***suggests an average discernible difference of around 5-6 dB, less if the second sound is louder and more if the second sound is quieter***; This difference is a perceptual memory effect and applied even where the two sounds were exactly the same. It may need to be taken into account in the design of any future comparison studies, and may help to explain why people in general often notice, or appear to notice, increases in noise, but not equivalent decreases.

› Segmentation of the overall sample revealed some suggestions of possible differences in discernibility between different base levels, but overall variances were too high to be able to draw any definitive conclusions on this point. Marginal differences were also observed between response charts for other segmentations, such as aircraft type (A380 vs A320), arrivals vs. departures, and base sound level, but none of these differences had statistical significance and may have arisen purely through chance variance.

4.1.2 Valued differences – in the laboratory

› Representative sequences of sounds were judged to provide a 'valuable (or a complete) break from aircraft noise' by 60% of the sample when the sound level difference between the two sequences was minus 6 dB (second sequence 6 dB quieter); by 65% of the sample when the sound level difference between the two sequences was plus 9 dB (first sequence 9 dB quieter); and by 85% of the sample when the sound level difference between the two sequences was minus 12 dB (first sequence 12 dB quieter).

› ***On average, most respondents 'valued' a noise sequence environment that was around 7-8 dB quieter; which is marginally greater than the threshold at which the majority of respondents are able to discern differences in sound level between separate events.*** Noting that the overall duration of the two sequences as heard in the SoundLab was only around 15 mins - and taking into account that, under real-life conditions, changes in aircraft noise sound levels mostly take place over very much longer time scales - it seems likely that even larger sound level differences would be required to be considered as 'valued' in the real world.

- Further segmentation of the sample did not expose any interesting findings or suggestions in terms of 'valued' differences, but it should be noted that the sample sizes within each segmented group were insufficient to be able to obtain sufficient statistical power to be able to demonstrate anything but the strongest effects.

4.1.3 Valued differences - Field data

- **The difference between two representative sequences of sounds was judged to be of 'some benefit' by 53% of the sample and of 'considerable benefit' by 33% of the sample when the sound level difference between the two sequences was minus 10 dB (second sequence 10 dB quieter).** However, the difference between the two sequences was judged to be of 'no benefit' by 14% of participants.
- Participants were also asked about their likely feelings if the airport was able to provide only 2-3 dB sound level difference, which would not be enough to be particularly noticeable (if at all). 13% had no feelings either way, 53% reported that they would have a more positive view of the airport, and 34% reported that they would be annoyed that the airport had wasted resources achieving little of actual impact. These responses can be compared against the 21% who reported that they would be pleased to learn that Heathrow had provided 2-3 dB quieter periods; and the 61% who would be pleased to learn that Heathrow had increased funding for community projects and/or provided enhanced insulation schemes.

4.1.4 Time of day preferences - Field data

- After listening to a demonstration of 10 dB sound level differences between representative sequences, **the times of the operational day when most respondents would wish to have quieter periods is at the ends of the day (i.e. early mornings and late evenings), and this is the case for the weekday and weekend.**

4.1.5 Activities that benefit the most from respite - Field data

- After listening to a demonstration of 10 dB sound level differences between representative sequences, the (daytime) activities that were reported as likely to benefit the most were: sleeping (35%), playing/being outside in the garden (24%), listening to music/watching TV (11%), children's bedtime/naps (6%), and uninterrupted conversation/less shouting (5%).

4.1.6 Stated Preference valuations - Field data – (note: relates to daytime, 0700 to 2300hrs only)

- After listening to a demonstration of 10 dB sound level differences between representative sequences, participants rank-ordered a set of nine cards stating different combinations of daytime respite periods and monetary value in terms of council tax payments both higher and lower than their current payments.
- On average, participants placed a higher monetary valuation on having weekday respite periods from 0700 to 1100 hrs (mornings) and 1900 to 2300 hrs (evenings) over having respite periods from 0700 to 1500 hrs (half-days).
- On average, participants considered that weekday respite periods from 1100 to 1900 hrs (mid-day and afternoons) would be of less monetary value (i.e. a dis-benefit) over having respite periods from 0700 to 1500 hrs (half-days).
- On average, participants placed a higher monetary valuation on having weekend respite periods from 0700 to 1100 hrs (mornings) and 1900 to 2300 hrs (evenings) over having respite periods from 0700 to 1500 hrs (half-days).
- The monetary values for having weekend respite periods from 1100 to 1900 hrs (mid-day and evenings) over having respite periods from 0700 to 1500 hrs (half-days) were not statistically

significant - although the average of the separate values for socio-economic groups A and B was statistically significant, (with a dis-benefit being identified). In general, segmentation between higher and lower socio-economic groups showed that wealthier participants tended to report higher monetary values.

› An alternative respite scheme defined as continuous alternation was tested on half of the sample. In continuous alternation, respite is provided by diverting every other flyover event onto an alternative and quieter route. For this simulation, the quieter route was represented by a 20 dB sound level difference, such that the frequency of '*noisy*' overflights was halved, leading to bigger time gaps between each '*noisy*' overflight and an overall reduction in LA_{eq} of 3 dB. This option was not preferred. Of all the "respite" options presented this showed the most significant monetary dis-benefit when compared to the experimental standard respite period from 0700 to 1500 hrs (half-days). This would suggest that delivery of respite by increasing the time between events is not desired.

› Whilst not presented above, the specific SP monetary valuations for respite simulated at 10 dB sound level difference between representative sequences were statistically significant and would aggregate to considerable amounts if added up across all affected households in the areas around Heathrow.

4.1.7 Consistency between Laboratory and Field Studies

› The pair-comparison test procedures in SoundLab appeared to work well in terms of engaging the participants in active listening, as did the audio simulations used in the Field tests. Where comparable, data obtained in SoundLab and in the Field tests appeared to be generally consistent.

4.2 Implications for respite policy

› Residents may be unlikely to notice or appreciate small dB reductions in average sound level, particularly against the context of typical day-to-day variation, and if any such changes take place over long time scales. Within this limitation, residents are more likely to notice increases in noise than equivalent decreases.

› However, this research also highlights that there could be considerable benefit to the airport, even if periods of respite achieved only modest reductions in noise (i.e. 2-3 dB) – as a majority of respondents said they would feel more positive about the airport (even if it would not be particularly noticeable); nevertheless, a small minority would see it as a waste of resources. This is an example of the many non-acoustic factors that may have greater influence on community attitudes and acceptability of changes in air-space management and expansion at the airport..

› For many residents, non-acoustic factors (NAF), such as the effectiveness of public engagement, trust and understanding could be at least as important as actual sound level differences in terms of their appreciation of noise respite policy.

› The finding that there was strong consensus of preferring the quieter periods to be at either end of the day; and these apply for weekends as well as weekdays, implies that it will be difficult to allocate quieter periods at the preferred times, to everybody. This, not surprising, result confirms the need to understand how best to allocate managed respite – e.g. maximise the number of people who get more modest levels of respite OR maximise the level of respite albeit to a smaller number of beneficiaries. The sharing principle implicit in alternation is worthy of further investigation.

› The sample sizes obtained in this study are relatively modest and the confidence intervals around many of the findings are quite wide. If there is a need to obtain more precise estimates of thresholds and/or values, then it would be reasonably easy to roll-out the research design to new

sample sites, to test responses elsewhere around Heathrow, and to increase the overall sample base of responses. On the other hand, since these results, albeit based on modest sample sizes, nevertheless appear to be generally consistent with both established theory and with recent qualitative (open ended in-depth interview) research carried out in areas around Heathrow.

4.3 Study Limitations

The intention of this work was to develop a set of principles for providing effective respite to the community from aviation noise that could be tested in further work. As with all research work, there are limitations to the study.

- This study relates to day-time judgments only.
- As noted above, sample sizes are relatively modest and more precise estimates of thresholds and/or values would require a larger sample size.
- SP valuations used as a comparison base quieter periods in the hours 0700-1500 only (not 1500-2300) and any specific values derived were applied to that base period only.
- The judged value of respite may or may not be applicable to those newly exposed to aircraft noise.
- Furthermore, question 1 refers to spatial separations and the findings of this recent research refer to discriminable differences and therefore further work is required to apply the findings in the development of spatial differences for various operations.

5 STATEMENT ON THE TECHNICAL WORK FROM THE PEER REVIEW GROUP

Respite from Aircraft Noise

Statement by Peer Review Group

The Peer Review Group (PRG) was appointed to oversee the scientific robustness of the research into respite from aircraft noise.

The PRG recognises that whenever an airport contemplates introducing new noise management measures, it should do so with as much understanding as possible of the consequences of that measure both in terms of the operational impact but also the measured and perceived impact on those affected. Furthermore, when new technological capabilities become available, it is important for an airport to be clear over how best that technology might be used to the benefit of both the industry and the affected communities.

In contemplating providing respite, the outcome of any such measure is likely to be reducing the noise burden on some parts of the population but increasing it on others. Therefore, understanding this impact and trying to strike the appropriate balance based on as much robust evidence as possible is essential. The PRG, therefore, very much welcome this study and believe that Heathrow Airport Limited should be commended for commissioning it. The PRG also welcome the opportunity to contribute to this study.

The PRG met three times over the period of the study. At those meetings and separately, by correspondence, the PRG provided feedback on seven technical notes prepared by the project team as well as the final technical report. The PRG felt that the project team was very receptive to the comments from the PRG and those comments were reflected in both the design of elements of the research and in the subsequent analysis that was undertaken.

The PRG felt that the study is helpful in defining respite as being “managed relief from aircraft noise”, i.e. respite includes a degree of predictability. This is seen as an important confirmation of what is meant by respite.

The laboratory work was felt by the PRG to be very good, with the results confirming what experienced practitioners may have intuitively expected, but also providing some very helpful detail.

This included the interesting result that the listeners were better (on average) at correctly identifying increases in sound rather than decreases (Para 3.1.4 of the final report). In addition,

there was the finding that there seems to be a need to provide a greater reduction in sound level to achieve the same level of discernment than would occur with an increase in sound level. Given that any respite measures would generally involve reducing the sound level at one location and increasing it another, this imbalance will make implementing a respite policy more challenging than if the opposite outcome had occurred. This research, therefore has provided this important evidence which will need to be borne in mind when implementing any respite measures.

During the study, the PRG engaged in quite a lot of discussion with the project team regarding the element of the project investigating the monetary value of respite. The PRG remain unclear about how precisely the results might be used. None of the PRG would claim to be experts in this particular field of study, but it remained unconvinced that people could meaningfully evaluate Council Tax payments against noise reductions. In addition, there was concern about other influences that might affect the outcome such as the existing Council Tax levels of the participants and their personal financial circumstances.

Having said that, the PRG agree that it is important to try to understand the value people would place on potential respite measures, especially given that such measures may come at some operational cost. Consequently, the PRG believes that there could be merit in seeking to develop some improved form of monetary evaluation of noise respite that might be able to be used on any future larger survey exploring the effect of noise respite.

Within the field work, one very interesting result was the time of day when the respondents would welcome respite (Figure 19). Again, some of the findings were not unexpected, insofar as the middle of the weekday was the time when the respondents did not particularly seek respite. The results, however, did show that weekends are still valued and that early morning respite was sought more for weekends than weekdays. This is an interesting result given that some may believe that, in terms of sensitivity to noise disturbance, the distinction between weekdays and weekends has been reducing.

Initially, the PRG was also concerned about the question regarding how people would react if they read about an operational measure that did not produce an acoustically noticeable outcome. The result, however, was very interesting in that over 50% of the respondents said they would have a more positive view of the airport (Figure 21). This result shows the importance of explaining properly proposed noise management measures and the expected outcome, especially where there might be a measurable reduction (in terms of average noise exposure) although it may not necessarily be noticeable.

The PRG was concerned about how the conclusion for this result was described: *"there could be considerable benefit to the airport even if periods of respite achieved only modest reductions in*

noise (i.e. 2- 3dB)….(even if it would not be particularly noticeable)". The result does suggest that there could be some benefit from such a measure. The PRG felt, however, that there could be a risk, in the longer term, of such measures being seen as merely cosmetic if the reduction in noise exposure cannot be discerned. Consequently, the value to the airport would be diminished. Nonetheless, this was an interesting result and one that should be borne in mind when contemplating respite measures, but taking account of the caution expressed above.

Overall, the PRG felt that this was a scientifically robust study providing a number of interesting and useful results. The PRG recognise that the sample size meant that for some elements, the results should be regarded as no more than an indication of what might be a wider response. Having said that, the study does provide a good evidential basis for developing respite policies and also indicates where further research might be appropriate to understand more fully this important issue.

6 RECOMMENDATIONS FOR FUTURE WORK

The work to date is part of a programme of work with the overall aim to "*To better understand the key characteristics of an effective respite strategy for Heathrow Airport and its local communities, consistent with efficient operations.*" At the current time the following stages have been undertaken.

The first stage was recognising the need to look at respite and the setting up of the Respite Working Group (RWG). This followed with the RWG report on the state of the art on respite and recommendations for research priorities.

The latest research has focussed on the identified priority of gaining a better understanding of how the community values respite. It has been aimed at determining information on community attitudes with respect to perceived differences and temporal preferences.

It is clear that effective respite is both a function of noise level difference and of the non-acoustic factors. In fact, non-acoustic factors, such as the effectiveness of public awareness, trust and understanding **could be at least as important** as actual sound level differences in terms of their appreciation of an effective noise respite policy. This recent work has given some basic information on noise level differences; using judgments of quasi artificial scenarios in the laboratory. However, the valuation of effective respite is also strongly dependent on the non-acoustic factors which can only be investigated in the field, based on real life experience of respite provision.

6.1 So what next?

1. **Dissemination:** The recent findings need to be shared with the aviation industry and community.

2. **Understanding implications:** There is a need to apply the learnings from this new research to understand the degree to which perceivable differences would exist (in terms of scale and populations) between comparable scenarios. It is therefore recommended that there should be an immediate assessment to explore the dB differences on maps for different flight operations. This will give insights into the inferred spatial differences between 2 routes to achieve different levels of noise benefits – the missing link to Research Question 1. It should aim to highlight the use of the basic difference principles and associated limitations.

3. **Reconvene the RWG:** Moving forward, the RWG should meet to consider priorities and make recommendations based on the recent research and the implications of that research as outlined above (2).

4. **Consideration of the role of Non Acoustic Factors**: If consideration is being given to extending the research, it might be considered opportune to widen the research objectives to include the possible contributions to attitudes and perceptions made by non-acoustic factors, based on real life experience of respite provision in the field.

APPENDIX 1

ARUP ACOUSTICS SOUNDLAB FOR RESEARCH

Text provided by Arup Acoustics.

SoundLab

Sound and noise (defined as unwanted sound) are familiar to everyone. However conventional techniques for describing the impacts are not easily accessible and are often misunderstood – for example the decibel seems counter-intuitive to many people.

SoundLab is a purpose-built acoustic facility at Arup's offices which enables people to listen for themselves to changes in an acoustic environment. It has been developed by Arup as a means of faithfully reproducing three-dimensional (3D) sound recordings and for simulating 3D sound for new projects. We present the information neutrally and it is for visitors to decide what they think and feel about what they hear.

Inside SoundLab, the 3D sound recordings are played back through an array of 16 loudspeakers and two sub-bass units, with the listener at the centre point of the array. The SoundLab is acoustically treated (like a sound recording studio) so that the room has minimal influence on the quality of the sound heard by the listener. The use of 3D sound in sound demonstrations is important because it allows a sense of movement to be communicated aurally, which influences what we perceive and how we react to sound. This is particularly relevant when listening to moving sound sources, like aircraft. As a major new innovation, High Speed 2 successfully applied this technology for the first time to environmental sound from a major new infrastructure project. Heathrow applied and evolved the same technology, building on experience and feedback from High Speed 2.

Aircraft recordings have been undertaken at various locations around Heathrow using a SoundField microphone, which is able to capture sound in 3D, allowing playback of the recordings directly in SoundLab. Along with the recordings, measurements were undertaken simulatanously using a Sound Level Meter to enable accurate calibration of the playback level of the recordings in SoundLab. Recording locations and times were chosen to minimise the effect of background noise on the recordings.

SoundLab is routinely calibrated as part of Arup's certified quality assurance processes to ensure that it is working correctly. Each demonstration is calibrated before each listening session.

The Sound Demonstrations for Heathrow Respite Project

Aims

The aim of the sound demonstrations was to create a scientifically robust simulation of the sound from aircraft in the context of the ambient sound (commercial activity, birdsong, road traffic noise, conventional rail, etc.).

The sound demonstrations were provided as part of Heathrow's respite project to enable people to listen to the difference between different types of aircraft at varying sound levels. This information was presented neutrally.


3D Sounds

APPENDIX 2

PEER REVIEW GROUP: TERMS OF REFERENCE (EXTRACT)

TERMS OF REFERENCE FOR THE PEER REVIEW GROUP (PRG) OF RESEARCH INTO RESPITE FROM AIRCRAFT NOISE, FUNDED BY HEATHROW AIRPORT LTD.

MEMBERSHIP

Dirk Schreckenberg	Zeus GmbH
Dr. rer. nat. Uwe Mueller	German Aerospace Centre (DLR)
Prof. Callum Thomas	Manchester Metropolitan University
Stephen Turner	Stephen Turner Acoustics Limited
Prof. Stephen Stansfeld	Queen Mary, University of London

PURPOSE

The Peer Review Group shall oversee the scientific robustness of the research into respite from aircraft noise as proposed by the Respite Working Group (RWG) and conducted by the Research Consortium led by Anderson Acoustics Ltd with SYSTRA and Arup.

FUNCTION

To provide an official forum for peer review of the Respite Research Project into respite from aviation noise at the outset and during the project, and prior to the external publication of the final report. The Group members will provide feedback to the project management group, Heathrow Airport and project stakeholders regarding the quality and appropriateness of the scope and execution of the research.

ACTIVITIES

The principle activities of the Peer Review Group are:

- To review project objectives, scope and methodologies, and provide comment as appropriate.
- To review key deliverables and make recommendations as required for subsequent stages of work.
- To draft and agree a final statement on the work and its findings to be included in the final report.
- To provide supporting evidence as appropriate for advice and recommendations.
- To consider issues of principle and practice in conducting the research work and to assist in the understanding of the management and control of these issues.

OUTPUT

All key findings shall be shared by the researchers with the PRG at the end of each work phase. In this way the PRG will be given the opportunity to comment on the research plans, on significant outcomes from work phases, and the final report. A statement on the work is requested at the end of the project.

CONDUCT

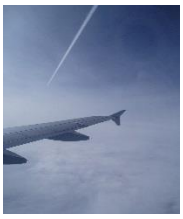
A person appointed by the PRG will chair the Group and Nicole Porter of Anderson Acoustics will provide the secretariat to the Group if required. The agenda and papers for any meetings ideally will be circulated not less than 3 working days before a meeting except where circumstances make this unavoidable. Records of the meeting will be taken and approved by the PRG.

The Group operates without prejudice to any local or political view and is expected to abide by the codes of practice set by relevant professional organisations.

The Group will report on its activities to the Project Management Group as necessary to inform them of advice and recommendations, usually in writing.

Community Attitudes **22/05/2017**

Reference number103548/12




RESPITE FROM AIRCRAFT NOISE


SYSTRA

COMMUNITY ATTITUDES

RESPITE FROM AIRCRAFT NOISE

IDENTIFICATION TABLE	
Client/Project owner	Heathrow Airport Ltd
Project	Community Attitudes
Study	Respite from Aircraft Noise
Type of document	Final Report
Date	22/05/2017
Reference number	103548/12
Number of pages	45

Version	Name		Date	Comments
1	Author	Paul Le Masurier	22/12/2016	Clarification to sound stimuli & conclusions (post PRG Mtg)
	Reviewer	Ian Flindell	22/12/2016	
2	Author	Paul Le Masurier	14/02/2017	Revisions following receipt of HAL comments to v2
	Reviewer	Ian Flindell	15/02/2017	
3	Author	Paul Le Masurier	18/05/2017	Final Version
	Reviewer	Ian Flindell	18/05/2017	

ACKNOWLEDGEMENTS

Heathrow Airport appointed and funded the Research Team to conduct the work described in this report. The work was undertaken by the integrated team comprising Anderson Acoustics, SYSTRA and Arup. The overall key roles and deliverables for the work for each team member was as below:

	Main Role	Key Deliverable
Anderson Acoustics Ltd	Overall project management Client Liaison Co-ordination of Governance Groups Project support	Overall Summary Report *
SYSTRA	Laboratory and fieldwork Technical Project Management	Technical Report on Laboratory and Fieldwork
Arup Acoustics	Provision and running of SoundLab Test Facility	Test Facility Information

* This report

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Appendix A

Quantitative Survey ['Field'] Materials

EXECUTIVE SUMMARY

Study Background and Objectives

The aviation industry is undergoing a period of airspace change, and Heathrow Airport Ltd wishes to take the opportunity to maximise operational efficiencies whilst continuing to manage the consequences of its operations on neighbouring communities.

The development of satellite navigation technology means that aircraft can now be flown much more consistently on specified paths giving the airport greater control over the noise impacts of aircraft. In particular, it gives added impetus to assessing the value to residents of sharing aircraft noise between communities so that, at any given time, some communities experience respite (i.e. airport-managed perceptible relief from aircraft noise).

This research examined two key characteristics that would be expected to contribute to an effective respite strategy:

a) By how far do you need to **spatially change routes** (in terms of any resulting differences in sound levels) to make a perceived difference to communities (in terms of discernibility and, ultimately, to be of perceived 'benefit')?

b) What are the optimum **temporal distribution patterns** required? In other words, are quieter periods resulting from managed route alternation more/less beneficial at different times of day; and is alternation of flight-path more/less beneficial than a block of time when one flight-path is used, followed by a block of time when the other flight-path is used?

Research Methodology

The first question was investigated through the use of Arup's SoundLab facility, which enabled the research team to reproduce representative aircraft flyover sounds at different sound levels to discover the 'sound difference' thresholds at which the majority of residents correctly identify changes in sound level; and the (hypothesised to be greater) threshold at which the majority of residents considered a quieter sequence of aircraft to be 'beneficial' to them and their household.

The respondents taking part in the sound exercises were typically 'ordinary' members of the public residing in noise-affected areas at different proximities to the airport. They were recruited to participate in research on aircraft noise by a specialist survey recruitment agency. Each participant gave up approximately 1 hour and 20 minutes at the SoundLab (plus their travel time) and were rewarded with a financial thank-you for their time.

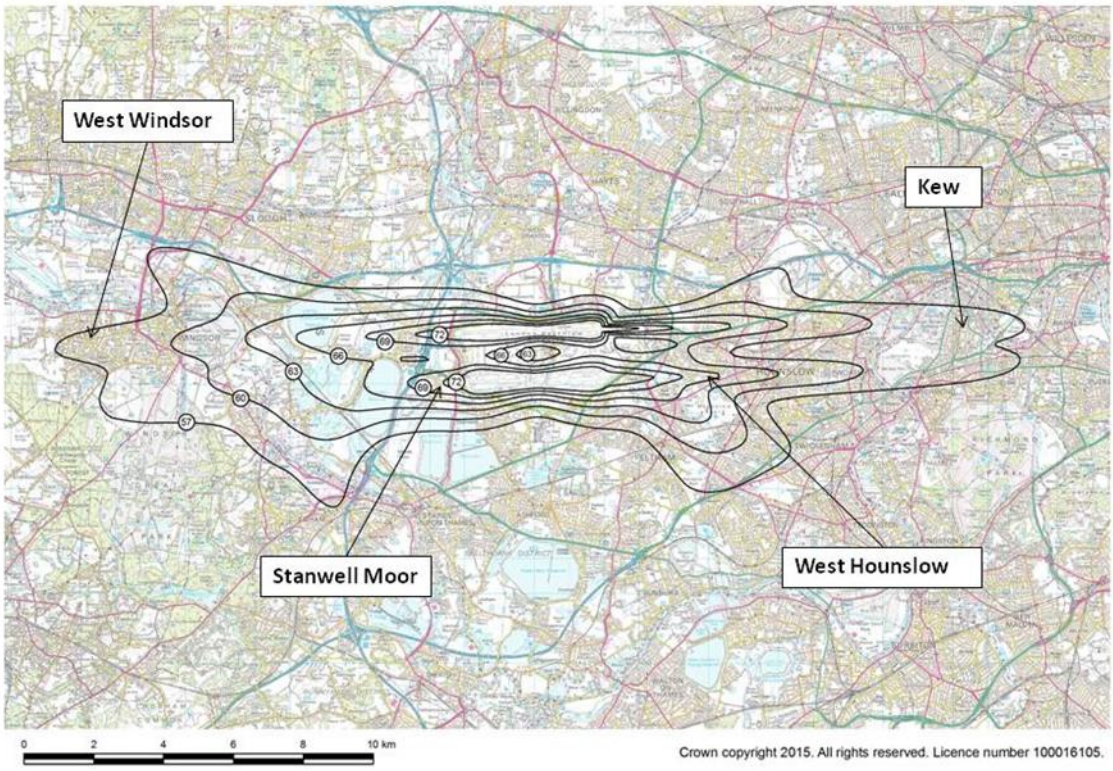
The discernible differences exercise took the form of a series of paired aircraft sounds and, for each pair, they were asked to say whether the second sound was quieter, the same, or noisier than the first sound. Each participant responded to a total of 14 paired aircraft sounds. Across the whole sample of 60 participants we obtained 60 x 14 = 840 observations, covering a range of LA_{max} decibel differences, and base aircraft sounds (defined by aircraft type, departure or arrival, and broad LA_{max} level – low/medium/high).

The 'beneficial' or 'valued' difference exercise took the form of a single observation from each participant due to the time needed to give participants sufficient context to make an informed decision. Each participant listened to two sequences of aircraft. Each sequence comprised the same

mix of aircraft type, with the same duration – the only difference was that the second sequence was either louder or quieter than the first, according to our pre-set design. Participants listened to each sequence (each lasting approximately 7 minutes) and then decided i) whether there was any difference in sound levels between the two sequences and, if so, ii) whether or not the perceived quieter sequence would, in their view, provide a 'complete' or 'valued' break from aircraft noise. Of the 60 SoundLab participants, 52 answered i) correctly so this was the sample size for identifying the difference threshold at which the reduction in aircraft flyover sound levels became 'valued'.

The second research question was explored via Hall-Tests in the field. That is, we took the sound recordings to the communities and applied standard sampling procedures to ensure a representative sample of residents responding to our quantitative survey. The four sampled sites were: West Windsor and Stanwell Moor to the west of the airport (predominantly affected by departures) and Kew and West Hounslow to the east (predominantly affected by arrivals). The location, and noise contour corresponding to each site is shown below.

Survey Sites for (Main) Field Hall-Tests



Prior to the main fieldwork, the test procedures and materials had been successfully piloted in Datchet and Wraysbury (both to the west of the airport). In total, we obtained a sample of 124 respondents.

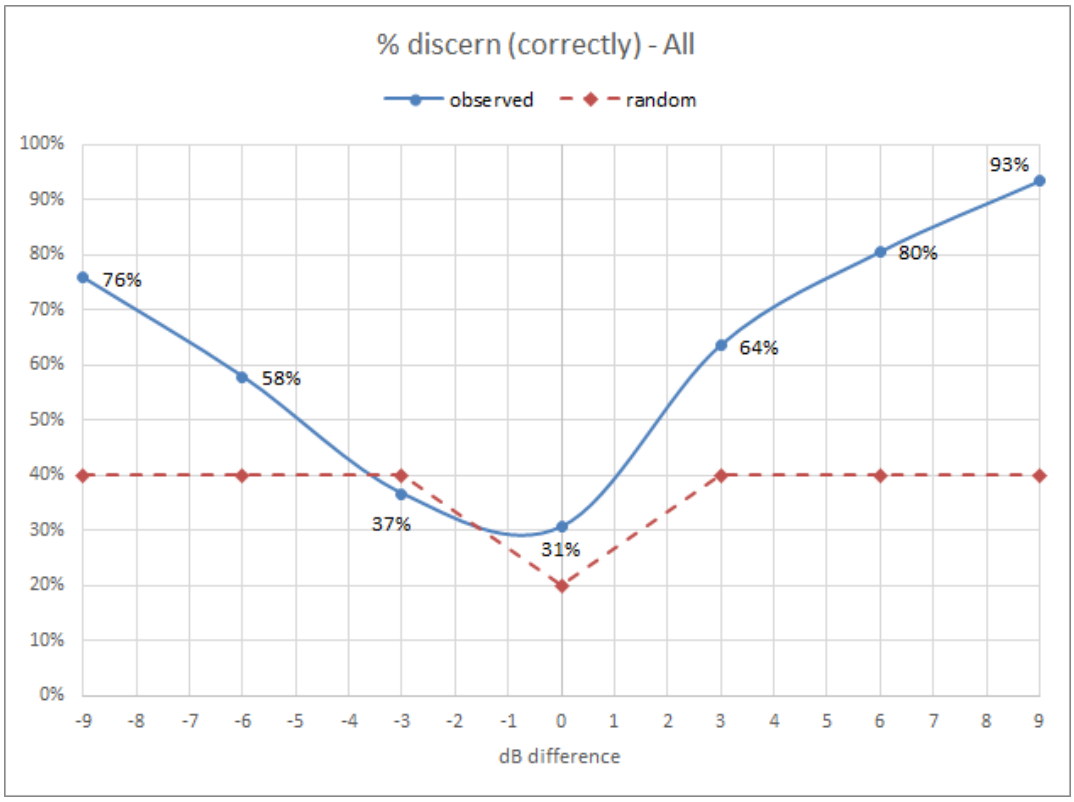
The quantitative questionnaire used in the Hall-Tests focused particularly on understanding residents' preferred times of the day (during the week and, separately, at weekends) for periods of noise respite; and to obtain the 'value', in monetary terms, residents place on having a period of quieter aircraft (defined to be -10dB as based on the earlier tests carried out in the SoundLab) at their preferred times of day. The former was obtained through simple tick-boxes of the eight hours, during the 16-hour operational day from 0700-2300, each respondent would most prefer to be quieter (they did not have to be consecutive hour slices). The latter was obtained through the use of stated preference

techniques where respondents ranked a number of different options, each defined in terms of times of day when aircraft noise was quieter and louder; and the annual amount of council tax that the household would pay.

Results

Discernible Differences in Sound Level

The shape of the 'Discernible Difference' curve is reported below. The blue line shows the percentage of participants who correctly discerned the different sound levels, by dB difference; and the brown line shows what the results would be if they were down to chance. The overall results were significantly different statistically.



Base = 832 observations (max 14 per respondent)

Discernible Difference Results

The horizontal axis shows the difference in dB between the two aircraft sounds within each pair presented. The dB difference varied, by design, and were: -9, -6, -3, 0, +3, +6, +9 dB. The vertical axis shows the percentage of the sample who were presented with each dB difference who said they noticed a difference in audibility between the two sounds and 'correctly' stated which sound was noisier.

The results reveal that:

- the participants were more easily able to discern a louder event if it was the second of the two sounds presented, than if it was the first;

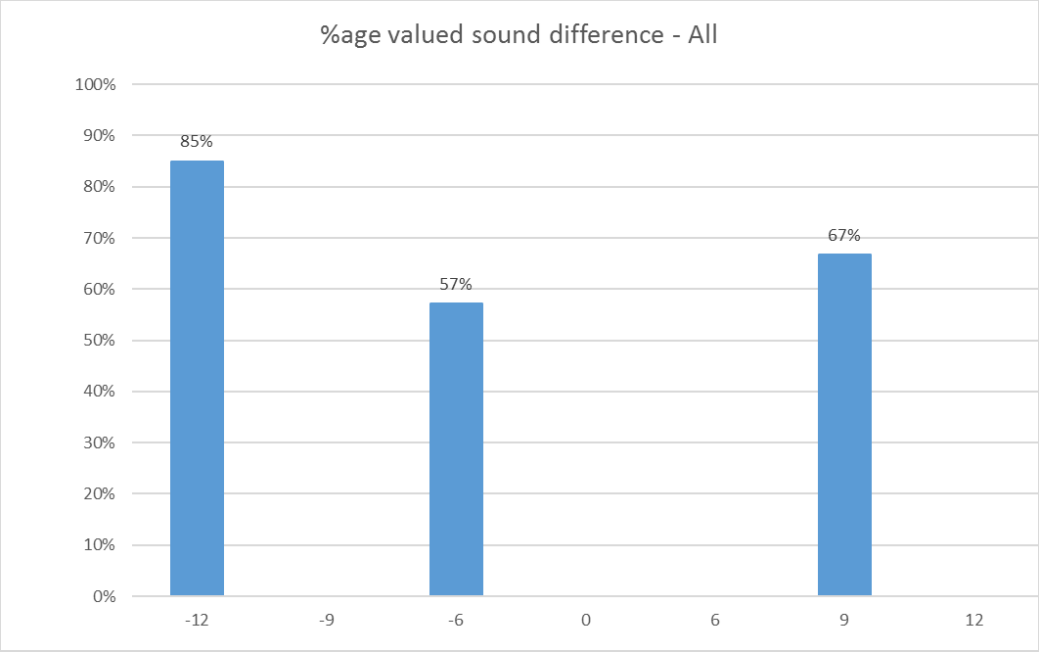
- a clear majority (~60%) of the participants discerned the difference in sound level when the second sound was -6 dB, and +3 dB, compared with the first sound;
- up to these thresholds, only a minority of participants were able to accurately discern the sound difference; and
- only a minority of participants (circa one in three people, 31%) were able to correctly discern hearing the same sound within quick succession (most thought they were different).

However, as with all sampled data, the results provide only an estimate of the result for the population. Calculating confidence intervals around each central estimate suggests that we can be 95% confident that the 'true' percentage of the population who would discern the sound difference lies within circa ±10% at each sound level difference.

More disaggregated analysis was undertaken but no statistically significant differences were found by aircraft type, departures/arrivals, or by demographic. There was some indication that the base LA_{max} level may impact on people's ability to discern sound level differences, with quieter second sounds seemingly being easier to discern; and louder second sounds being harder to discern; at a lower base.

Valued Differences in Sound Level (Soundlab)

The results of the Valued Difference exercise are presented in the chart below.



Valued Difference Results

The horizontal axis shows the difference in dB between the two aircraft sequences presented. The dB difference varied, by design, and were: -12, -6, +9 dB. The vertical axis shows the percentage of the sample who were presented with each dB difference who said they noticed a difference in audibility between the two sounds, 'correctly' stated which sound was noisier and said that the quieter sequence of aircraft was either a 'complete' or 'valuable' break from noise.

The results reveal that:

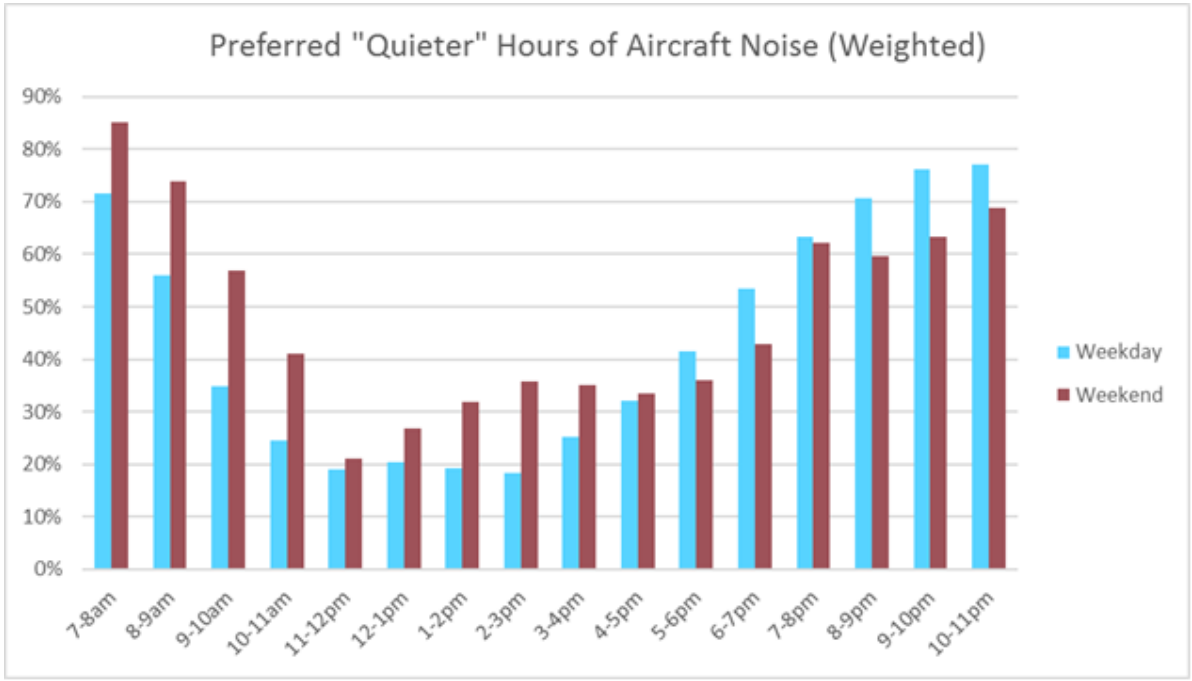
- a clear majority (85%) of participants valued the difference in sound level at -12 dB, and a majority (57%) at -6 dB quieter;
- when the second sound was louder, a clear majority (67%) of the public valued the difference at +9dB; and
- the percentage of participants who value the 9dB quieter sequence (when it was second) lies in between the percentages of respondents who valued the 6dB and 12dB quieter sequences (when it was played first).

Interpolation of the results from this study suggests that the reduction in sound level at which the quieter sound level is 'valued' by a clear majority of the public (i.e. for at least 60% of people) is around 7-8 dB; and marginally exceeds the threshold at which the majority of participants correctly discern differences in sound level (around 3-6 dB).

The fewer number of observations for the Valued Difference exercise means larger confidence intervals apply (circa ±15-20% at the 95% level of significance), compared with the Discernible Difference exercise.

Preferred Times of Day for Respite (Hall-Tests)

Respondents were given 16 hourly slices of the operational day (from 7am to 11pm) and asked to identify the eight hours of the day when they would most prefer to have quieter periods. The profile of preferred quieter periods (for each hour of the operational day) is presented below, for weekday and weekend separately. The vertical axis shows the percentage of respondents who considered that a given hour should be one of the 8 quieter hours.



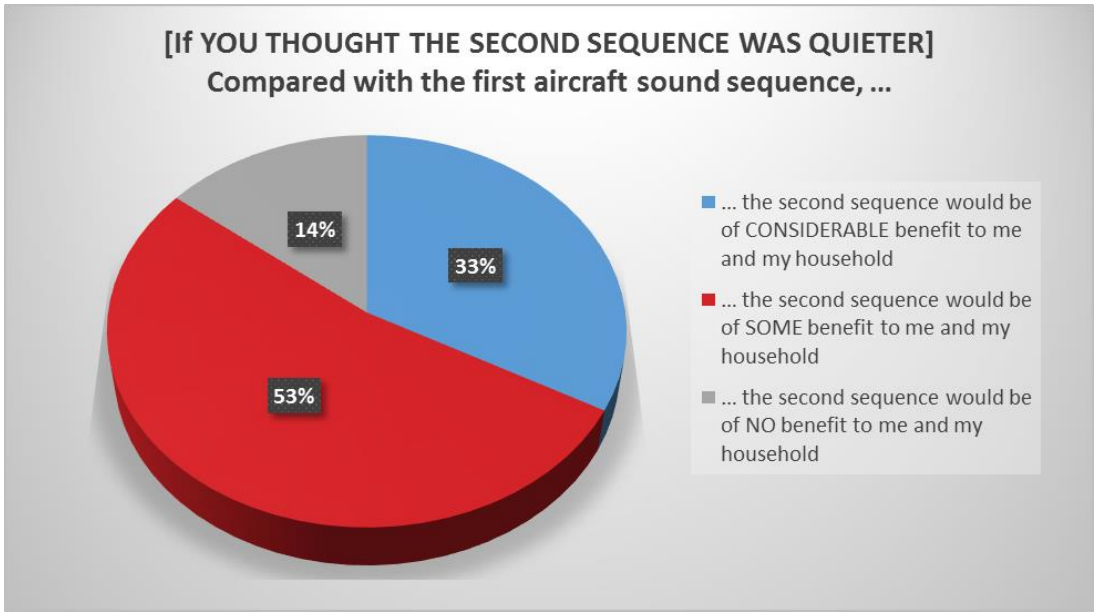
Preferred Time of Day for Noise Respite

For both the weekday and weekend, the mornings and late evenings are the most sensitive times of the day.

The Value of Noise Respite at different times of day (Hall-Tests)
Respondents listened to two representative sequences of aircraft whereby the second sequence was precisely 10dB quieter than the first. Those respondents who confirmed that they thought the second sequence was quieter, were asked which of three statements best reflected their view of the two sequences for them and their household:

- the second sequence would be of CONSIDERABLE benefit to me and my household;
- the second sequence would be of SOME benefit to me and my household; and
- the second sequence would be of NO benefit to me and my household.

The majority of respondents (86%) thought that a 10 dB reduction of all aircraft noise would be of 'some' OR of 'considerable' benefit to them and their household.



Base = 110

Residents' Perceptions of the Effect on Household of a 10 dB Reduction in Aircraft Noise

Respondents were presented with two aircraft noise sequences – where each aircraft within the second sequence was precisely 10dB quieter than the each aircraft in the first sequence. This 'quieter' sequence was offered to respondents at different times of day, along with different sums of money, in the form of a stated preference (SP) exercise. This involved respondents considering different options – each described in terms of noisier and quieter periods at different times of day, and changes in annual council tax – and stating which option they preferred. By analysing the components of the favoured option relative to the components of the other options in the choice-set, we gain an understanding of the relative importance of the different noise levels at the different times of day, and relative to the importance of having more/less money.

The results of the SP ranking exercise are reported in the table below – for the overall sample, and by socio-economic group.

Noise Respite Valuations by Socio-economic group

VARIABLE	OVERALL	HIGH SEG [A/B]	MEDIUM/LOW SEG [C/D/E]
Weekday: Quieter 7am-3pm + Noisier 3pm-11pm ➔ Quieter route 7am-11am & 7pm - 11pm + Noisier route 11am-7pm	+£307 p.a.	+£453 p.a.	+£299 p.a.
Weekday: Quieter 7am-3pm + Noisier 3pm-11pm ➔ Noisier route 7am-11am & 7pm - 11pm + Quieter route 11am-7pm	-£179 p.a.	-£264 p.a.	-£175 p.a.
Weekday: Quieter 7am-3pm + Noisier 3pm-11pm ➔ Continuous Alternation between 7am and 11pm	-£389 p.a.	-£573 p.a.	-£379 p.a.
Weekend: Quieter 7am-3pm + Noisier 3pm-11pm ➔ Quieter route 7am-11am & 7pm - 11pm + Noisier route 11am -7pm	+£160 p.a.	+£236 p.a.	+£156 p.a.
Weekend: Quieter 7am-3pm + Noisier 3pm-11pm ➔ Noisier route 7am-11am & 7pm - 11pm + Quieter route 11am -7pm	*insignificant*	-£113 p.a.	-£75 p.a.

The above results indicate that, on average, respondents place a significant value, circa £307 a year, to having noise respite [of -10dB] at their preferred times (i.e. the first and last four hours of the operational day) on every weekday compared with having the respite always between 7am – 3pm.

In contrast, respondents negatively value, at circa -£180 p.a., having respite during the middle of the weekday and always having it louder during the first and last four hours of the operational day, compared with having the respite always between 7am – 3pm.

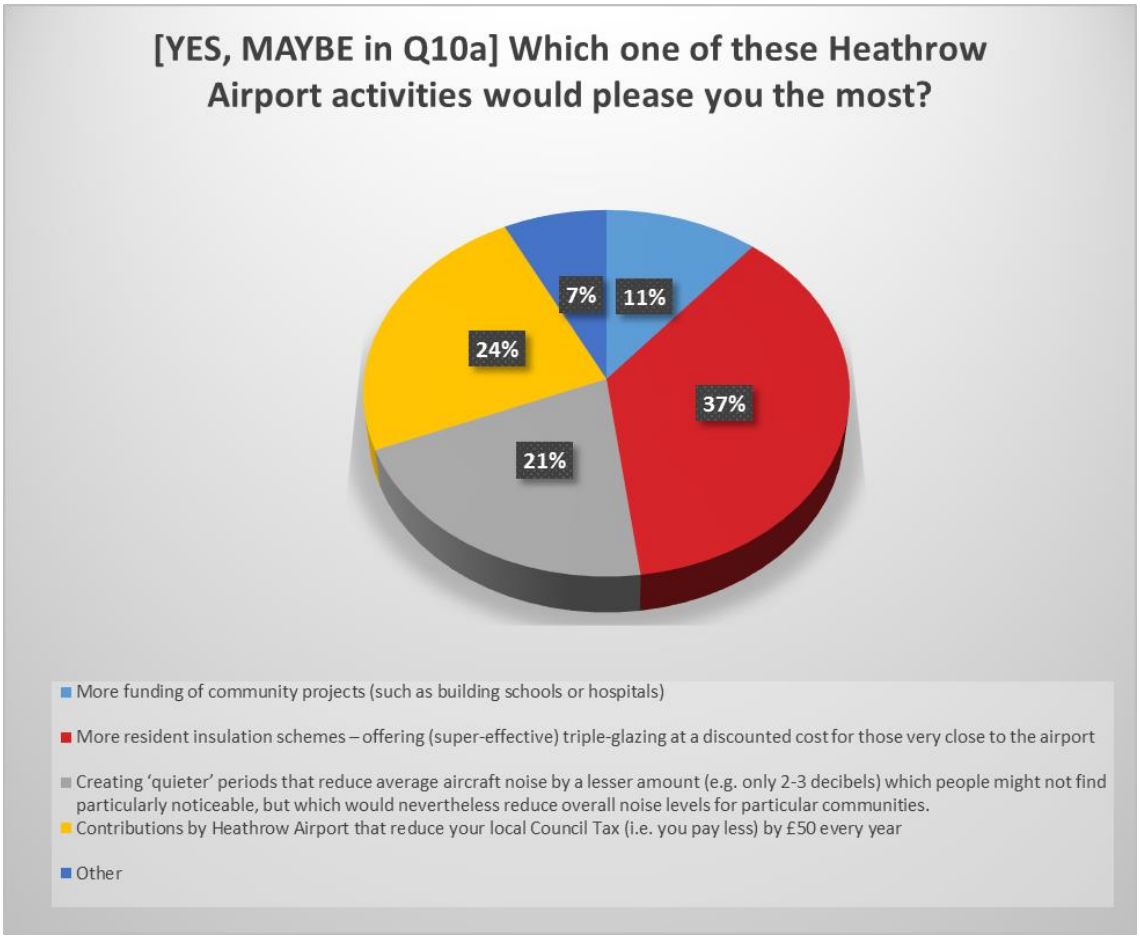
At the weekend, respondents assign a significant value, circa £160 a year, to having noise respite [of -10dB] at their preferred times on every Saturday and Sunday, compared with having the respite always between 7am – 3pm OR having the respite always between 11am – 7pm on Saturdays and Sundays. Continuous alternation between the near and far routes is perceived to be significantly worse than having the respite always between 7am – 3pm.

The right-hand side columns show that respondents in socio-economic groups A and B (i.e. high level management roles, etc) assign a significantly higher monetary value to having noise respite at their preferred time of day, compared with those in lower socio-economic groups (lower management, unskilled and not working).

Respondents' Perceptions of 2-3 dB Quieter Aircraft Noise (Hall-tests)
Respondents were asked which one of four airport activities they would most prefer to happen. The four options were:

- More funding of community projects (such as building schools or hospitals);
- More resident insulation schemes – offering (super-effective) triple-glazing at a discounted cost for those very close to the airport;
- Creating 'quieter' periods that reduce average aircraft noise by 2-3 decibels which, as it was explained to participants, people might not find particularly noticeable, but which would nevertheless reduce overall noise levels for particular communities; and
- Contributions by the airport that reduce residents' local Council Tax by £50 every year.

The results were quite mixed, as reported below.



Base = 103

Residents' Perceptions of a 2-3 dB Reduction in Aircraft Noise

Of the four prompted options, the most preferred was to have more resident insulation schemes (37%), followed by contributions to reduce their Council Tax by £50 p.a. (24%). Creating quiet periods of 2-3 dB which might not be particularly noticeable was preferred by just over one in five respondents (21%), with just over one in ten respondents (11%) most preferring investment in new local community projects.

Conclusions

The key findings from the lab and field phases of research that inform directly on the research objectives, were that:

- a clear majority (~60%) of respondents discerned the difference in sound level when the second sound was -6 dB, and +3 dB, compared with the first sound. Averaging out the effect of whether the second sound was quieter, or louder than the first, suggests an average discernible difference of around 5 dB, less if the second sound is louder and more if the second sound is quieter;

- most respondents **'valued' a noise sequence environment** that was around 7-8 dB quieter; which is marginally greater than the threshold at which the majority of respondents are able to discern differences in sound level between separate events;

- the times of the operational day when most respondents would wish to have quieter periods is at the ends of the day (i.e. **early mornings and late evenings**), and this is the case for the weekday and weekend; and

- respondents were willing to pay significant sums of money to secure a defined quieter period (of -10 dB LA_{max} quieter aircraft sequences) at their preferred times of the day. Overall, respondents were willing to pay more than **£300 per annum, per household** for quieter periods between 7-11am and 7-11pm rather than have quieter periods just in the morning and early afternoon (7am-3pm).

These results suggest that routes would have to change considerably to create quieter environments of the above magnitude, especially when we bear in mind that the research was conducted under active listening conditions – meaning that discernible differences (and valued differences) may be greater in real-life situations compared with those identified in this research. It should be noted that, in practice, achieving differences in average sound levels of these magnitudes could require considerable differences in route centrelines. In addition, the research was unavoidably carried out under active listening conditions which are not necessarily representative of real-life listening conditions where people may or may not pay as much attention to noise events as they are invited to under listening laboratory and hall-test conditions.

Moreover, the finding that there was strong consensus of preferring the quieter periods to be at either end of the day; and these apply for weekends as well as weekdays, implies that it will be difficult to allocate quieter periods at the preferred times, to everybody. This, not surprising, result confirms the need to understand how best to allocate managed respite – e.g. maximise the number of people who get more modest levels of respite OR maximise the level of respite albeit to a smaller number of beneficiaries.

At more than £300 per household, the sum of money that respondents would be willing to pay, on average, to have quieter aircraft at their preferred times of day, is quite large when considered as values that would apply every year; and aggregated across the number of residents potentially affected.

This research also highlights that there could be considerable benefit to the airport, even if periods of respite achieved only modest reductions in noise (i.e. 2-3 dB) – as a majority of respondents said they would feel more positive about the airport (even if it would not be particularly noticeable); nevertheless, a small minority would see it as a waste of resources. This is an example of the many

non-acoustic factors that may have greater influence on community attitudes and acceptability of changes in air-space management and expansion at the airport.

It must also be borne in mind that the sample sizes obtained in this study are relatively modest and the confidence intervals around many of the findings are quite wide. If there is a need to obtain more precise estimates of thresholds and/or values, then it would be reasonably easy to roll-out the research design to new sample sites, to test responses elsewhere around Heathrow, and to increase the overall sample base of responses.

On the other hand, since these results, albeit based on modest sample sizes, nevertheless appear to be generally consistent with both established theory and with recent qualitative (open ended in-depth interview) research carried out in areas around Heathrow (e.g. Heathrow Airport's 2014 DOKEN multiple routes research), then if consideration is being given to extending the research, it might be considered more opportune to widen the research objectives to include the possible contributions to attitudes and perceptions made by non-acoustic factors such as the effectiveness of public engagement.

1. INTRODUCTION

1.1 Background

1.1.1 The concept of providing respite from aircraft noise has been around since the 1970s and has frequently been identified as a useful and effective strategy for providing relief from aviation noise to the communities living around airports. However, there is extremely limited study on the subject; and this research represents an initial step to gain insight on the value of respite for different levels of noise relief and at different times of day.

1.1.2 The Respite Working Group (RWG), as set up by Heathrow's Noise Forum (HNF), has now established that there are many different ways of delivering noise respite at different airports, and that there is no consensus internationally about the best ways to deliver effective noise respite. The RWG concluded that, in order to optimise the delivery of noise respite consistent with efficient operations in the future, Heathrow Airport Ltd (HAL) should commission new research to better understand the key characteristics of an effective respite strategy for the airport and its noise affected communities. Such research would help underpin and inform noise management at Heathrow, rather than provide a specific solution.

1.2 Research Objectives

1.2.1 The overall research objective was:

> *to better understand the key characteristics of an effective respite strategy for the airport and its noise affected communities*

1.2.2 The two key issues that needed to be explored in relation to developing a set of principles that underpin community preferred options for effective respite were:

a) By how far do you need to **spatially change routes** to make a perceived difference (in terms of height and track, and for arrivals and departures)? For example, to provide effective respite through route alternation, the routes must be spatially separated to a sufficient extent to make meaningful differences in sound levels as perceived on the ground.

b) What are the optimum **temporal distribution patterns** required? In theory, and subject to operational constraints, it may be possible to provide respite according to any preferred temporal distribution, and it could be of considerable value to better understand community preferences in this respect.

1.2.3 The first key question set out above was to be investigated through laboratory simulations to explore the discernible differences (as perceived on the ground) between the noise characteristics of flight operations reflecting different height and lateral distances from the receiver, and to explore the value/benefit of these differences when providing respite options. Arup's SoundLab provided just such a

facility. Any perceived visual benefits of not being directly overflown was outside the scope of this research.

1.2.4 The second key question set out above is to be investigated through research in the field to explore the preferences of residents in terms of when they would most like relief from noise. We also qualitatively and quantitatively assessed:

- the relief levels that are perceived to be 'worthwhile' (i.e. of benefit) to residents;
- residents' preferred periods of noise relief;
- whether 'continuous alternation' (i.e. sharing operations across both runways so that the interval between noisy events is doubled throughout the day) is more, or less, preferable than changing over from continuous operations on one runway to the other runway at just one or two points each day (such as the current 3pm runway switch-over);
- residents' perceived benefit of a relative modest (but probably realistic) reduction of noise – i.e. how worthwhile is respite of, say, 2-3 dB, and alternative options for managing aircraft noise; and
- the value, in relative and monetary terms, of noise relief at different times of day.

1.2.5 Valuing different amounts of overall respite was out of scope.

1.2.6 The 'in the field' research required a sound simulation presentation system so that we could present to participants a range of stimuli that took into account differences in aircraft type, arrivals and departures, distances and angles from the listener to the aircraft position. However, we also wanted to present the sounds, and undertake the interviews, in areas close to where residents live – so that we could recruit a representative sample from each target community. We used the same sound stimuli as in the SoundLab phase and presented them in local venues.

1.3 Testing and Piloting

1.3.1 The subject matter, stimuli and options researched in this study are complex, and considerable cognitive testing was required to ensure materials were fit-for-purpose prior to conducting the main fieldwork.

1.3.2 Four rounds of piloting in the SoundLab were undertaken, with each testing progressions of materials and stimuli, until such a time that we were confident that they would deliver the required insights, both qualitatively and quantitatively.

- Informal pre-pilot with fellow project team members – late February 2016;
- Informal pilot with fellow project team members – mid March 2016;
- Informal pilot with technicians who had had no involvement in the project until that point – early April 2016; and
- Formal pilot with members of the public – mid April 2016.

1.3.3 At which point, the qualitative feedback suggested that we had the research mechanism for facilitating participants' response in the way that we had hoped. That is, respondents were able to provide their 'true' view on the stimuli presented to them, and with good cognitive understanding and in an attentive and constructive manner from participants.

1.3.4 Further piloting was carried out in local venues (in mid-July and August) which showed that aircraft sounds could be adequately 'realistic' in field settings even when full ambisonic reproduction was not used. The sounds were pink-noise calibrated so that we could ensure the relative difference in sound levels between presented aircraft was controlled and, hence, fit-for-purpose.

2. RESEARCH METHODOLOGY

2.1 The Lab-test Phase

The Lab Interview

2.1.1 The structure and content of the Lab-test interview is summarised in Figure 1.

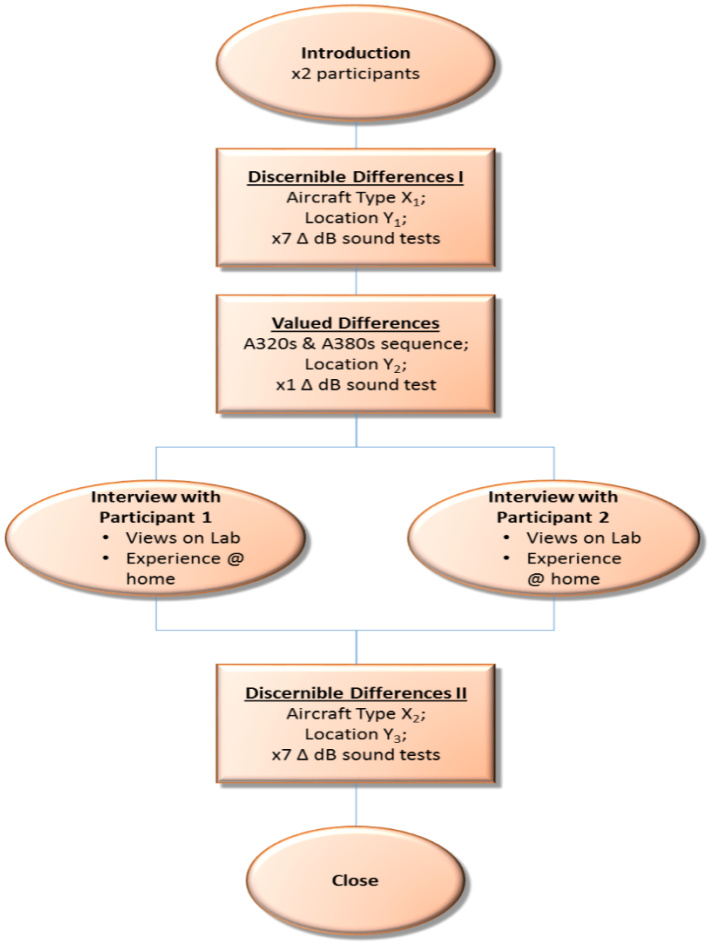


Figure 1. Lab Interview structure

Introduction and Explanation [2-3 mins]

2.1.2 During each lab session, up to three participants took part. The context we gave the participants encompassed the following explanation and research context:

- of our 'independent researcher' status, and that we were doing the research on behalf of Heathrow Airport Ltd;
- of the "rules" (no right or wrong answers, anonymity, recorder etc);

- of Arup's SoundLab being a state-of-the-art, sound-proofed facility; with participants sitting in the centre of a sphere of loudspeakers; 4 on the ceiling, 8 laterals and 4 on the floor; controlled by sophisticated hardware and software; and

- that the research was to help HAL better understand how to effectively manage the noise consequences of its operations on neighbouring communities.

Discernible Differences Exercise I [20 mins]

2.1.3 The method adopted to explore discernible differences between different aircraft noise events was to play two aircraft noise events and then ask the participant to say whether one was quieter, the same or louder than the other. The sounds were presented with a static street-scene only with no visualisations of aircraft.

2.1.4 Participants were asked to imagine that they lived in an area either similar to the depicted residential scene, or somewhere nearby (such that the aircraft sounds would be generally similar) and they were outside their home when listening to the different aircraft noise events. This was so that we could ask, at a later stage of the interview, whether the sounds seemed realistic, etc. and to ensure that the participants considered the research to be relevant to them (to increase the likelihood of them remaining attentive throughout the exercise).

"Please imagine that you were outside and close to home, perhaps in your front drive or garden, and you heard these sounds.

We will play to you a series of paired aircraft sounds one after the other and, for each pair, we would like to know whether each of the two sounds seem to be the same, or different [SEE RECORD SHEET]. Please feel free to add any other observations on the form.

As it is human-nature to be at least a tiny bit influenced by other people's opinions, please would you turn to one side when you record your response to each pair of aircraft noises"

2.1.5 The listening test comprised a series of pairwise aircraft sounds, and, after each pair of sounds, each participant indicated on a record sheet whether there was a difference between the two sounds, as follows.

- The second aircraft was much louder than the first
- The second aircraft was a bit louder than the first
- The second aircraft was **no different** to the first
- The second aircraft was a bit quieter than the first
- The second aircraft was much quieter than the first

2.1.6 During the interview, each participant responded to: 7 x pairwise sounds x 2 baselines (defined by aircraft and location) – so we obtained 14 observations on discriminable differences per respondent.

Valued Differences Exercise [20 mins]

2.1.7 The valued differences exercise explored the extent to which a representative sequence of quieter events present a valued break from aircraft noise exposure, in the context of providing respite periods. The context to the exercise was as follows:

> *"We will play you two sequences of aircraft sounds, which will be representative of the typical variation in sound levels that occurs at Heathrow or any other airport. The aircraft sounds will occur at approximately every 50 seconds or so for 7 or 8 minutes with 'normal' background noise. This is about twice as often as actually occurs at any airport (IF ASKED - it is done for this exercise to avoid having to keep you here any longer than necessary)*
>
> *Q. Did you notice any difference between the second and first sequences of aircraft noise?*
>
> *[If they did]*
>
> *Q. Which was noisier – the first or second sequence?*
>
> *[depending on first or second sequence being noisier – show relevant SHOWCARD]*
> *Q. Which, of the following three judgements, best reflects your personal view of the noise difference between the two sequences [SHOWCARD]"*

SHOWCARD A **Compared with the first aircraft noise sequence, …**	
… the second aircraft noise sequence provides a complete break from the aircraft noise	1
… the second aircraft noise sequence provides a valuable break from the aircraft noise	2
… the second aircraft noise sequence does NOT provide a valuable break from aircraft noise	3
OR: **SHOWCARD B** **Compared with the second aircraft noise sequence, …**	
… the first aircraft noise sequence does NOT provide a valuable break from aircraft noise	4
… the first aircraft noise sequence provides a valuable break from the aircraft noise	5
… the first aircraft noise sequence provides a complete break from the aircraft noise	6

2.1.8 The intention of the question was to give participants the experience of a sequence of aircraft (for 7-8 mins); and then a sequence of a similar type and profile of aircraft (for a further 7-8 mins) but all at a fixed difference in sound level,

dB compared with the first sequence (according to a careful design). Background noise was played continuously (i.e. audible in between sound events) and consisted of general traffic and other street noise at 50 dB LA_{eq}. To avoid making the task monotonous for participants, we limited each sequence to just 7-8 minutes.

Qualitative In-depth Interview [15 mins]

2.1.9 The content of the in-depth interview was as follows:

- feedback on the SoundLab experience, realism of play-backs, visuals, etc;
- feedback on the ease/difficulty of doing the exercises and recording responses; and
- overall participant observations and consideration, or not, of the policy context that might be driving the research and whether this influenced their responses in any way.

Discernible Differences Exercise II [20 mins]

2.1.10 This was an exercise of similar form to the first exercise for each participant – i.e. comprising a series of pairwise aircraft sounds, and, after each pair of sounds, each participant indicated on a record sheet whether there was a difference, or not, between the two sounds. This second discernible difference exercise had a different base (defined by aircraft type and location) compared with the first exercise presented to participants.

2.1.11 Since the focus of the lab-tests was on exploring discernible differences in noise levels – i.e. whether they did, or did not, notice a difference between two sounds - there was no opportunity for the participant to influence policies through their responses.

2.1.12 Overall, participants gave up around 1¼ hours of their time. A financial 'thank you' (of £35) was provided on completion of the SoundLab session.

Sound Stimuli

2.1.13 Our overall experimental design for discernible difference testing was as follows: Note that the overall design was repeated for both arrivals and departures, across the sample.

2.1.14 The aircraft sounds were ambisonic recordings made at carefully selected locations to the east and west of Heathrow which avoided confounding background noise as far as possible. Recording locations were selected so as to be representative of different distances from the flight paths to obtain representative high, medium, and low aircraft sound levels. The base sound levels (LA_{max}) then used in the SoundLab tests were representative averages of the sound levels as measured for the original ambisonic sound recordings as made in the field.

2.1.15 The original recordings were edited to remove extraneous background sounds from the beginning and end of each flyover event and then the 'best' recordings selected for the listening tests. Each selected recording was then re-calibrated so that it would be reproduced at the base LA_{max} sound levels as shown in the table below. The 6 arrivals and 6 departures recordings were then reproduced at the tabled base sound levels, subject to plus and minus variation as described below, in all subsequent SoundLab and field listening tests.

base	**LA_{max}**		**decibel differences**						
	arrivals	**departures**							
A380 high	86	85	0	+3	+6	+9	-3	-6	-9
A380 medium	74	71	0	+3	+6	+9	-3	-6	-9
A380 low	61	57	0	+3	+6	+9	-3	-6	-9
A320 high	80	75	0	+3	+6	+9	-3	-6	-9
A320 medium	71	67	0	+3	+6	+9	-3	-6	-9
A320 low	58	58	0	+3	+6	+9	-3	-6	-9

2.1.16 The table above shows 7 pairwise sound tests (e.g. +3 dB, + 6 dB, etc) for each of 6 base sounds (I.e. 3 locations x 2 aircraft types). The first sound of each comparison pair was reproduced at the base LA_{max} sound level as shown in the table above, and then the second sound was reproduced at a plus or minus different sound level as shown in the table - with the only exception that, for the highest base LA_{max} sound level, it was necessary to reduce the sound level of the first sound by 3 dB just for the +9 dB comparison to avoid overloading the system by the second sound at +9 dB. A detailed experimental design based on a 7 x 7 graeco-latin square was followed to ensure that each decibel difference was presented the same number of times in each position in the order of presentation of the 7 pairs, and that each decibel difference pair followed every other decibel difference pair an approximately equal number of times. It was not, of course, possible to achieve a perfect balance of the orders of presentation across 7 difference pairs (including the zero difference pair) because there were only 6 rows in the design based on the six base levels for each of the arrivals and departures tests separately.

2.1.17 There was no background sound played to participants in between aircraft sounds.

2.1.18 For the valued differences exercise (see section 2.1.7 above) each aircraft noise event sequence was assembled from individual aircraft noise events at +0 dB (A320), -3 dB (A380), +6 dB (A320), -3dB (A320), +0 dB (A380), and +0 dB (A320), so as to be generally representative of typical variation in sound levels (LA_{max}) that actually occurs in real life[1]. For the valued difference testing, the overall duration was 7-8 mins for each sequence x 2 sequences = 15 mins. Thus, just one single observation was obtainable per respondent for the discernible difference exercise, so we had to adopt a more limited experimental design, as follows:

[1] All decibel differences noted here are relative to the base LA_{max} sound levels as presented in the discernible differences exercise.

Base [sequence]	LA_{max}	decibel differences		
A320s & A380s medium	68-77	-12	-6	+9

2.1.19 Each participant was presented with a single base/dB sequence difference combination. Across the sample, we have obtained, on average, 10 observations for each dB variation (further split by arrivals/departures).

Recruitment

2.1.20 We recruited a mix of 'ordinary' members of the public via door-to-door and telephone contact boosted (during the pilots) by using people who had done previous participatory research, such as attend focus group discussions. Demographic profiles were monitored to ensure that we obtained a suitable mix of people by gender, age, and socio-economic group. We did not actively screen in or out on the basis of whether participants were members of an amenity group such as Heathrow Association for the Control of Aircraft Noise (HACAN), or have family working at Heathrow, etc. We noted, during the interview, any strong biases towards, or against, Heathrow (such as being a frequent airport user or being a member of an amenity group).

2.1.21 It should be noted that the lab work was not expected to obtain a sample that was sufficient in number, nor of a composition, to accurately reflect the profile of residents 'affected' by aircraft noise (say by gender, age and socio-economic group). However, we did want the overall Lab sample to cover the spectrum of different types of people who may be affected by noise from aircraft using Heathrow and, by definition, such participants can only (i.e. must) be taken from the sub-population of people who are willing to participate in research.

2.1.22 In addition to recruiting 'ordinary' members of the public, a small number of stakeholders also witnessed, or participated in, the Lab research, including members of Department for Transport (DfT) and Heathrow's Noise Forum, representing communities affected by Heathrow and other stakeholders. Their observations have been included in the analysis.[2]

2.1.23 A total sample of sixty participants was obtained.

Timing of Main Lab Phase

2.1.24 Eight waves of Lab work were undertaken, as follows:

- Waves 1 – 4 [arrivals]: late June and early July 2016;
- Waves 5 – 8 [departures]: mid-July and August 2016.

[2] Since we simply asked the participant whether the second sound was quieter or louder etc than the first sound, there is no opportunity for policy-bias in the data collected.

2.2 The Field Phase

The Field Interview

2.2.1 The structure and content of the 'field' interview is summarised in Figure 2.

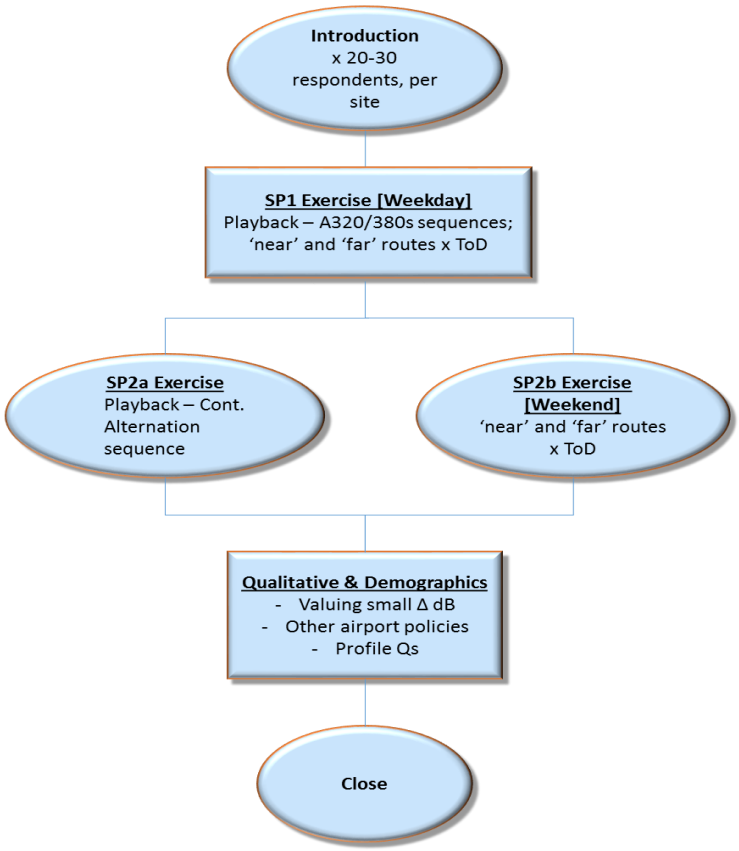


Figure 2. Field Interview structure

Introduction and Explanation [2-3 mins]

2.2.2 We defined the context in which we wanted participants to give their views and responses. This encompassed the explanation:

- of our 'independent researcher' status, and that we were doing the research on behalf of HAL;
- of the "rules" (no right or wrong answers, anonymity, recorder etc);
- the focus of the research was on airport operations, and aircraft noise, between 7am – 11pm.
- That the research was to help HAL better understand how to effectively manage the noise consequences of its operations on neighbouring communities.

SP Exercise 1 - Valuing Quiet Periods by Time of Day, during the **Week**

2.2.3 All respondents completed this exercise. The context to the exercise was as follows:

> *"We will play you a sequence of 6 aircraft coming into land/taking off at Heathrow [customised by area] - when aircraft fly closest to where you live. The aircraft we will play you will vary in type and be typical of the variation in aircraft at Heathrow. The aircraft sounds will occur every 60 seconds or so for 6 minutes.*
>
> *We will then play you a second sequence of 6 aircraft over 6 minutes. These will be of the same types of aircraft but travelling along a route further away, so will be quieter. We would like to know whether you think the second noise environment is noticeably quieter or not; and, if so, whether you think the quieter environment would of significant benefit to you?"*

2.2.4 Though each aircraft in the second sequence was precisely 10 dB lower than each corresponding aircraft in the first sequence, the variation within the sequence was such that the noisiest aircraft in the quieter sequence was almost as loud as the quietest aircraft in the noisier sequence.

2.2.5 After respondents had indicated whether they had noticed the difference and (if so), how beneficial the quieter sequence would be if like that throughout the operation day. They were then asked to respond to an SP exercise.

> *"I would like you to consider NINE different options that describe when and where aircraft would fly in relation to your residential area every WEEK day (i.e. Monday to Friday). Aircraft noise at the weekends would remain as now. Each is described in terms of:*
>
> - *Route used – the 'noisier route' would be like you heard for the first sequence; the 'quieter route' would be like you heard for the second sequence [which was 10 dB quieter];*
> - *the time of day when each route is used; and*
> - *the amount of council tax you pay – which may go up or down compared with now, depending upon future airport contributions to Local Authority expenditure and revenues (such as that received from the airport in the form of business rates and environmental considerations)."*

2.2.6 The form of each option was as follows, with respondents needing to rank the nine options in order of preference.

Option A

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
£X more/less *than now*

2.2.7 The noise environments that were presented in this exercise were:

- Quieter route (i.e. 'far' runway) between 7am – 3pm and noisier route (i.e. 'near' runway) between 3 - 11pm;
- Quieter route between the hours of 7-11am and 7-11pm, and noisier between 11am – 7pm; and
- Quieter route between 11am – 7pm, and noisier between the hours of 7-11am and 7-11pm.

2.2.8 Each respondent was then presented with a second exercise – either a) a 'continuous alternation' exercise that required respondents to hear a third aircraft sequence that comprised a mix of A320s/380s alternating between the near and far routes OR b) undertake a time of day SP exercise that focused on weekend aircraft noise.

SP Exercise 2a - Valuing 'Continuous Alternation' between 'Near' and 'Far' routes

2.2.9 This exercise assessed whether, all other things being equal, residents prefer their respite in 'blocks' and at the times that they are most sensitive OR prefer to spread the 'benefit' across the operational day so that there are always longer intervals between the noisier aircraft. Half of our sample completed this exercise; and half did Exercise 2b (overleaf).

2.2.10 The context to the exercise was as follows.

"We have been considering defined blocks of aircraft using the 'quieter' route, and defined blocks of aircraft using the 'noisier' route. Another option would be to have

continuous alternation *between the noisier and quieter routes throughout the 16-hour operational day. This would increase the time intervals between the noisier aircraft to approximately 180 seconds [i.e. every 3 minutes] but throughout the whole period.*

We will now play you a third sequence of 6 aircraft over 6 minutes. These will be of the same types of aircraft alternating between quieter and noisier routes. It is therefore a mix of the two sequences you have heard previously."

2.2.11 Once they had heard the 'continuous alternation' sequence, respondents were asked to consider a new option – Option X – that took the form:

Option X

7am – 11pm [16 hrs]:
Continuous Alternation

Noisier – Quieter –
Noisier – Quieter … etc

Council Tax (annual):
You pay
the SAME as now

2.2.12 Respondents were asked to position Option X within their ranked ordering of the nine (blue) SP cards defining blocks of 'respite' and money.

2.2.13 Once they had done this, we introduced two more 'Continuous alternation' options (Y and Z) that were similar to Option X but with different monetary implications (£50 more and £25 less, respectively). Respondents were asked to include these two options into an overall ranking order from 1st to 12th.

SP Exercise 2b - Valuing Quiet Periods by Time of Day, during the **Weekend**

2.2.14 The requirement was as for SP Exercise 1, but the context was 'at the weekend'.

2.2.15 The interview questionnaire also covered questions on the following:

- a qualitative assessment of the difference between the two sequences, in terms of whether having the quieter sequence for a large period of the operational day would be of NO, SOME or CONSIDERABLE benefit to them and their household;
- simple tick-box answers to enable respondents to indicate which 8 hours (of the 16-hour operational day, from 7am – 11pm, during the week) would they most prefer to be quiet(er);

- as above but for the weekend;
- how worthwhile it would be for Heathrow to create 'quieter' periods that reduce average aircraft noise by a small amount (that research has found would not be noticeable to most people); and
- other attitudinal questions on noise in the community, and demographics.

Sample Design

2.2.16 We surveyed residents in the following four locations.

West Windsor

- Dedworth, 2014 day-time noise contour around 57-58 LA_{eq}.
- mainly exposed to easterly arrivals onto 09L around 20-25% of the time. This location will benefit if/when Cranford agreement no longer applies.
- westerly departures mostly fly either to the north or south of this location according to the westerly noise preferential routes.
- Socio-economically mixed.

Stanwell Moor

- location centred on north of village (Horton Road) - note that aircraft noise falls away to the south of this village.
- 2014 day-time noise contour around 69-72 LA_{eq}.
- mainly exposed to westerly departures off 27L, to a lesser extent westerly departures turning to the south west off 27R (around 70-75% of the time), and easterly arrivals onto 09R (around 5% of the time); hence only limited opportunities for respite, which would be further reduced if/when Cranford agreement no longer applies.
- Socio-economically mixed.

West Hounslow

- location centred on Barrack Road between Staines Road and Beavers Lane.
- 2014 day-time noise contour around 66-69 LA_{eq}.
- mainly exposed to westerly arrivals onto 27L (around 35% of the time) and easterly departures off 09R (around 20-25% of the time).
- Socio-economically mixed, mostly 1930s semi-detached housing and relatively high proportion of Asian population.

Kew

- location centred on Kew Gardens railway station, 2014 day-time noise contour around 57-58 LA_{eq}.
- mainly exposed to westerly arrivals onto 27R around 30-35% of the time.

- easterly departures mostly fly either to the north or south of this location according to the easterly noise preferential routes.
- Socio-economically mixed - determined by a range of well-established terrace housing, some of which are divided into apartments.

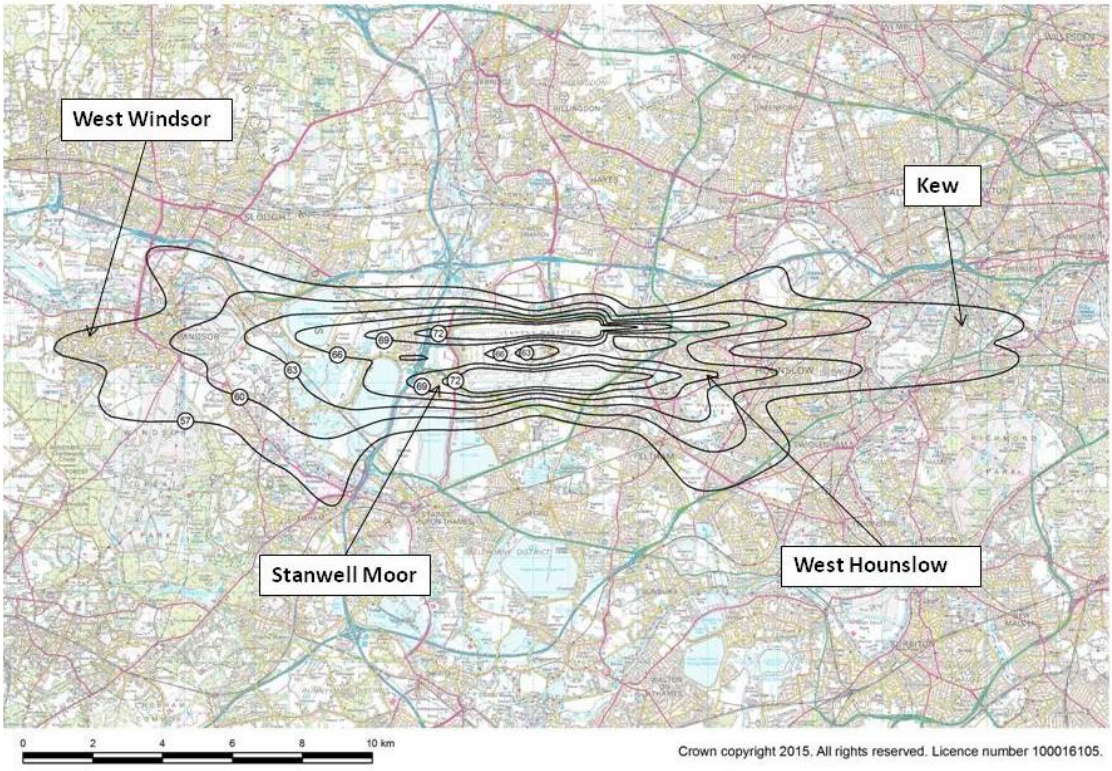
2.2.17 The above was subject to finding suitable venues for the research and, in particular, an environment for respondents to receive all noise and other survey stimuli without disruption.

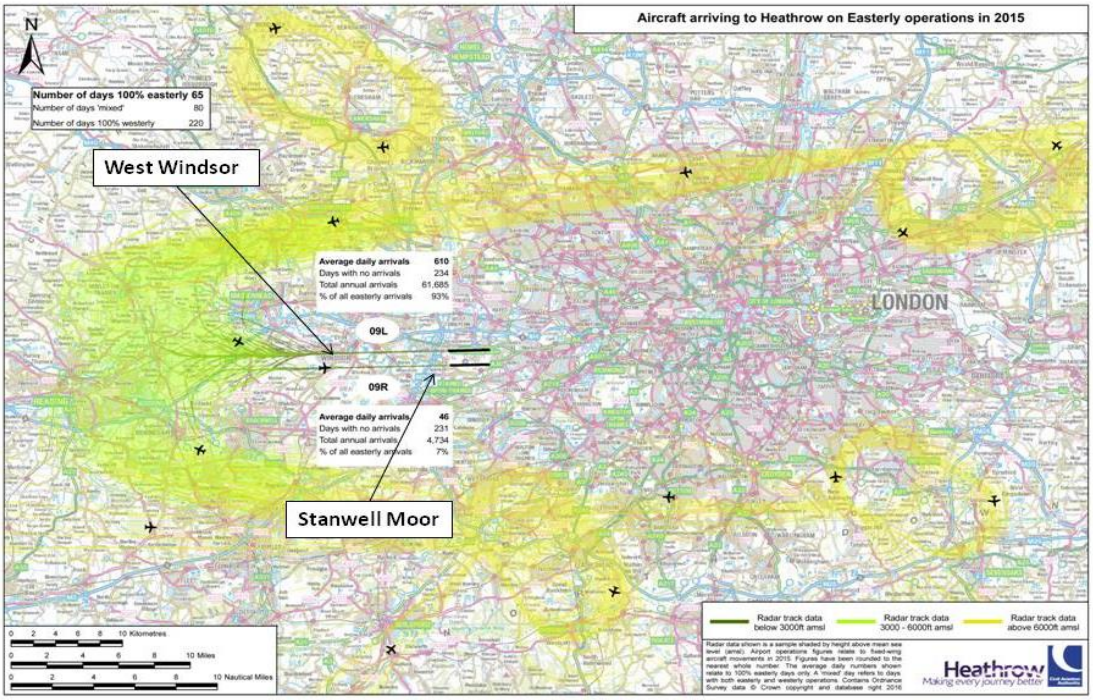
2.2.18 We avoided residents whose houses front onto main roads running through the area if possible. The only location where this does not apply is Stanwell Moor where the background noise from the M25, A3044 etc. is pervasive throughout.

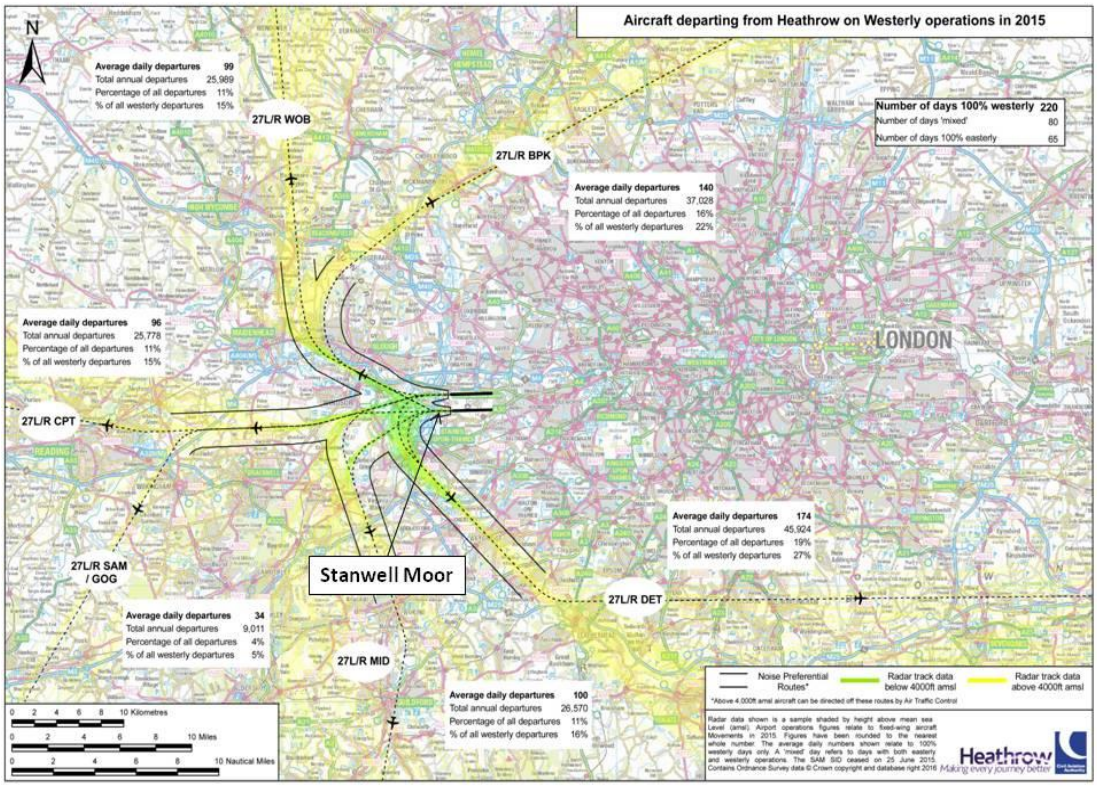
2.2.19 We required a meeting/function room at each location capable of accommodating up to 10 participants seated around a table, or at tables, plus additional space around the seated participants for convenors, loudspeakers, and other equipment. There was no background music or other sounds (staff radios, vacuum cleaners, etc. audible during each session). Each venue was within easy access of participants' houses at each sample location.

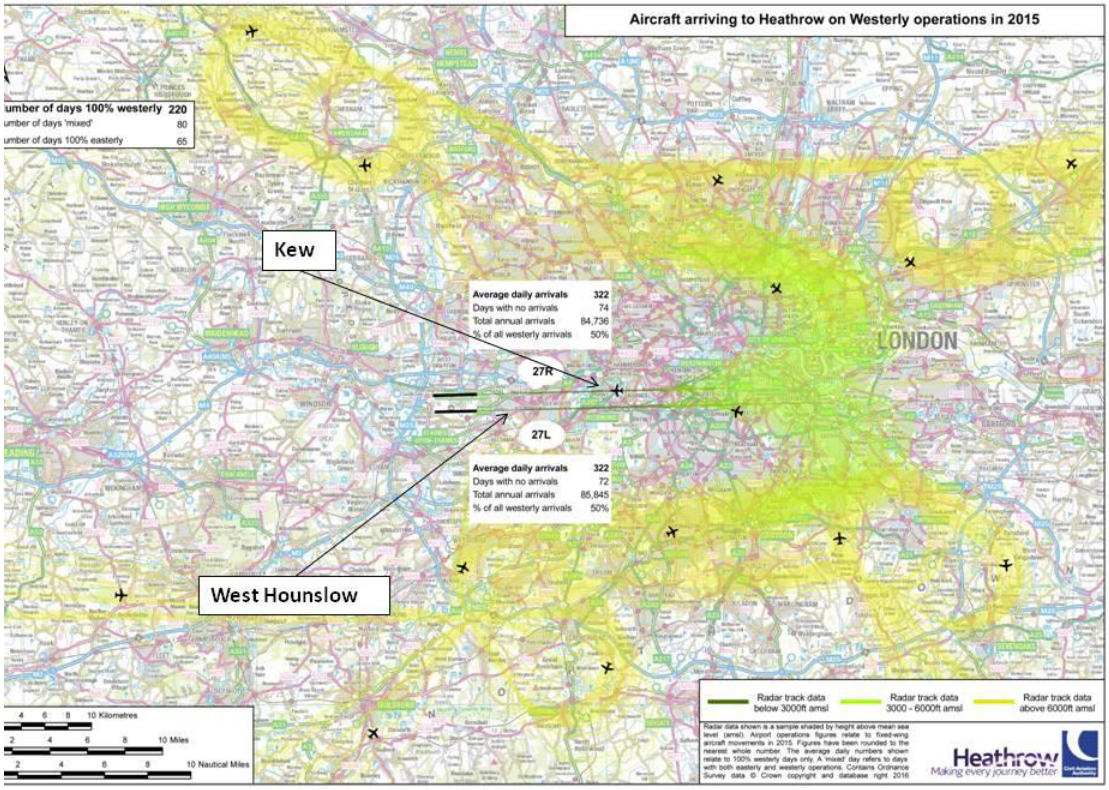
2.2.20 Respondents were recruited via field staff going door-to-door within the defined target areas; and according to quotas defined by Census population data on gender, age and socio-economic group in each area.

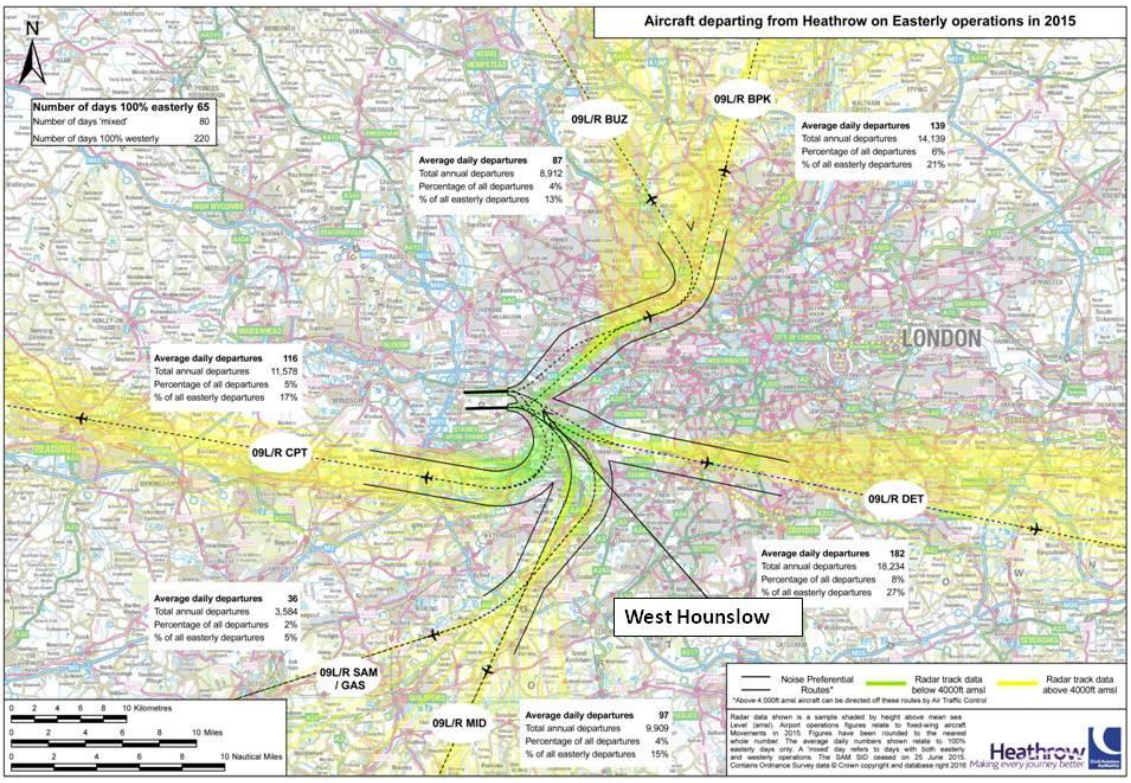
Figure 3. Survey Sites for Main Survey




Aircraft arriving to Heathrow on Easterly operations in 2015
N
Number of days 100% easterly 65
Number of days 'mixed' 80
Number of days 100% westerly 220
West Windsor
Average daily arrivals 610
Days with no arrivals 234
Total annual arrivals 61,685
% of all easterly arrivals 93%
09L
09R
Average daily arrivals 46
Days with no arrivals 231
Total annual arrivals 4,734
% of all easterly arrivals 7%
Stanwell Moor
LONDON
Radar track data below 3000ft amsl
Radar track data 3000 - 6000ft amsl
Radar track data above 6000ft amsl
10 Kilometres
10 Miles
10 Nautical Miles
Heathrow
Making every journey better


Aircraft departing from Heathrow on Westerly operations in 2015
N
Average daily departures 99
Total annual departures 25,989
Percentage of all departures 11%
% of all westerly departures 15%
27L/R WOB
27L/R BPK
Average daily departures 140
Total annual departures 37,028
Percentage of all departures 16%
% of all westerly departures 22%
Number of days 100% westerly 220
Number of days 'mixed' 80
Number of days 100% easterly 65
Average daily departures 96
Total annual departures 25,778
Percentage of all departures 11%
% of all westerly departures 15%
27L/R CPT
LONDON
Average daily departures 174
Total annual departures 45,924
Percentage of all departures 19%
% of all westerly departures 27%
27L/R SAM / GOG
Stanwell Moor
27L/R DET
Average daily departures 34
Total annual departures 9,011
Percentage of all departures 4%
% of all westerly departures 5%
27L/R MID
Average daily departures 100
Total annual departures 26,570
Percentage of all departures 11%
% of all westerly departures 16%
Noise Preferential Routes*
Radar track data below 4000ft amsl
Radar track data above 4000ft amsl
*Above 4,000ft amsl aircraft can be directed off these routes by Air Traffic Control
10 Kilometres
10 Miles
10 Nautical Miles
Heathrow
Making every journey better


Aircraft arriving to Heathrow on Westerly operations in 2015
Number of days 100% westerly 220
Number of days 'mixed' 80
Number of days 100% easterly 65
Kew
West Hounslow
27R
27L
Average daily arrivals 322
Days with no arrivals 74
Total annual arrivals 84,736
% of all westerly arrivals 50%
Average daily arrivals 322
Days with no arrivals 72
Total annual arrivals 85,845
% of all westerly arrivals 50%
LONDON
Radar track data below 3000ft amsl
Radar track data 3000 - 6000ft amsl
Radar track data above 6000ft amsl
10 Kilometres
10 Miles
10 Nautical Miles
Heathrow
Making every journey better


Aircraft departing from Heathrow on Easterly operations in 2015
N
Number of days 100% easterly 65
Number of days 'mixed' 80
Number of days 100% westerly 220
09L/R BUZ
09L/R BPK
09L/R CPT
09L/R DET
09L/R SAM / GAS
09L/R MID
West Hounslow
LONDON
Average daily departures 87
Total annual departures 8,912
Percentage of all departures 4%
% of all easterly departures 13%
Average daily departures 139
Total annual departures 14,139
Percentage of all departures 6%
% of all easterly departures 21%
Average daily departures 116
Total annual departures 11,578
Percentage of all departures 5%
% of all easterly departures 17%
Average daily departures 182
Total annual departures 18,234
Percentage of all departures 8%
% of all easterly departures 27%
Average daily departures 36
Total annual departures 3,584
Percentage of all departures 2%
% of all easterly departures 5%
Average daily departures 97
Total annual departures 9,909
Percentage of all departures 4%
% of all easterly departures 15%
Noise Preferential Routes*
Radar track data below 4000ft amsl
Radar track data above 4000ft amsl
10 Kilometres
10 Miles
10 Nautical Miles
Heathrow
Making every journey better

2.2.21 The final sample size was **124** respondents, comprising:

- 29 Windsor residents;
- 30 Stanwell Moor residents;
- 29 Kew residents;
- 17 Hounslow residents; and
- 19 pilot interviews (10 Datchet residents + 9 Wraysbury residents).

2.2.22 Small anomalies between sample and population profiles were addressed through post-data collection weighting.

3. RESULTS – DISCERNIBLE DIFFERENCES

3.1 Discernible Differences - Overall

3.1.1 The results in this chapter are derived from analysis of the Discernible Differences exercise conducted as part of our SoundLab work (so the exercise can be considered as having been conducted in an 'active listening' environment). Each of the 60 respondents provided a response to each of 7 paired sound tests, for each of two sound exercises, making 60 x 7 x 2 = 840 observations in total.

3.1.2 The result, for the sample overall, is provided in Figure 4.

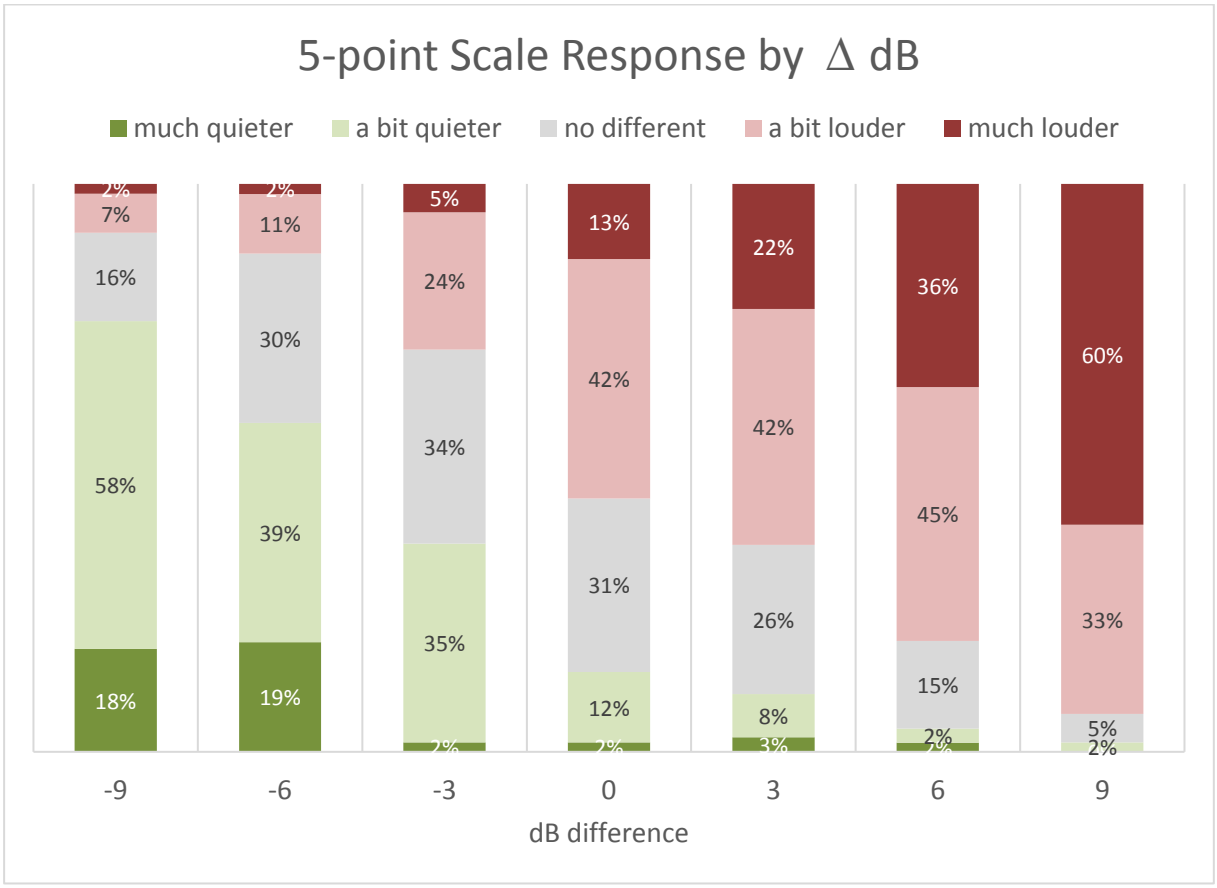


Figure 4. Discernible Difference Response (as a %) by Change in dB Presented

3.1.3 So:

- at –9 dB difference, 76% report much or a bit quieter, but 16% report no difference, and 9% report a bit or much louder.
- at –6 dB difference, 58% report much or a bit quieter, 30% report no difference, and 13% report a bit or much louder.
- at –3 dB difference, 37% report much or a bit quieter, 34% report no difference, and 29% report a bit or much louder.

- at 0 dB difference, 14% report much or a bit quieter, 31% report no difference, and 55% report a bit or much louder.
- at +3 dB difference, 11% report much or a bit quieter, 26% report no difference, and 64% report a bit or much louder.
- at +6 dB difference, 4% report much or a bit quieter, 15% report no difference, and 81% report a bit or much louder.
- at +9 dB difference, 2% report a bit quieter, 5% report no difference, and 93% report a bit or much (60%) louder.

3.1.4 These results reveal that listeners are better (on average) at correctly identifying increases than decreases in sound level.

3.1.5 The average discernible difference (defined as where the percentage 'correct' is greater than the percentage 'incorrect') seems to be around +3 dB for increases, and around –6 dB for decreases.

3.1.6 To further understand the nature of responses, in relation to the sound stimulus, Figure 5 shows the Mean response (from -2 = 'the second aircraft was much quieter than the first' to +2 = 'the second aircraft was much louder than the first').

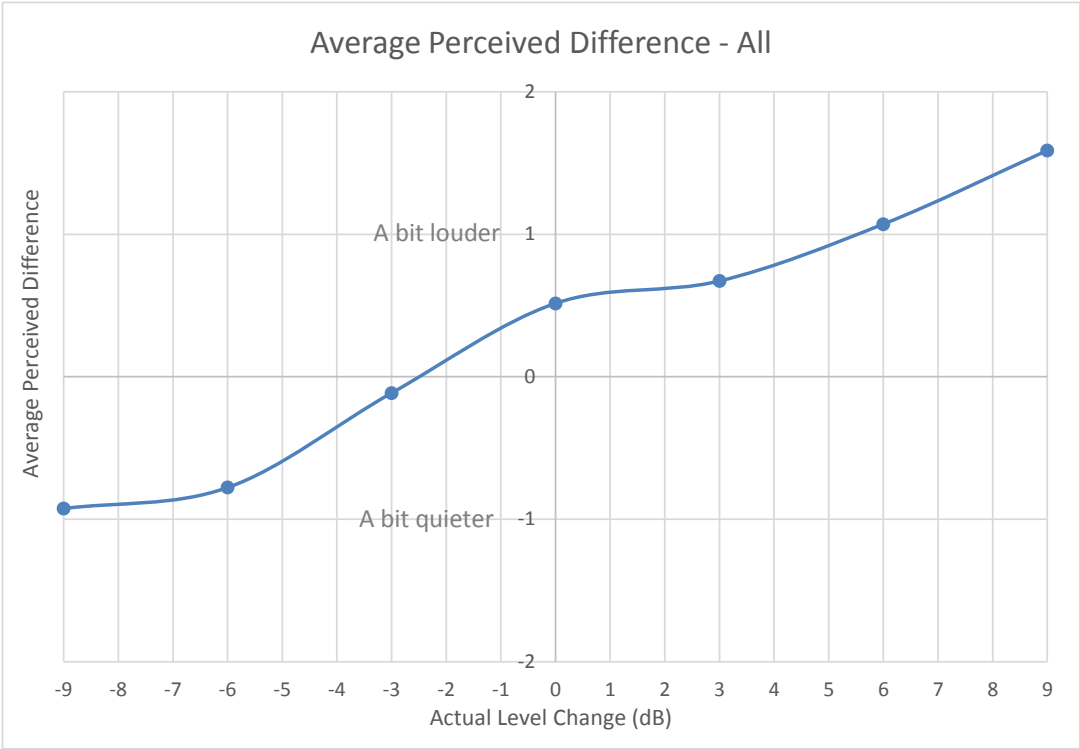


Figure 5. Mean Discernible Difference Response by Change in dB Presented

3.1.7 The results show that:

- as the second sound gets relatively louder than the first (i.e. moving from left to right across the chart), the mean response increases, as expected;

- at the limits (i.e. when the stimuli presented differences in sound level of -9 dB and +9 dB), the average response does not exceed -1 and +1.5 respectively (i.e. 'a bit' quieter and half 'a bit' noisier and half 'much noisier'). This suggests that not everybody was convinced of what they perceived even at these sound differentials; and

- at the 0 dB point [when the two presented sounds were the same], the mean perception is positive – i.e. there was a tendency, across the whole sample, to consider the second sound to be louder.

3.1.8 In principle deciding whether a response was 'correct' or not is straight-forward. However, the nature of the 5-point scale, which requires respondents to differentiate between 'a bit' quieter/noisier and 'much' quieter/noisier means that a subjective call is required. We adopted the following 'acceptance' criteria:

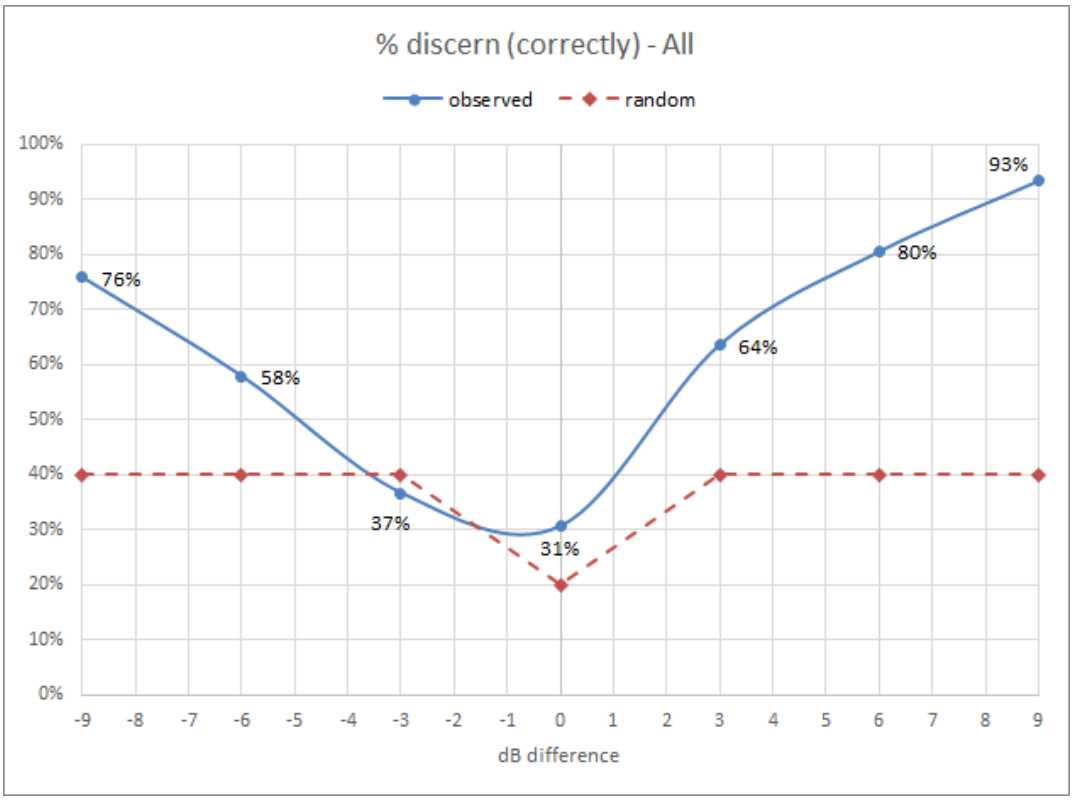
1=correct and 0=incorrect answers					
	-2	-1	0	1	2
	much quieter	a bit quieter	no different	a bit louder	much louder
dbDiff	5	4	3	2	1
-9	1	1	0	0	0
-6	1	1	0	0	0
-3	1	1	0	0	0
0	0	0	1	0	0
3	0	0	0	1	1
6	0	0	0	1	1
9	0	0	0	1	1

Figure 6. Discernible Difference Acceptance Criteria

3.1.9 In essence, we reduced the responses to a 3-point scale [quieter / same / louder] and disregarded the subtlety of 'a bit' and 'much'. This means that, to be considered correct, all quieter second sounds must have been deemed 'much' or 'a bit' quieter by the respondent; and all louder second sounds must have been deemed 'much' or 'a bit' louder; and all 0 dB differences must have been deemed 'no different'. Any other acceptance criteria seemed, on the face of it, to be counter-intuitive; though we have conducted sensitivity tests applying different acceptance criteria[3]. The shape of the 'Discernible Difference' curve is reported in Figure 7.

[3] In fact there are only very few alternative criteria that could be considered reasonable and fair

3.1.10 The blue line shows the percentage of respondents who correctly discerned the different sound levels, by dB difference; and the brown line shows what the line would look like with random data. The results are statistically significant at all differences except for -3 dB.



Base = 832 observations

Figure 7. Discernible Difference Results – Whole Sample

3.1.11 The horizontal axis shows the difference in dB between the two aircraft sounds within each pair presented. As described in the previous section, the dB difference varied, by design, and were: -9, -6, -3, 0, +3, +6, +9 dB. The vertical axis shows the percentage of the sample who were presented with each dB difference who said they noticed a difference in audibility between the two sounds and 'correctly' stated which sound was noisier.

3.1.12 The results reveal that:

- the participants were more easily able to discern a louder event if it was the second of the two sounds presented, than if it was the first;
- a clear majority (~60%) of participants discerned the difference in sound level when it reached circa -6 dB, and +3 dB;
- up to these thresholds, only a minority of participants were able to correctly discern the sound difference; and

- only a minority of the participants (circa one in three, 31%) were able to correctly discern hearing the same sound within quick succession (most thought they were different).

3.1.13 As with all sampled data, the results provide only an estimate of the result for the population. Figure 8 shows the intervals in which we can be 95% confident that the 'true' percentage of the population who would discern the sound difference lies within. Typically, the variation is around ±10% at each sound level difference.

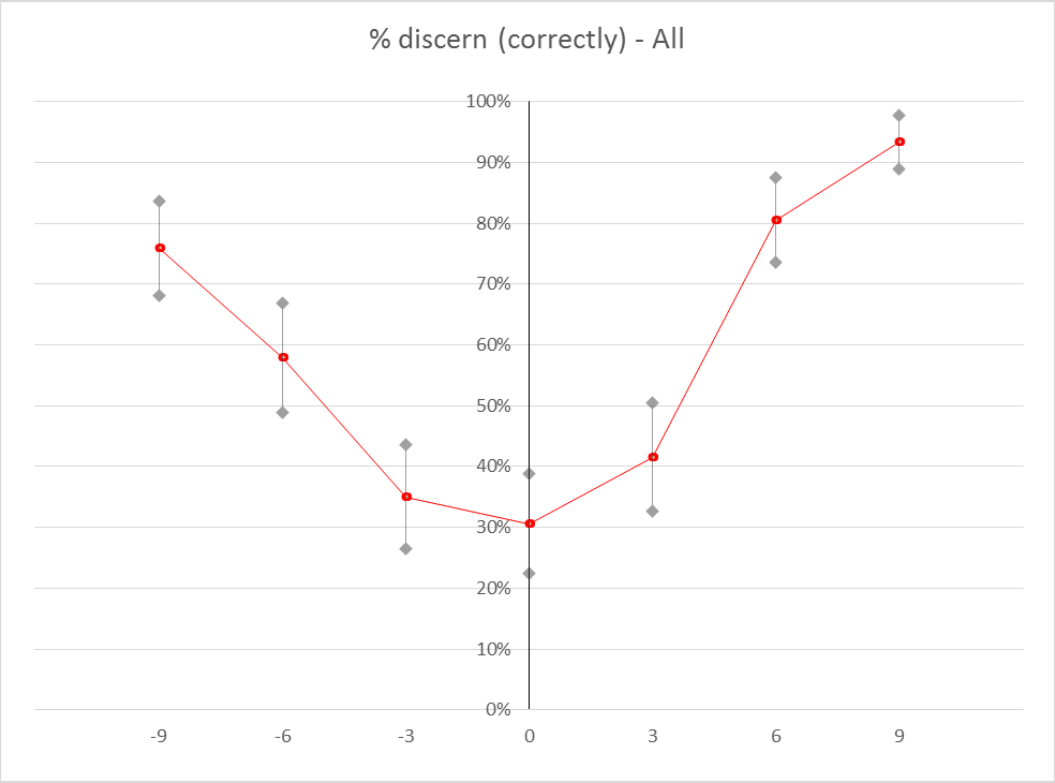


Figure 8. Discernible Difference Results – 95% Confidence Intervals

3.1.14 The remainder of this chapter provides results at a segmented level.

3.2 Discernible Differences – by Base Sound Level

3.2.1 The base levels, from which we presented ΔdB were: Low = circa 55 dB; Medium = circa 67 dB; and High = circa 80 dB. The discernible differences by base sound level is provided in Figure 9.

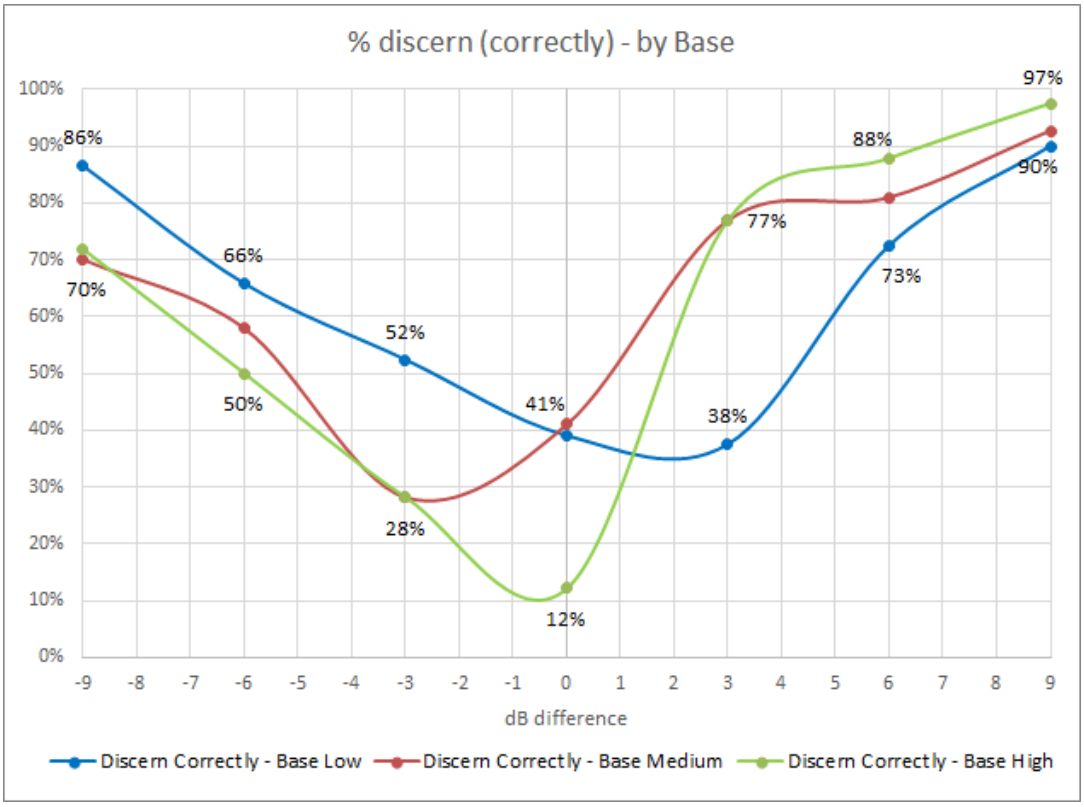


Figure 9. Discernible Difference Results – by base

3.2.2 These results (see Figure 9 above) suggest that, when the louder event was the second of the two sounds presented, the participants found it easier to correctly discern the difference between the two sounds with a high and medium base level (green and brown lines) compared with a low base (blue line). Furthermore, when the louder event was the first of the two sounds presented, the participants found it easier to correctly discern the difference between the two sounds with a low base level compared with a medium or high base level. Thus, the overall indication that the participants were more easily able to discern an increase than a decrease in sound level between the two sounds (see 3.1.12) does not seem to apply so obviously when the base is low (55 dB, i.e. when both sounds are relatively quiet).

3.3 Discernible Differences – by Aircraft Type and Arrivals/Departures

3.3.1 The discernible differences by aircraft type are reported in Figure 10; and by arrivals/departures in Figure 11. Neither chart shows statistically different results.

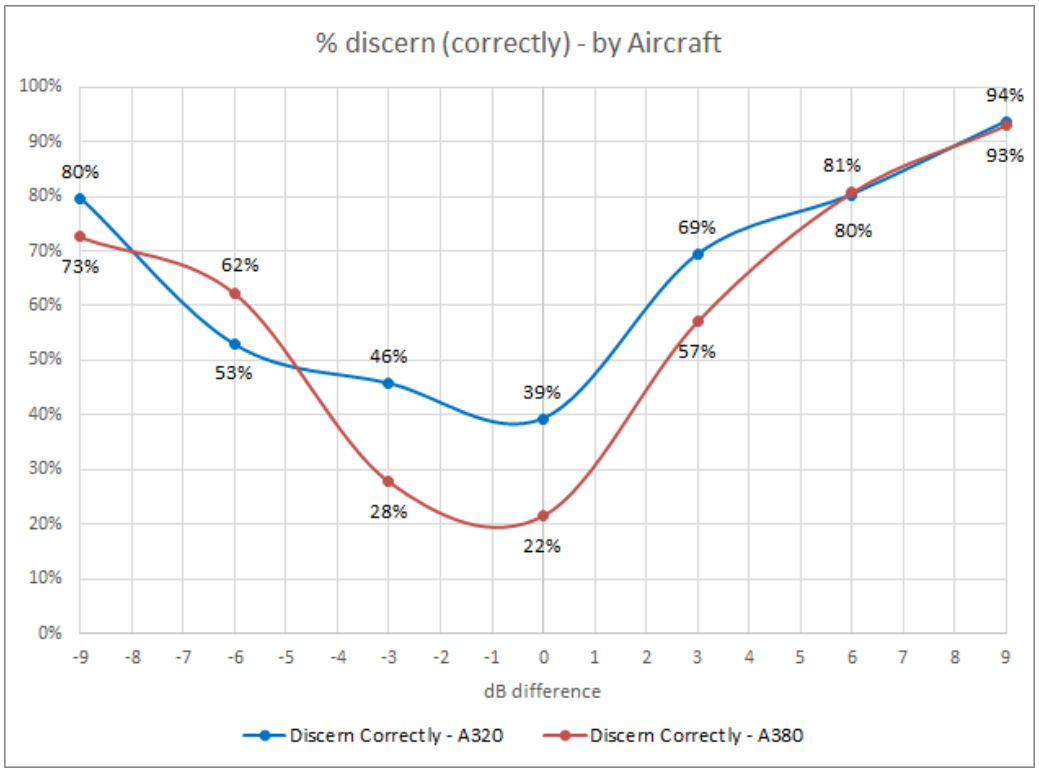


Figure 10. Discernible Difference Results - by Aircraft Type

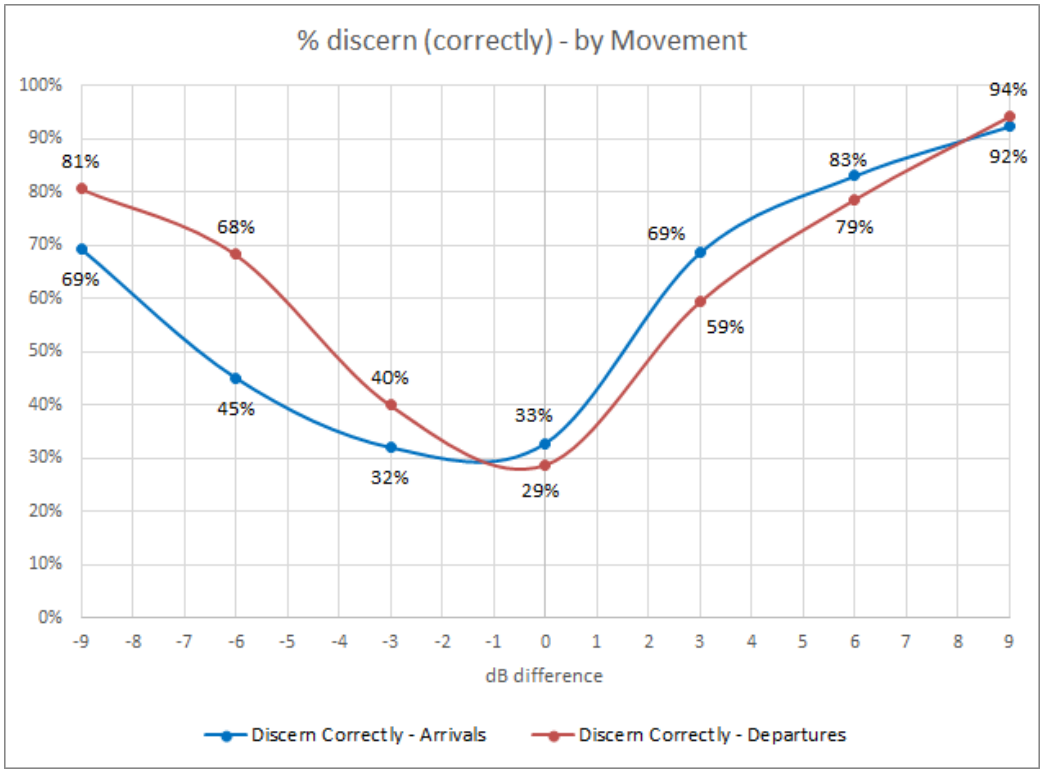


Figure 11. Discernible Difference Results - by Arrivals/Departures

3.4 Discernible Differences – by Gender

3.4.1 The discernible differences by gender are provided in Figure 12.

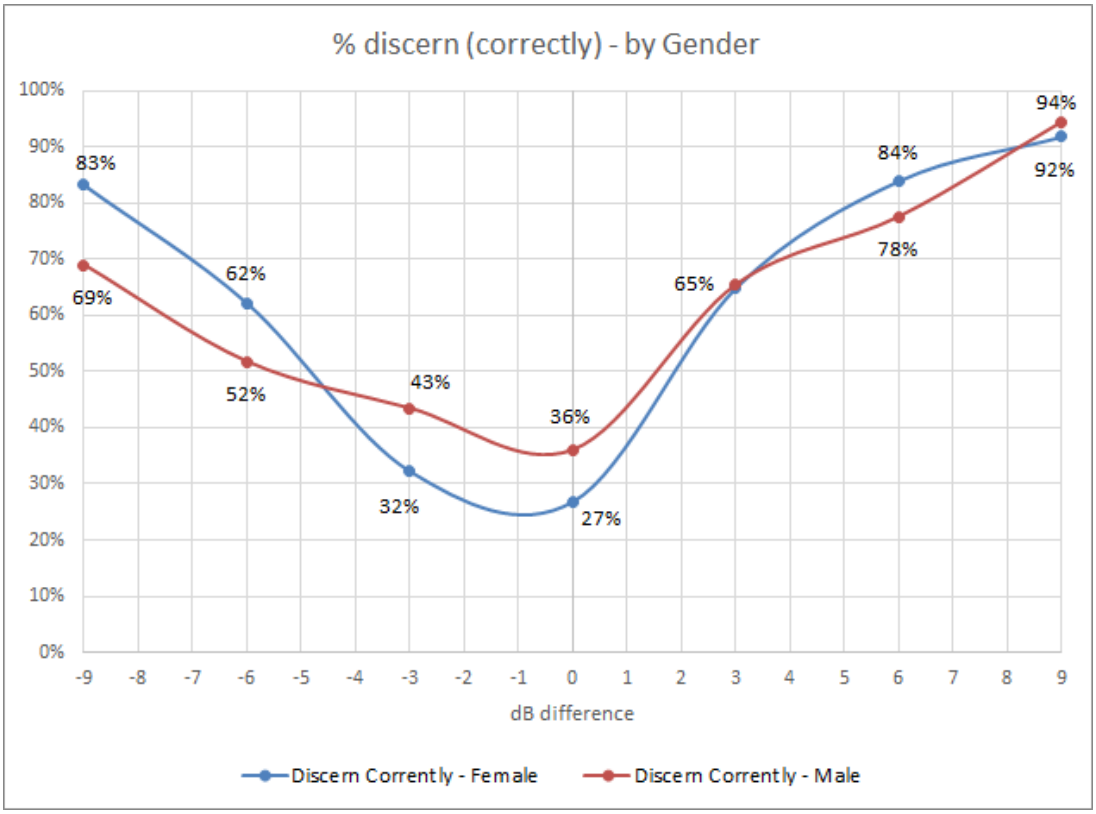


Figure 12. Discernible Difference Results – by Gender

3.4.2 There is no evidence of differences in discernibility by gender. Similarly, investigation by other demographics showed no statistical differences in discernibility by age or socio-economic group.

4. RESULTS – VALUED DIFFERENCES

4.1 Valued Differences - Overall

4.1.1 The focus of this chapter is to understand the sound level difference at which residents notice and 'value' a quieter aircraft sequence. The results in this chapter are derived from analysis of the Valued Differences exercise conducted as part of our SoundLab work. Of the 60 respondents who heard the two sequences, 2 noticed no difference in sound levels and 6 identified the wrong one as being the quieter sequence. Thus, 52 respondents were in a position to identify whether the quieter sequence would be of value to them and their household (if aircraft remained at that quieter level for a number of hours). The result, for the sample of 52 respondents, is provided in Figure 13.

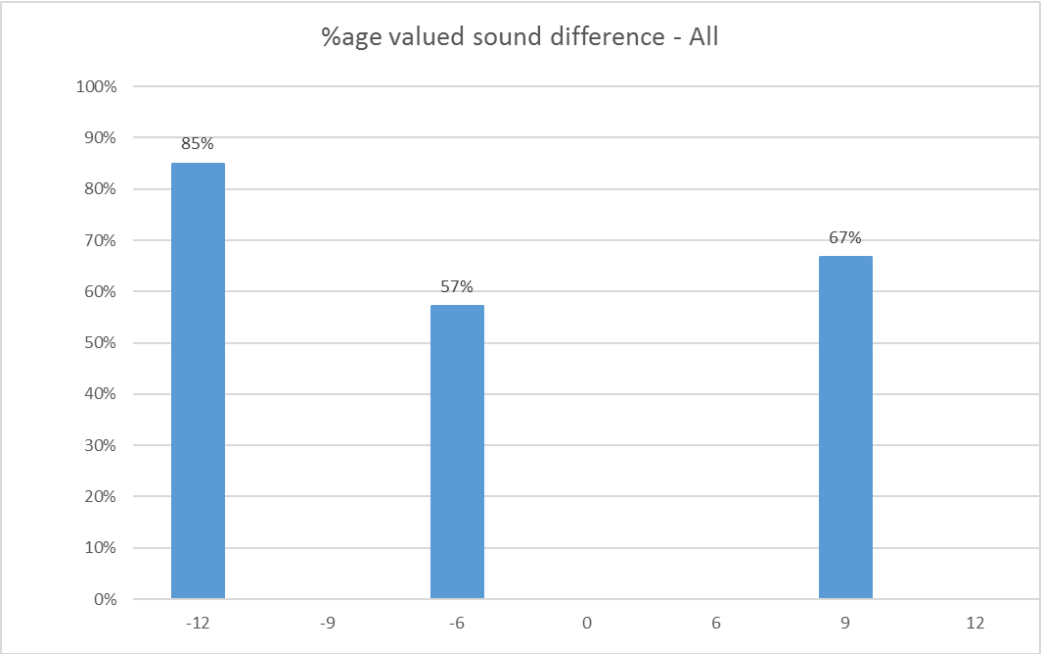


Figure 13. Valued Difference Results – Whole Sample

4.1.2 The horizontal axis shows the difference in dB between the two aircraft sequences within each pair of sequences presented. As described in the previous section, the dB differences varied, by design, and were: -12, -6, +9 dB. The vertical axis shows the percentage of the sample who were presented with each dB difference who said they noticed a difference in audibility between the two sounds, 'correctly' stated which sound was noisier and said that the quieter sequence of aircraft was either a 'complete' or 'valuable' break from noise.

4.1.3 The results reveal that:

- a large majority (85%) of the public valued the difference in sound level at -12 dB, and a small majority (57%) when it reached -6 dB quieter (which is **very similar to** the percentage confidently discerning a difference at -6 dB quieter);
- when the second sequence was louder, a clear majority (67%) of the public valued the difference at +9 dB (compared with confidently discerning a difference when +3 dB louder); and
- the percentage of respondents who value the quieter sequence when the second sequence was +9 dB lies in between the percentages of respondents who valued the quieter sequence when it was presented second (57% at -6 dB and 85% at -12 dB). In contrast to the discernible difference findings, there is thus no compelling evidence to suggest that sequences of quieter/louder sounds are as sensitive to ordering as with discernible differences. However, it should also be noted that the design did not permit testing both increases and decreases at all three difference levels.

4.1.4 Interpolation of the data in this study suggests that the reduction in sound level of sequences at which the quieter period is 'valued' by a clear majority of the public (i.e. for at least 60% of people) is around 7-8 dB; and could be marginally greater than the threshold at which the majority of people correctly discern differences in sound level between single events (around 5-6 dB).

4.1.5 The limited number of observations for each Valued Difference exercise means larger confidence intervals, compared with the Discernible Difference exercise. As can be seen from Figure 14, considerable variation exists when trying to estimate valued difference percentages for the population.

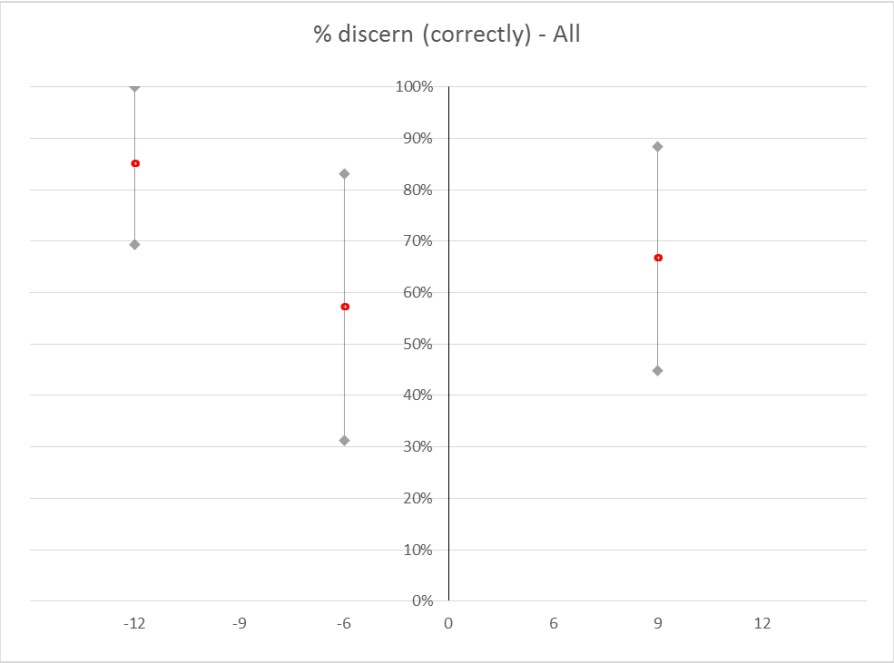
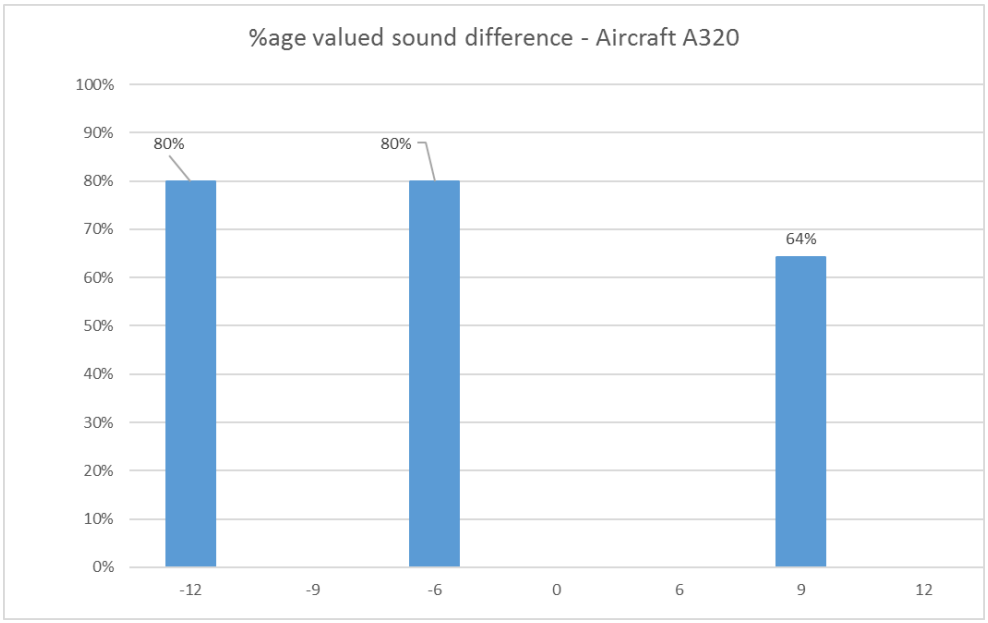


Figure 14. Valued Difference Results – 95% Confidence Intervals

4.2 Valued Differences by Aircraft Type

4.2.1 The results segmented by aircraft type are presented in Figure 15, but it should be noted that sub-sample sizes for each segment separately is circa just 10 respondents.



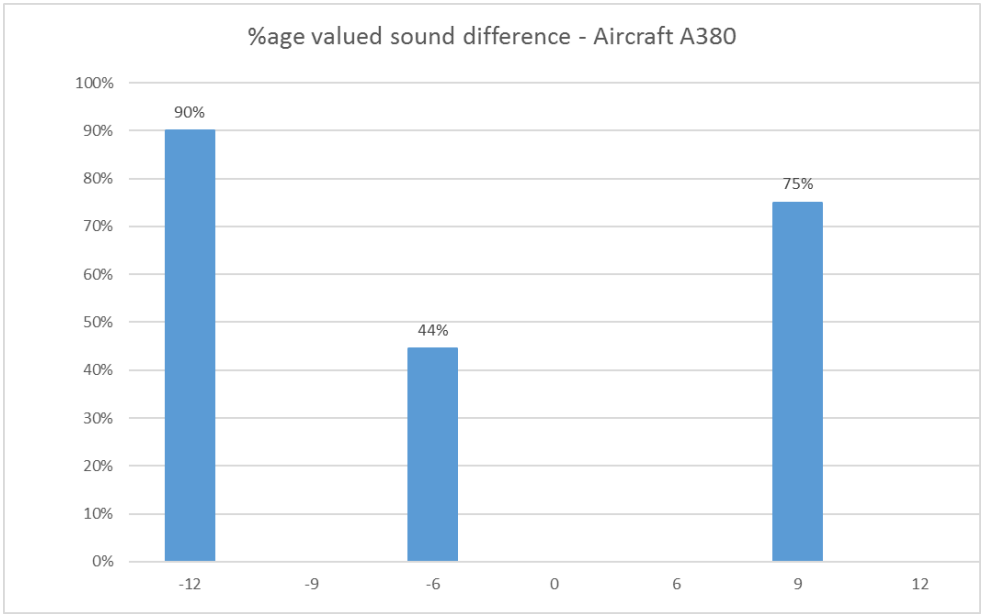


Figure 15. Valued Difference Results – by Aircraft Type

4.3 Valued Differences by Base and Arrivals/Departures

4.3.1 The results segmented by base [low, medium, high] are presented in Figure 16.

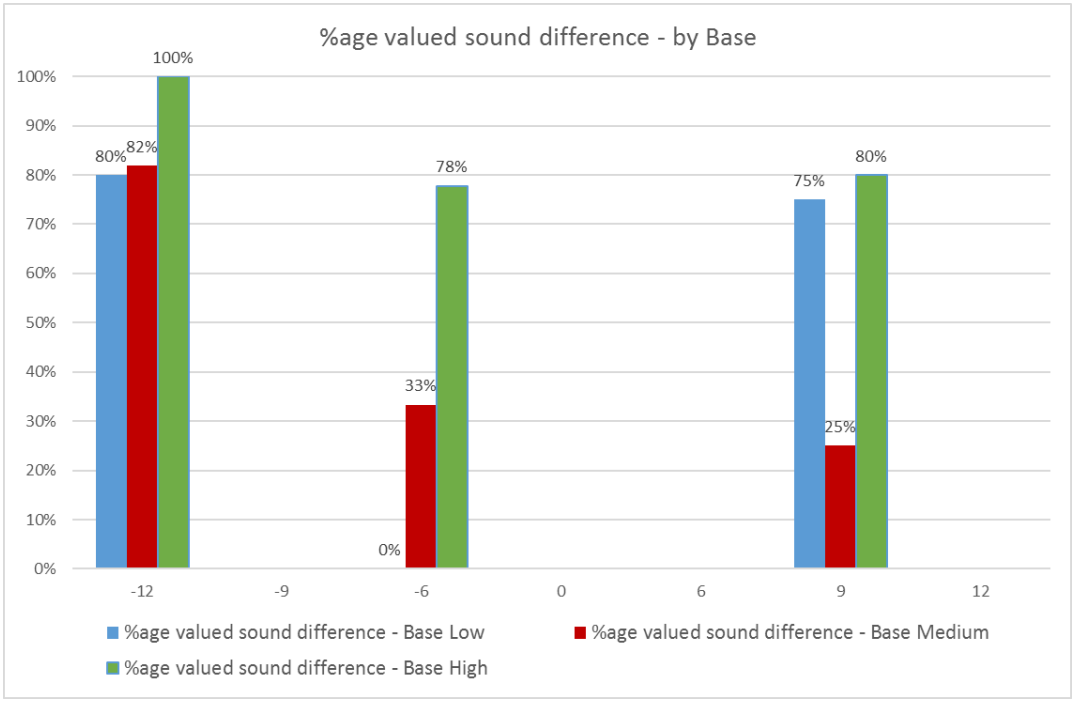


Figure 16. Valued Difference Results – by Base

4.3.2 Segmenting the data by arrivals/departures showed little difference.

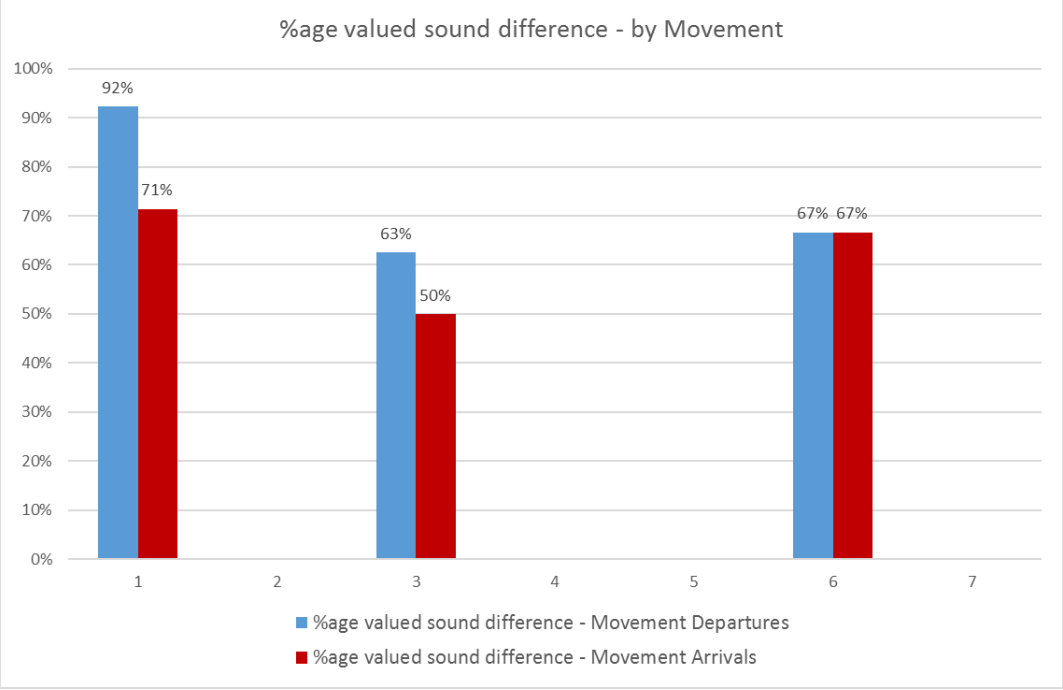


Figure 17. Valued Difference Results – by Arrivals/Departures

5. RESULTS – MONETARY VALUE OF RESPITE BY TIME OF DAY

5.1 The Value of Noise Respite (-10 dB) at Different Times of Day

5.1.1 In this section we report findings for the following research questions:

- A qualitative valuation for a period of (10 dB) quieter aircraft;
- the time periods that are most sensitive to residents and, thus, when they would most value periods of respite;
- monetary estimates of the value residents attach to a defined reduction of aircraft noise at different times of day; and
- whether continuous alternation is, or is not, preferred over periods of respite and periods of noisier aircraft.

5.1.2 Each is reported in turn, with a base sample of 124 respondents. The results in this chapter are derived from analysis of the Field phase of research.

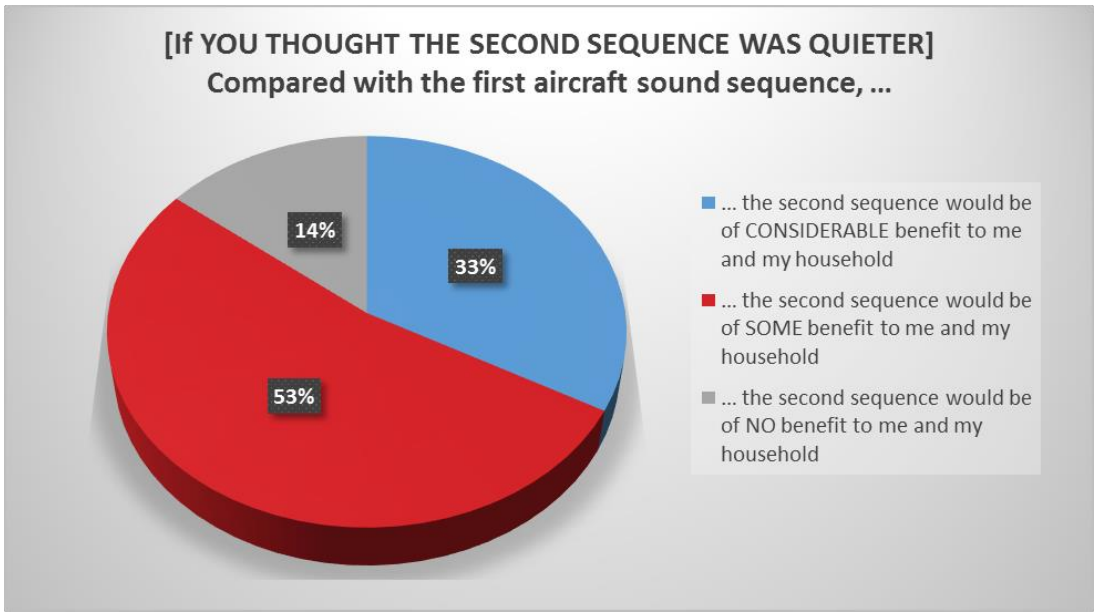
Qualitative Valuation of 10 dB Quieter Aircraft Noise

5.1.3 The results reported in this chapter are based on analysis of responses obtained from the field phase. The results can therefore be considered to be broadly representative of the populations who live in the four areas we have surveyed.

5.1.4 All respondents were asked to consider two sequences of aircraft whereby the second sequence was precisely 10 dB quieter than the first. Those respondents [N=110] who confirmed that they thought the second sequence was quieter, were asked which of three statements best reflected their view of the two sequences for them and their household:

- the second sequence would be of CONSIDERABLE benefit to me and my household;
- the second sequence would be of SOME benefit to me and my household; and
- the second sequence would be of NO benefit to me and my household.

5.1.5 Just over half (53%) of respondents thought that a 10 dB reduction of all aircraft noise would be of 'some' benefit to them and their household; and a further one-third (33%) thought that a 10 dB reduction of all aircraft noise would be of 'considerable' benefit to them and their household.



Base = 110

Figure 18. Residents' Perceptions of the Effect on Household of a 10 dB Reduction in Aircraft Noise

Preferred Times of Day for Noise Respite

5.1.6 The profile of preferred quieter periods (for each hour of the operational day) is presented in Figure 19. The vertical axis shows the percentage of respondents who considered that a given hour should be one of the 8 quieter hours.

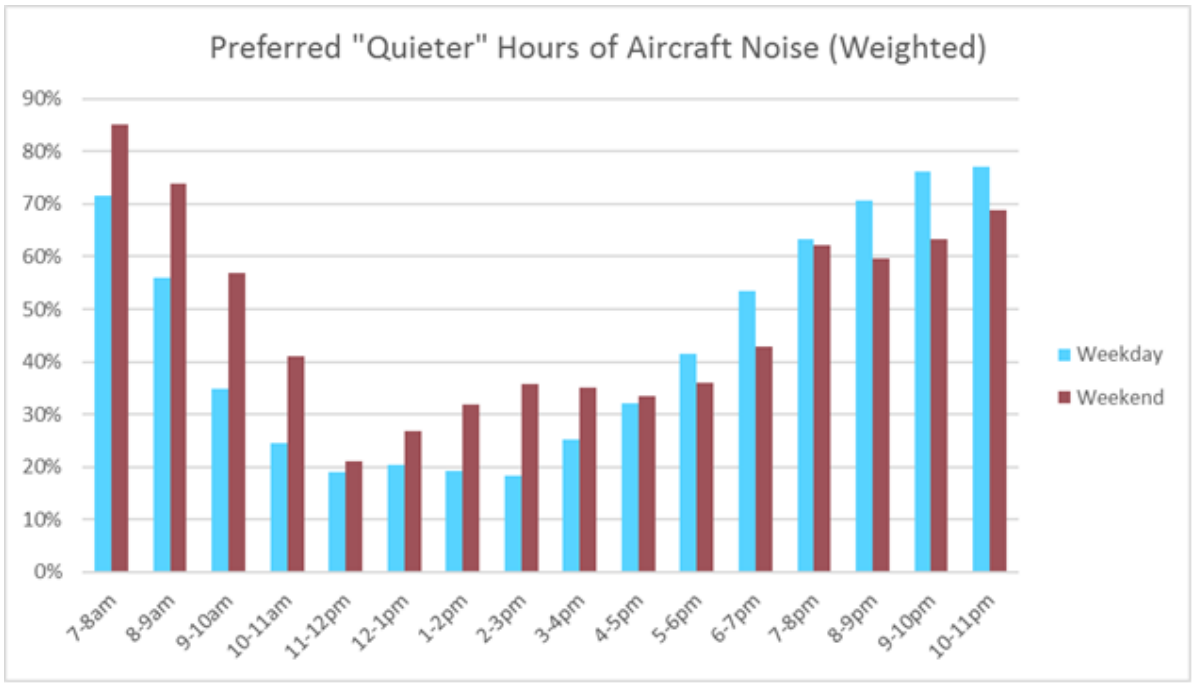


Figure 19. Preferred Time of Day for Noise Respite

5.1.7 Respondents were given 16 hourly slices of the operational day (from 7am to 11pm) and asked to identify the eight hours of the day when they would most prefer to have quieter periods. [They did not have to be consecutive hours].For both the weekday and weekend, the mornings and late evenings are the most sensitive times of the day. This is expected for weekdays, when many household members are not at home (and thus exposed to the aircraft noise) during the main part of the day. The fact that this is the case for weekends may come as a surprise, but these results chime with qualitative findings that highlighted that mornings and evenings are the times of day when (aircraft) noise seems most obtrusive and when peace and quiet is most sought – for example, because people want the chance of a lie-in at the weekend.

"I'm a working person, so if [the noise] could be all in the daytime I'd say yes please… but I do understand that there are people at home… but then I'd say that evenings and night times are usually the times when everyone wants to relax, so if we can have complete quiet around that time, and all the activities during the day, because usually during the day people are busy doing something or other, so they might not even notice" [female, aged 34, social grade B]

5.1.8 The activities that respondents find are most adversely affected by (aircraft) noise are listed in descending order in Figure 20 (note only the first activity listed has been coded and quantitatively analysed). More than one-third of respondents perceive that they have their sleep affected by aircraft noise; whilst one-quarter identified watching TV or listening to music as being the activity that is most adversely affected by aircraft noise.

"When you are sleeping, or doing outdoor activities like gardening or having a barbeque, those are activities which would benefit because they are activities where you are interacting, trying to have a conversation with someone, so a loud noise might ruin it" [female, aged 31, social grade C2]

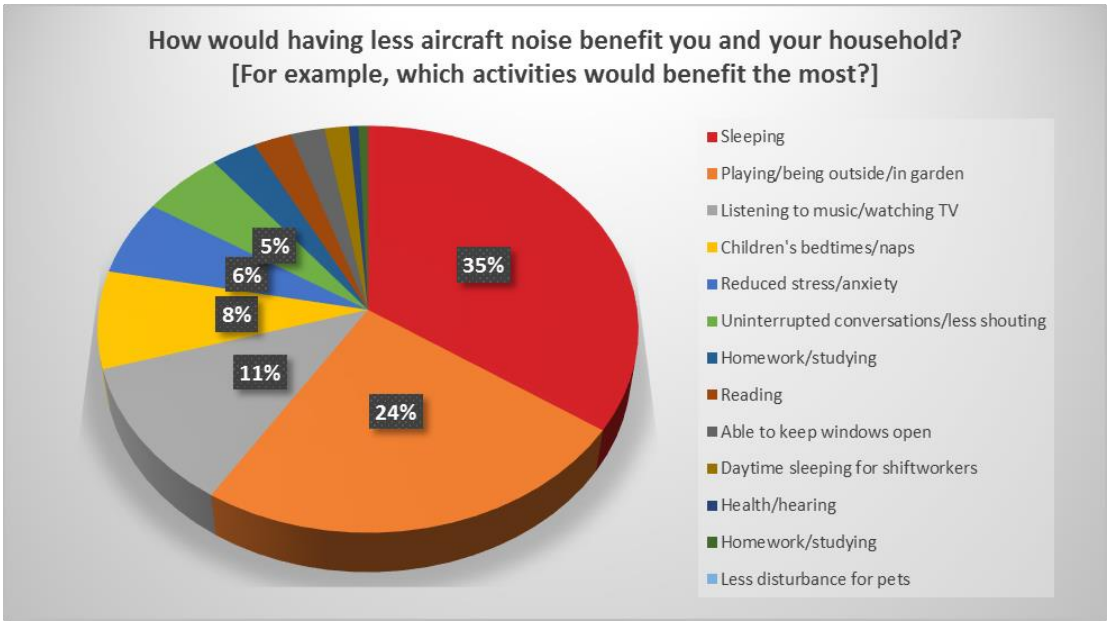


Figure 20. Household Activities Affected Most by Aircraft Noise

The Value of Noise Respite at different times of day

5.1.9 Respondents were asked to consider two aircraft noise sequences – where each aircraft within the second sequence was precisely 10 dB quieter than the corresponding aircraft in the first sequence. This 'quieter' and 'louder' sequences were included as variables to describe different noise environments, within a stated preference (SP) exercise. The exercise involved asking respondents to choose their preferred option from a choice-set of four options, with each describing a different noise environment [different times of day when there would be noise respite], and an annual council tax charge [which varied across the options].

5.1.10 The results of the SP ranking exercises are reported in Table 1. The sign of each relative coefficient (one per component of the noise environment, and money) indicates whether the defined change (e.g. per £1 saving in council tax, or change from being 'Quieter 7am-3pm + Noisier 3pm-11pm' to 'Quieter route 7am-11am & 7pm - 11pm + Noisier route 11am-7pm') is positive or negative. The size of each relative coefficient indicates the extent of benefit/disbenefit that applies to each variable/defined change.

5.1.11 The monetary value is derived by dividing the coefficient for having quieter periods at the ends of the operational day (i.e. the relative weight given to having the preferred time of day for respite, 1.050) by the cost coefficient (i.e. the relative weight given to having an extra £1 saving off their Council Tax, 0.003) = +£307 per annum, per household.

5.1.12 It should be noted that the whole sample completed the SP exercise to evaluate respite periods during the weekday; whilst (only) half the sample completed the SP exercise to evaluate respite periods at the weekend and (the other) half completed the SP exercise to evaluate continuous alternation.

Table 1. Residents' Noise Respite Valuations

VARIABLE	RELATIVE COEFFICIENT	T-STATISTIC	MONETARY VALUES
Weekday:			
Saving in council tax [£ p.a. per HH]	0.003	+12.4	-
[Weekday] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Quieter route 7am-11am & 7pm - 11pm + Noisier route 11am-7pm	1.050	+7.7	+£307 p.a.
[Weekday] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Noisier route 7am-11am & 7pm - 11pm + Quieter route 11am-7pm	-0.613	-4.0	-£179 p.a.
[Weekday] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Continuous Alternation between 7am and 11pm	-1.330	-3.4	-£389 p.a.
Weekend:			
[Weekend] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Quieter route 7am-11am & 7pm - 11pm + Noisier route 11am -7pm	0.548	+3.7	+£160 p.a.
[Weekend] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Noisier route 7am-11am & 7pm - 11pm + Quieter route 11am -7pm	*-0.262*	*0.14*	*insignificant*
			Sample Base = 99
			Observations = 1284
			Rho bar squared = 0.12

5.1.13 The above results indicate that, on average, respondents place a significant value – more than £300 a year – to having noise respite [of -10 dB] at their preferred times (i.e. the first and last four hours of the operational day) on every weekday compared with having the respite always between 7am – 3pm.

5.1.14 In contrast, respondents negatively value, at circa -£180 p.a., having respite during the middle of the weekday and always having it louder during the first and last four hours of the operational day, compared with having the respite always between 7am – 3pm.

5.1.15 At the weekend, respondents would assign a significant value – circa £160 a year – to having noise respite [of -10 dB] at their preferred times on every Saturday and Sunday, compared with having the respite always between 7am – 3pm OR having the respite always between 11am – 7pm on Saturdays and Sundays.

5.1.16 Continuous alternation between the near and far routes is perceived to be significantly worse than having the respite always between 7am – 3pm.

5.2 Variations in Value of Noise Respite by Segment

5.2.1 In this section, we explore respondents' value of respite by time of day for different resident types, by keeping the noise coefficients constant; and testing for differences in the cost coefficient for different segments. Segmentations tested includes: gender, age, socio-economic group (SEG), working status, arrivals/departures and sites. Only two stratifications led to statistically significant differences between segments – SEG and site.

5.2.2 The valuations by high and medium/low SEG are reported in Table 2. Respondents in higher socio-economic groups assign a greater monetary value to having respite at either end of the operational day (between 7am – 11am and between 7pm – 11pm) compared with other residents, in line with likely increased disposable income and, thus, affordability.

Table 2. Noise Respite Valuations by Socio-economic group

VARIABLE	OVERALL	HIGH SEG [A/B]	MEDIUM/LOW SEG [C/D/E]
[Weekday] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Quieter route 7am-11am & 7pm - 11pm + Noisier route 11am-7pm	+£307 p.a.	+£453 p.a.	+£299 p.a.
[Weekday] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Noisier route 7am-11am & 7pm - 11pm + Quieter route 11am-7pm	-£179 p.a.	-£264 p.a.	-£175 p.a.
[Weekday] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Continuous Alternation between 7am and 11pm	-£389 p.a.	-£573 p.a.	-£379 p.a.
[Weekend] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Quieter route 7am-11am & 7pm - 11pm + Noisier route 11am -7pm	+£160 p.a.	+£236 p.a.	+£156 p.a.
[Weekend] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Noisier route 7am-11am & 7pm - 11pm + Quieter route 11am -7pm	*insignificant*	-£113 p.a.	-£75 p.a.

5.2.3 The valuations by residents of Kew, compared with all other residents, are reported in Table 3[4]. Respondents in Kew assign a greater monetary value to having respite at the beginning and end of the operational day, compared with other residents. This is likely to reflect the relative affluence of Kew residents, and thus is an overlap with the findings in Table 2.

Table 3. Noise Respite Valuations by Area

VARIABLE	OVERALL	KEW	OTHER RESIDENTS
[Weekday] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Quieter route 7am-11am & 7pm - 11pm + Noisier route 11am-7pm	+£307 p.a.	+£438 p.a.	+£307 p.a.
[Weekday] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Noisier route 7am-11am & 7pm - 11pm + Quieter route 11am-7pm	-£179 p.a.	-£222 p.a.	-£156 p.a.
[Weekday] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Continuous Alternation between 7am and 11pm	-£389 p.a.	-£496 p.a.	-£348 p.a.
[Weekend] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Quieter route 7am-11am & 7pm - 11pm + Noisier route 11am -7pm	+£160 p.a.	+£213 p.a.	+£149 p.a.
[Weekend] Quieter 7am-3pm + Noisier 3pm-11pm ➔ Noisier route 7am-11am & 7pm - 11pm + Quieter route 11am -7pm	*insignificant*	*insignificant*	*insignificant*

5.2.4 No other customer segmentation led to statistically significant results, but this may be due to the relatively modest overall sample size.

[4] We analysed the results segmenting by all areas, and the only significant difference in values by location was found to be amongst Kew residents compared with all other residents

6. OTHER RESEARCH FINDINGS

Residents' Perceptions of 2-3 dB Quieter Aircraft Noise

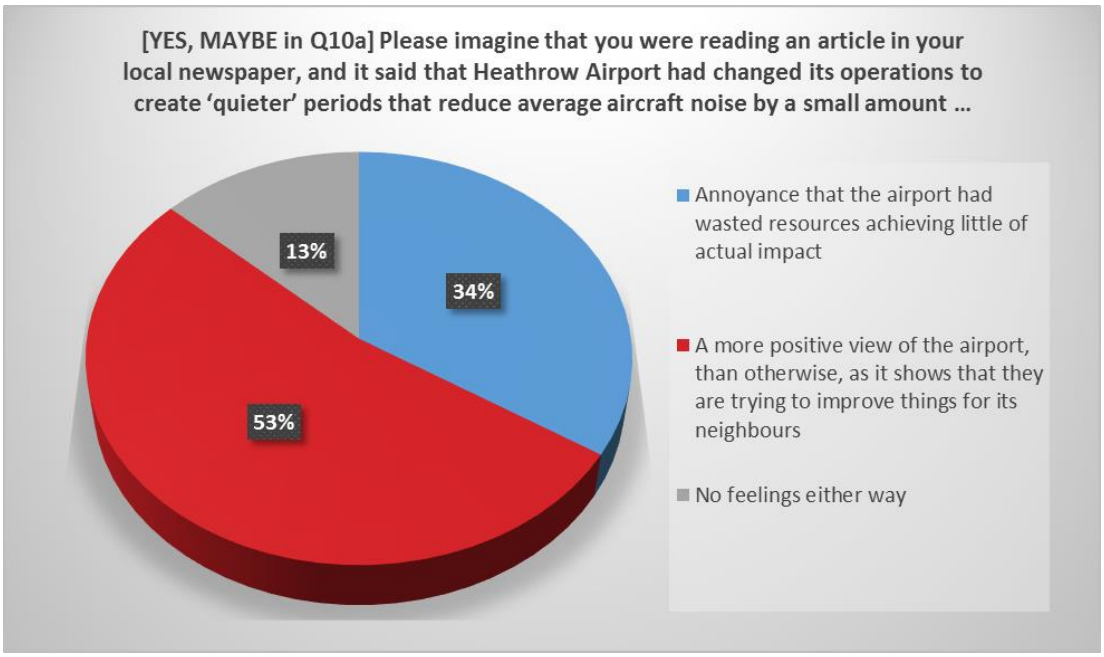
6.1.1 Those respondents who indicated an interest in knowing the timing of Heathrow's controlled quieter periods, were asked for their opinion on a situation where aircraft noise was 2-3 dB quieter than now:

> *"Please imagine that you were reading an article in your local newspaper, and it said that Heathrow Airport Ltd had changed its operations to create 'quieter' periods that reduce average aircraft noise by a small amount (e.g. only 2-3 decibels, which is much less than the 10 decibel difference which we demonstrated in Q4 a few minutes ago) – and which our research suggests that most people might not find particularly noticeable. Which one of these general sentiments do you think you would feel?"*

6.1.2 Respondents were asked which of three general sentiments would best reflect their likely feelings:

- Annoyance that the airport had wasted resources achieving little of actual impact;
- A more positive view of the airport, than otherwise, as it shows that they are trying to improve things for its neighbours; and
- No feelings either way.

6.1.3 The results are reported in Figure 21. Again, just over half of respondents (53%) felt it would give them a more positive view of HAL despite the noise reduction being insufficient to be noticed by most people.



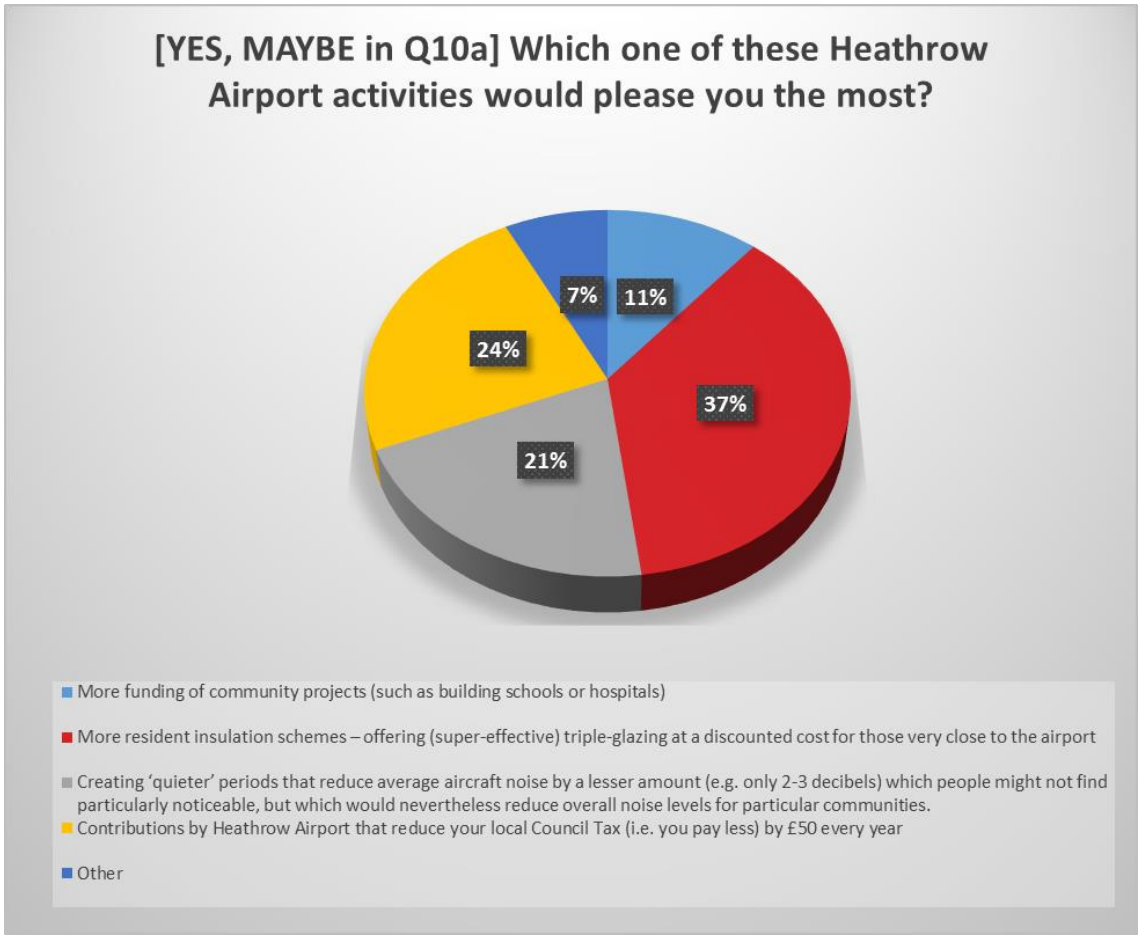
Base = 103

Figure 21. Residents' Perceptions of a 2-3 dB Reduction in Aircraft Noise

6.1.4 Respondents were then asked which one of four HAL activities [plus anything the respondent preferred Heathrow to do] they would most prefer to happen. The four options were:

- More funding of community projects (such as building schools or hospitals);
- More resident insulation schemes – offering (super-effective) triple-glazing at a discounted cost for those very close to the airport;
- Creating 'quieter' periods that reduce average aircraft noise by a lesser amount (e.g. only 2-3 decibels) which people might not find particularly noticeable, but which would nevertheless reduce overall noise levels for particular communities; and
- Contributions by HAL that reduce your local Council Tax (i.e. you pay less) by £50 every year.

6.1.5 The results were quite mixed, as reported in Figure 22.



Base = 103

Figure 22. Residents' Perceptions of a 2-3 dB Reduction in Aircraft Noise

6.1.6 Of the four prompted options, the most preferred was to have more resident insulation schemes (37%), followed by contributions to reduce their Council Tax by £50 p.a. (24%). Creating quiet periods of 2-3 dB which might not be particularly

noticeable was preferred by just over one in five respondents (21%), with just over one in ten residents (11%) most preferring investment in new local community projects.

6.1.7 Around one in four respondents chose to provide additional comments on aircraft noise (which is constructive in its own right of course, but also demonstrates that respondents were still interested and willing to contribute to the survey even when they were free to depart). The most frequent comments, in descending order, were:

- Statements regarding how annoying aircraft noise is (especially in the Spring and Summer);
- Support for more research into aircraft noise (including technology to make aircraft quieter);
- Support for more information to the public;
- Consideration of air pollution as well as noise pollution; and
- Heathrow should particularly focus on the noise impacts on local schools.

6.2 Influences on Attitudes to Noise and Noise Respite

Community Annoyance with aircraft Noise

6.2.1 Almost two in every five respondents (39%) were very or extremely annoyed by aircraft noise, according to their response to the Standard ISO question that asks them to think about the past year. In contrast, one in four respondents reported being either slightly or not at all annoyed.

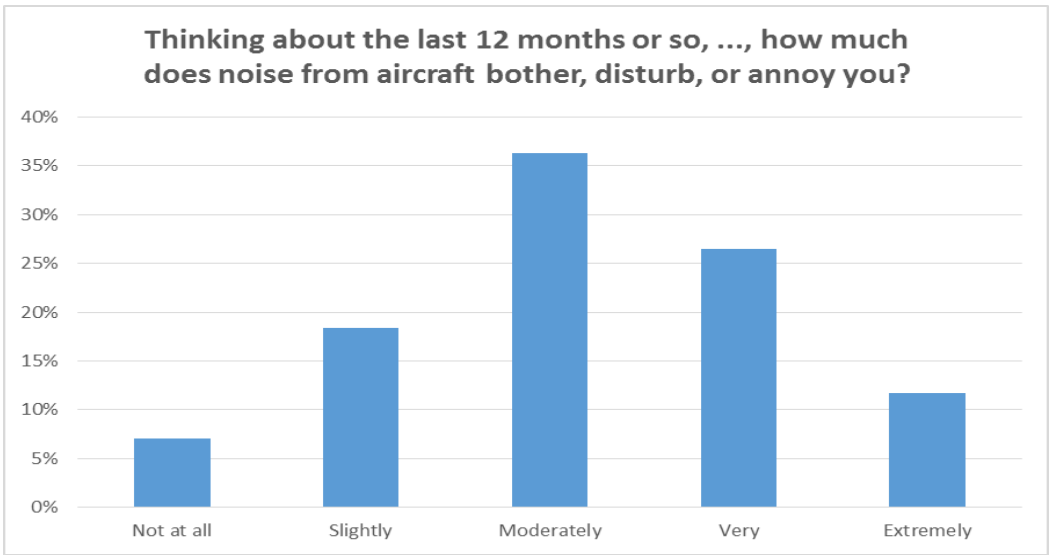


Figure 23. Residents' Attitudes to Aircraft Noise

Influence on Time of Day Sensitivities

6.2.2 Respondents were asked:

> *"Overall, how much do you think your judgements about time of day preferences for 'quieter' periods were influenced by the times of day <u>when you and/or your household</u> are usually at home?"*

6.2.3 The results are reported in Table 4, and indicate that when people are at home affects most residents' preferences for quiet periods (81%), but not everybody.

Table 4. Influence on Time of Day Respite Preferences

Overall, how much do you think your judgements about time of day preferences for 'quieter' periods were influenced by the times of day when you and/or your household are usually at home?	TOTAL
Very influenced by times when usually (or not) at home	62%
A bit influenced by times when usually (or not) at home	19%
Not at all influenced by this / We're at home most times	19%
Total	100%
Base Size	105
Prefer not to say	19

Influence on Sensitivity to Aircraft Noise

6.2.4 Other factors that may have had an impact on respondents' attitudes and values in relation to aircraft noise respite are provided in Tables 5-8.

Table 5. Double-Glazing in the Home

Do you have double-glazing in your home?	TOTAL
Yes in all rooms	82%
Yes in some rooms	10%
No	8%
Total	100%
Base Size	120
Prefer not to say	4

Table 6. Number of Years close to Heathrow

For how many years have you lived close to Heathrow or close to a flight-path?	TOTAL
Less than a year	10%
More than 1 year, but less than 4 years	6%
More than 4 years, but less than 11 years	10%
More than 11 years, but less than 20 years	22%
More than 20 years	53%
Total	47%
Base Size	120
Prefer not to say	4

Table 7. Whether work at Heathrow

Do you, or a family member work at Heathrow?	TOTAL
Yes	20%
No	80%
Total	100%
Base Size	120
Prefer not to say	4

Table 8. Whether use Heathrow for Air travel

Do you, or other household members, ever use Heathrow?	TOTAL
Yes, several times a year	37%
Yes, once a year or so	34%
Yes, but seldom	24%
No, never	6%
Total	100%
Base Size	120
Prefer not to say	4

6.2.5 Overall, the vast majority (92%) of respondents in the study areas have at least some double-glazing; have lived close to Heathrow for more than 11 years (75%) – though not necessarily in the same house for all those years; and/or use Heathrow at least once a year for air travel (71%) indicating strong signs of broad tolerance to living close to the airport. Most respondents (80%) do not have a family member who actually works at the airport.

7. CONCLUSIONS

7.1 Discernible differences - SoundLab

Main finding

7.1.1 While some correct responses were obtained for 3 dB differences between the test sounds of each pair, larger differences (6 dB and 9 dB) were required for statistically reliable discrimination. Discrimination was not perfect (i.e. less than 100%) even at 9 dB difference. In practical terms, the results suggest that 5 to 6 dB differences between successive sounds would be required for reliable discrimination between the first and second sounds of a pair of sounds differing only in sound level, and auditioned under active listening conditions.

Secondary findings

7.1.2 On average, and across the whole sample, the most recently heard sound appears to be the equivalent of around 2 dB louder than the first sound. This difference is a perceptual memory effect and applied even where the two sounds were exactly the same. It may need to be taken into account in the design of any future comparison studies, and may help to explain why people in general often notice, or appear to notice, increases in noise, but not equivalent decreases.

7.1.3 Segmentation of the overall sample revealed some suggestions of possible differences in discernibility between different base levels, but overall variances were too high to be able to draw any definitive conclusions on this point. Marginal differences were also observed between response charts for other segmentations, such as aircraft type (A380 vs A320), arrivals vs. departures, and base sound level, but none of these differences had statistical significance and may have arisen purely through chance variance.

7.2 Valued differences - SoundLab

Main finding

7.2.1 Representative sequences of sounds were judged to provide a 'valuable (or a complete) break from aircraft noise' by 60% of the sample when the sound level difference between the two sequences was minus 6 dB (second sequence 6 dB quieter); by 65% of the sample when the sound level difference between the two sequences was plus 9 dB (first sequence 9 dB quieter); and by 85% of the sample when the sound level difference between the two sequences was minus 12 dB (first sequence 12 dB quieter).

Secondary findings

7.2.2 On average, it appears that to be judged as 'valued', sound level differences between sequences need to be at least as large and probably larger [7-8 dB] than the sound level differences between separate events to be discernible. Noting that the overall duration of the two sequences as heard in the SoundLab was only around 15 minutes - and taking into account that, under real-life conditions,

changes in aircraft noise sound levels mostly take place over very much longer time scales – we remain some way away from understanding how attitudes would change in response to long term average changes.

7.2.3 Further segmentation of the sample did not expose any interesting findings or suggestions in terms of 'valued' differences, but it should be noted that the sample sizes within each segmented group were insufficient to be able to obtain sufficient statistical power to be able to demonstrate anything but the strongest effects.

Time of day preferences - Field data

7.2.4 After listening to a demonstration of 10 dB sound level differences between representative sequences, the preferred daytime (0700 to 2300 hrs) 'quieter hours' were mornings (0700 to 1100 hrs) and evenings (1900 to 2300 hrs) for both weekdays and weekends; with additional preferences for mornings over afternoons at weekends.

Activities that benefit the most from respite - Field data

7.2.5 After listening to a demonstration of 10 dB sound level differences between representative sequences, the (daytime) activities that were reported as likely to benefit the most were: sleeping (35%), playing/being outside in the garden (24%), listening to music/watching TV (11%), children's bedtime/naps (6%), and uninterrupted conversation/less shouting (5%).

7.3 Valued differences - Field data

Main finding

7.3.1 The difference between two representative sequences of sounds was judged to be of 'some benefit' by 53% of the sample and of 'considerable benefit' by 33% of the sample when the sound level difference between the two sequences was minus 10 dB (second sequence 10 dB quieter). However, the difference between the two sequences was judged to be of 'no benefit' by 14%.

Secondary findings

7.3.2 Participants were also asked about their likely feelings if the airport was able to provide only 2-3 dB sound level difference, which would not be enough to be particularly noticeable (if at all). 13% had no feelings either way, 53% reported that they would have a more positive view of the airport, and 34% reported that they would be annoyed that the airport had wasted resources achieving little of actual impact. These responses can be compared against the 21% who reported that they would be pleased to learn that Heathrow had provided 2-3 dB quieter periods; and the 61% who would be pleased to learn that Heathrow had increased funding for community projects and/or provided enhanced insulation schemes.

7.4 SP valuations, Field data - daytime (0700 to 2300hrs)

Main findings

7.4.1 After listening to a demonstration of 10 dB sound level differences between representative sequences, participants rank-ordered a set of nine cards stating different combinations of daytime respite periods and monetary value in terms of council tax payments both higher and lower than their current payments. On average, participants valued having weekday respite periods from 0700 to 1100 hrs (mornings) and 1900 to 2300 hrs (evenings) at £307 per household per annum over having respite periods from 0700 to 1500 hrs (half-days). On average, participants valued having weekday respite periods from 1100 to 1900 hrs (mid-day and afternoons) at minus £179 per household per annum (i.e. a disbenefit) over having respite periods from 0700 to 1500 hrs (half-days).

7.4.2 On average, participants valued having weekend respite periods from 0700 to 1100 hrs (mornings) and 1900 to 2300 hrs (evenings) at £160 per household per annum over having respite periods from 0700 to 1500 hrs (half-days). The monetary values for having weekend respite periods from 1100 to 1900 hrs (mid-day and evenings) over having respite periods from 0700 to 1500 hrs (half-days) were not statistically significant -although the average of the separate values for socio-economic groups A and B was statistically significant, at around minus £100 per household per annum. In general, segmentation between higher and lower socio-economic groups showed that wealthier participants tended to report higher monetary values.

7.4.3 An alternative respite scheme defined as continuous alternation was tested on half of the sample. In continuous alternation, respite is provided by diverting every other flyover event onto an alternative and quieter route. For this simulation, the quieter route was represented by a 20 dB sound level difference, such that the frequency of '*noisy*' overflights was halved, leading to bigger time gaps between each '*noisy'* overflight and an overall reduction in LA_{eq} of 3 dB. This option was not preferred and was given an average value of minus £389 per household per annum compared to the experimental standard respite period from 0700 to 1500 hrs (half-days).

General findings

7.4.4 The pair-comparison test procedures in SoundLab appeared to work well in terms of engaging the participants in active listening, as did the audio simulations used in the Field tests. Where comparable, data obtained in the SoundLab and in the Field tests appeared to be generally consistent. The SP valuations for respite simulated at 10 dB sound level difference between representative sequences were statistically significant and would aggregate to considerable amounts if added up across all affected households in the areas around Heathrow.

Implications for respite policy

7.4.5 Residents are unlikely to notice or appreciate small dB reductions in average sound level, particularly against the context of typical day-to-day variation, and if any

such changes take place over a long time. Within this limitation, residents are more likely to notice increases in noise than equivalent decreases. For many residents, non-acoustic factors, such as effective public engagement, trust and understanding could be at least as important as actual sound level differences in terms of their reaction to a noise respite policy. The noise sharing principle implicit in alternation is worthy of further investigation.

7.4.6 The sample sizes obtained in this study are relatively modest and the confidence intervals around many of the findings are quite wide. If there is a need to obtain more precise estimates of thresholds and/or values, then it would be reasonably easy to roll-out the research design to new sample sites. On the other hand, these results - albeit based on modest sample sizes - appear to be generally consistent with both established theory and with recent qualitative (open ended in-depth interview) research carried out in areas around Heathrow[5]. If consideration was given to extending the research, it may be more constructive to widen the research objectives to include the possible contributions to attitudes and perceptions made by non-acoustic factors (such as the effectiveness of public engagement) in conjunction with average dB reductions.

[5] *"DOKEN Trials - Impact of Precise Navigation Flight-Paths on Overflown Residents"*, Heathrow Airport Ltd, by SYSTRA, Ian Flindell & Associates and Manchester Metropolitan University (September, 2014)

Appendix A – Quantitative Survey ['Field'] Materials

Sound Test Recruitment

Good morning/afternoon/evening. I'm working on behalf of independent research agency, Protel fieldwork, recruiting residents of Dedworth who live under, or close to, the Heathrow flight-paths to gather views on aircraft noise.

We are looking for people who live in this area to take part in a group discussion on 1st November at the Royal Windsor Racecourse, Maidenhead Road, Windsor, Berkshire, SL4 5JJ in the Paddock Pavilion. This will involve listening to different aircraft sounds and you telling us what you think!

We would really appreciate the opportunity to meet with you and hear your views. The sessions will last 35 minutes and you would receive £25 as a thank you for your time.

Does this sound like something you would be interested in?

Is it OK to ask you a few questions to establish whether we are able to invite you to participate in this group?

[IF ASKED, the research is being conducted on behalf of Heathrow Airport Limited. IF FURTHER REASSURANCE REQUIRED: All views will be treated in confidence, and in accordance with the Market Research Code of Conduct and Data Protection Act].

Q1.

Could I confirm you live in *Dedworth or nearby either underneath or off to one side of an aircraft flight-path*? [IF ASKED; WE HAVE BEEN ASKED TO RECRUIT VOLUNTEERS FROM A RANGE OF AREAS EITHER UNDERNEATH OR OFF TO ONE SIDE OF FLIGHT PATHS].

Yes	1
No	2

(IF NO THANK AND CLOSE)

Q2

Could you please confirm your full postcode?

Gender – recruiter auto code

Male	1
Female	2

(AIM FOR MIX)

Q3

Could I ask for your age on your last birthday?

(AIM FOR MIX OF AGES)

Q3b

Would you describe yourself as having hearing difficulties?

Yes	1
No	2

（IF YES THANK AND CLOSE: Thank you for your interest in this research, however we are currently only recruiting those who do not class themselves as having hearing difficulties because the research involves listening to different aircraft sounds.）

Q4

Please could I ask for your current occupation?

（Recruiter to code）

AB	1
C1	2
C2	3
DE	4

Please could you confirm if you would BE available to help us by visiting the Royal Windsor Racecourse, Maidenhead Road, Windsor, Berkshire, SL4 5JJ in the Paddock Pavilion on November 1st in any of the following time slots?

November 1st	3pm	
November 1st	4:30pm	
November 1st	6:30pm	

（IF NONE THANK AND CLOSE）

IF WILLING:

NAME: _____

ADDRESS:

_____

_____

_____

_____

TEL: _____

Valuing Noise Respite: Hounslow

INTRODUCTION

- Introduce team
- Explain 'independent researcher' status. Please turn off phones, or put on 'silent'.
- Explain "rules" (no right or wrong answers, anonymity etc.) adhering to the code of conduct of the Market Research Society and Data Protection Act.
- SYSTRA has been commissioned by Heathrow Airport Ltd to undertake this research for them. The research will be used to help the airport understand how changing their operations may affect communities living close to the airport.
- This project is just relating to aircraft sounds between the time period of **7am and 11pm**. Heathrow Airport understands that aircraft sound during the night period is very important to residents, however this research only refers to the 16 hour day period.

Please put the date & session time on the front sheet of your questionnaire, and then complete the questions on the front page only.

I would then like us all to go through the next sections of the questionnaire together, when everyone is ready.

When everyone is ready: please turn over, for the first sound exercise.

Section 2: Valued Quiet Periods

We will play you a sequence of 6 aircraft taking off from Heathrow. Depending on whether there are easterly or westerly winds, the runways aircraft use for taking off and landing vary. Therefore, the aircraft sounds may vary from what you are used to when you are, for example, standing outside your house. The aircraft we will play you will vary in type and be typical of the variation in aircraft at Heathrow. The aircraft sounds will occur every 60 seconds or so for 6 minutes.

(IF ASKED – 6 aircraft in 6 minutes is more frequent than actually occurs at any airport, and is done for research purposes to avoid having to keep you here any longer than necessary).

We will then play you a second sequence of 6 aircraft over 6 minutes. These will be of the same types of aircraft but travelling along a route further away, *so will be quieter*. We would like to know whether you think the second noise environment is noticeably quieter or not; and, if so, whether you think the quieter environment would of significant benefit to you?

[AFTER BOTH SEQUENCES HAVE BEEN PLAYED]

Q4. Did you notice that the second sequence was quieter than the first?

[If YES]

Q5. Which, of the following three judgements, best reflects your personal view of the difference between the two sequences, <u>if</u> they were to fly like this throughout the operational day?

Q6a. If you could decide which hours of the day, aircraft use the more distant route, and the hours of the day when aircraft use the near route – **which hours would you choose?**

Please first consider WEEKDAYS. You can choose any particular hours that you like – they do not have to be sequential, but you cannot have more than 8.

Please tick exactly 8 boxes.

Q6b. How would having less aircraft noise benefit you and your household? [For example, which activities would particularly benefit quiet?]

_____

Once you have answered Q6b, please wait before we continue.

Section 3: Valuing Quiet Periods by Time of Day [DURING THE WEEK] – 1st SP Exercise

I would like you to consider NINE different options that describe when and where aircraft would fly in relation to your residential area every WEEK day (i.e. Monday to Friday). Aircraft noise at the weekends would remain as now. Each is described in terms of:

- Route used – the 'noisier route' would be like you heard for the first sequence; the 'quieter route' would be like you heard for the second sequence – which was 10 dB quieter.
- the time of day when each route is used; and
- the amount of council tax you pay – which may go up or down compared with now, depending upon future airport contributions to Local Authority expenditure and revenues (such as that received from the airport in the form of business rates and environmental considerations).

[HAND OUT THE NINE SP CARDS – BLUE (WEEKDAY)]

Q7a. Please look at these nine options [SP EXERCISE] and rank them in order of preference for you and your household.

You may find it easiest to sort in to 'most preferred' and 'least preferred' groups; and then rank within each group]. [CHECK RANK ORDER]

If Questionnaire A: If you are laying the cards out on the table, leave then in this order as we will be presenting you with additional options next.

QUESTIONNAIRE A

Section 4a: Valuing Continuous Alternation – 2nd SP Exercise

We have been considering defined blocks of aircraft using the 'quieter' route, and defined blocks of aircraft using the 'noisier' route. Another option would be to have **continuous alternation** between the noisier and quieter routes throughout the 16-hour operational day. This would increase the time intervals between the noisier aircraft to approximately 180 seconds [i.e. every 3 minutes] but throughout the whole period.

We will now play you a third sequence of 6 aircraft over 6 minutes. These will be of the same types of aircraft alternating between *quieter* and *noisier* routes. It is therefore a mix of the two sequences you have heard previously.

[AFTER THIRD SEQUENCE HAS BEEN PLAYED – HAND (GREEN) OPTION X TO EACH RESPONDENT]

Q8a.
Please consider this additional option [OPTION X] – which, rather than have blocks of 'noisier' and 'quieter' periods, would alternate continuously throughout the 16 hour operational day. Please insert it within your current ordering of preferred (blue) options for a WEEKDAY – so, if you think it better than all the nine previously ranked options then you would place it first; and if you think it worse than all the nine previously ranked options then you would place it tenth.

Position of (Green) Option X: _____ [from 1st to 10th]

Q8b.
Now please consider where you would rank Options Y and Z – which are the same as Option X but with different money implications. [HAND OUT OPTIONS Y & Z]

Position of (Green) Options Y & Z: _____ [from 1st to 12th]

Q9. If you could decide which hours of the WEEKEND, aircraft use the more distant route, and when aircraft use the near route – which hours would you choose? Please tick exactly 8 boxes.

Q10a. Would it be useful to you to know when the airport's managed 'quieter' periods are for your area?

If you answer 'Yes' or 'Maybe', please continue with Q10b, and then complete the rest of the survey at your own pace. If your answer is 'No', please skip to Q11a in the Demographics section and then complete the rest of the questionnaire at your own pace.

QUESTIONNAIRE B

Q7b. ***When would you choose to have the 8 'quieter' hours <u>at weekends</u>? Please tick exactly 8 boxes.***

Section 4b: Valuing Respite (WEEKEND) – 3rd SP Exercise

Still thinking about weekends, I would like you to consider these NINE different options that describe when and where aircraft would fly in relation to your residential area - but <u>at the weekend</u>. (Aircraft noise during the week would remain as now). As before, each is described in terms of:

- Route used – the 'noisier route' would be like you heard for the <u>first</u> sequence; the 'quieter route' would be like you heard for the <u>second</u> sequence.
- the time of day when each route is used; and
- the amount of council tax you pay.

[HAND OUT THE NINE PINK SP CARDS]

Q9. Please rank the NINE options in order of preference for you and your household.

[CHECK RANK ORDER]

Q10a. Would it be useful to you to know when the airport's managed 'quieter' periods are for your area?

If you answer 'Yes' or 'Maybe', please continue with Q10b, and then complete the rest of the survey at your own pace.

If your answer is 'No', please skip to Q11a in the Demographics section and then complete the rest of the questionnaire at your own pace.

Section 5: Demographics

Block 1: Pages 1-3

Option A

7am – 11am [4 hrs]:
Quieter Route

11am – 7pm [8 hrs]:
Noisier Route

7pm – 11pm [4 hrs]:
Quieter Route

Council Tax (annual):
You pay
£300 less *than now*

Option B

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
£300 less *than now*

Option C

7am – 11am [4 hrs]:
Quieter Route

11am – 7pm [8 hrs]:
Noisier Route

7pm – 11pm [4 hrs]:
Quieter Route

Council Tax (annual):
You pay
£25 less *than now*

Option D

7am – 11am [4 hrs]:
Quieter Route

11am – 7pm [8 hrs]:
Noisier Route

7pm – 11pm [4 hrs]:
Quieter Route

Council Tax (annual):
You pay
*the **SAME** as now*

Option E

7am – 11am [4 hrs]:
Noisier Route

11am – 7pm [8 hrs]:
Quieter Route

7pm – 11pm [4 hrs]:
Noisier Route

Council Tax (annual):
You pay
***£100 less** than now*

Option F

7am – 11am [4 hrs]:
Quieter Route

11am – 7pm [8 hrs]:
Noisier Route

7pm – 11pm [4 hrs]:
Quieter Route

Council Tax (annual):
You pay
***£275 more** than now*

Option G

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
£50 more *than now*

Option H

7am – 11am [4 hrs]:
Noisier Route

11am – 7pm [8 hrs]:
Quieter Route

7pm – 11pm [4 hrs]:
Noisier Route

Council Tax (annual):
You pay
the ***SAME*** *as now*

Option I

7am – 11am [4 hrs]:
Noisier Route

11am – 7pm [8 hrs]:
Quieter Route

7pm – 11pm [4 hrs]:
Noisier Route

Council Tax (annual):
You pay
£50 more *than now*

Block 2: Pages 4-6

Option J

7am – 11am [4 hrs]:
Quieter Route

11am – 7pm [8 hrs]:
Noisier Route

7pm – 11pm [4 hrs]:
Quieter Route

Council Tax (annual):
You pay
£100 less *than now*

Option K

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
£100 less *than now*

Option L

7am – 11am [4 hrs]:
Noisier Route

11am – 7pm [8 hrs]:
Quieter Route

7pm – 11pm [4 hrs]:
Noisier Route

Council Tax (annual):
You pay
£300 less *than now*

Option M

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
£25 less *than now*

Option N

7am – 11am [4 hrs]:
Quieter Route

11am – 7pm [8 hrs]:
Noisier Route

7pm – 11pm [4 hrs]:
Quieter Route

Council Tax (annual):
You pay
£50 more *than now*

Option O

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
the ***SAME*** *as now*

Option P

7am – 11am [4 hrs]:
Noisier Route

11am – 7pm [8 hrs]:
Quieter Route

7pm – 11pm [4 hrs]:
Noisier Route

Council Tax (annual):
You pay
£25 less *than now*

Option Q

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
£275 more *than now*

Option R

7am – 11am [4 hrs]:
Noisier Route

11am – 7pm [8 hrs]:
Quieter Route

7pm – 11pm [4 hrs]:
Noisier Route

Council Tax (annual):
You pay
£275 more *than now*

Option Y

7am – 11pm [16 hrs]:
Continuous Alternation

Noisier – Quieter –
Noisier – Quieter … etc

Council Tax (annual):
You pay
£50 more *than now*

Option X

7am – 11pm [16 hrs]:
Continuous Alternation

Noisier – Quieter –
Noisier – Quieter … etc

Council Tax (annual):
You pay
the ***SAME*** *as now*

Option Z

7am – 11pm [16 hrs]:
Continuous Alternation

Noisier – Quieter –
Noisier – Quieter … etc

Council Tax (annual):
You pay
£100 less *than now*

Block 1: Pages 1-3

Option A

At the Weekend

7am – 11am [4 hrs]:
Quieter Route

11am – 7pm [8 hrs]:
Noisier Route

7pm – 11pm [4 hrs]:
Quieter Route

Council Tax (annual):
You pay
£300 less *than now*

Option B

At the Weekend

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
£300 less *than now*

Option C

At the Weekend

7am – 11am [4 hrs]:
Quieter Route

11am – 7pm [8 hrs]:
Noisier Route

7pm – 11pm [4 hrs]:
Quieter Route

Council Tax (annual):
You pay
£25 less *than now*

Option D

At the Weekend

7am – 11am [4 hrs]:
Quieter Route

11am – 7pm [8 hrs]:
Noisier Route

7pm – 11pm [4 hrs]:
Quieter Route

Council Tax (annual):
You pay
*the **SAME** as now*

Option E

At the Weekend

7am – 11am [4 hrs]:
Noisier Route

11am – 7pm [8 hrs]:
Quieter Route

7pm – 11pm [4 hrs]:
Noisier Route

Council Tax (annual):
You pay
***£100 less** than now*

Option F

At the Weekend

7am – 11am [4 hrs]:
Quieter Route

11am – 7pm [8 hrs]:
Noisier Route

7pm – 11pm [4 hrs]:
Quieter Route

Council Tax (annual):
You pay
***£275 more** than now*

Option G

At the Weekend

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
£50 more *than now*

Option H

At the Weekend

7am – 11am [4 hrs]:
Noisier Route

11am – 7pm [8 hrs]:
Quieter Route

7pm – 11pm [4 hrs]:
Noisier Route

Council Tax (annual):
You pay
the ***SAME*** *as now*

Option I

At the Weekend

7am – 11am [4 hrs]:
Noisier Route

11am – 7pm [8 hrs]:
Quieter Route

7pm – 11pm [4 hrs]:
Noisier Route

Council Tax (annual):
You pay
£50 more *than now*

Block 2: Pages 4-6

Option J

At the Weekend

7am – 11am [4 hrs]:
Quieter Route

11am – 7pm [8 hrs]:
Noisier Route

7pm – 11pm [4 hrs]:
Quieter Route

Council Tax (annual):
You pay
£100 less *than now*

Option K

At the Weekend

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
£100 less *than now*

Option L

At the Weekend

7am – 11am [4 hrs]:
Noisier Route

11am – 7pm [8 hrs]:
Quieter Route

7pm – 11pm [4 hrs]:
Noisier Route

Council Tax (annual):
You pay
£300 less *than now*

Option M

At the Weekend

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
£25 less *than now*

Option N

At the Weekend

7am – 11am [4 hrs]:
Quieter Route

11am – 7pm [8 hrs]:
Noisier Route

7pm – 11pm [4 hrs]:
Quieter Route

Council Tax (annual):
You pay
£50 more *than now*

Option O

At the Weekend

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
the ***SAME*** *as now*

Option P

At the Weekend

7am – 11am [4 hrs]:
Noisier Route

11am – 7pm [8 hrs]:
Quieter Route

7pm – 11pm [4 hrs]:
Noisier Route

Council Tax (annual):
You pay
£25 less *than now*

Option Q

At the Weekend

7am – 3pm [8 hrs]:
Quieter Route

3pm – 11pm [8 hrs]:
Noisier Route

Council Tax (annual):
You pay
£275 more *than now*

Option R

At the Weekend

7am – 11am [4 hrs]:
Noisier Route

11am – 7pm [8 hrs]:
Quieter Route

7pm – 11pm [4 hrs]:
Noisier Route

Council Tax (annual):
You pay
£275 more *than now*

Date: _____ Questionnaire A Session Time: _____

Community Noise Questionnaire: Hounslow

Section 1: Profile Information

Thank you for agreeing to participate in this research with residents around the airport, on behalf of Heathrow Airport.

Q1a. Which of those listed best fits your current working status?

Work (full-time, 30+ hours a week)	☐1
Work (part-time, <30 hours a week)	☐2
Student	☐3
Retired	☐4
Looking after the home	☐5
Permanently/temporarily unemployed	☐6
Sick/Infirm	☐7

Q1b. [Q1a = 1 OR 2] Do you mainly work at home?

Yes, mainly work at home	☐1
No, mainly don't work at home	☐2

Q1c. [Q1a = 1 OR 2] Do you work night shifts once a week or more?

Yes, often work night-shifts	☐1
No	☐2

Q2. GENDER

Male	☐1
Female	☐2

Q3. Which age group are you in…?

18-24	☐1
25-34	☐2
35-44	☐3
45-54	☐4
55-64	☐5
65+	☐6

Please wait before turning over.

Section 2: Valued Quiet Periods

PLEASE WAIT UNTIL AFTER YOU HAVE LISTENED TO TWO SEQUENCES OF AIRCRAFT SOUNDS.

- We will play you a sequence of 6 aircraft taking off from Heathrow
- The aircraft we will play you will vary in type and be typical of the variation in aircraft at Heathrow.
- The aircraft sounds will occur every 60 seconds or so for 6 minutes.
- They will sound similar to when you are outside, such as when in your garden or outside your house, but may be a bit louder or quieter than the aircraft noises you are used to hearing.

- We will then play you a second sequence of 6 aircraft over 6 minutes.
- These will be of the same types of aircraft but travelling along a route further away, *so will be quieter*.
- We would like to know whether you think the second noise environment would be much better for you and your family than the other (i.e. does it make any difference which route they use).

ONLY ANSWER THE QUESTIONS AFTER BOTH SEQUENCES HAVE BEEN PLAYED

Q4. Did you notice that the second sequence was quieter than the first?

Yes	1	PLEASE ANSWER Q5
No	2	PLEASE SKIP TO Q6

[If YES]

Q5. Which, of the following three judgements, best reflects your personal view of the difference between the two sequences, if they were to fly like this throughout the operational day?

Compared with the first aircraft sound sequence, …	
… the second sequence would be of CONSIDERABLE benefit to me and my household	1
… the second sequence would be of SOME benefit to me and my household	2
… the second sequence would be of NO benefit to me and my household	3

Q6a
If you could decide which hours of the day, aircraft use the more distant route, and the hours of the day when aircraft use the near route – **which hours would you choose?**

Please first consider WEEKDAYS. You can choose any particular hours that you like – they do not have to be sequential, but you cannot have more than 8.

PLEASE TICK BELOW WHEN YOU WOULD LIKE THE 8 'QUIETER' HOURS.

WEEKDAYS

7-8 am	
8-9	
9-10	
10-11	
11-12	
12-1 pm	
1-2	
2-3	
3-4	
4-5	
5-6	
6-7	
7-8	
8-9	
9-10	
10-11	

Q6b. **How would having less aircraft noise benefit you and your household?** [For example, which activities would benefit the most?] Please write in below:

_____

_____

Section 3: Valuing Quiet Periods by Time of Day [DURING THE WEEK]

PLEASE WAIT UNTIL YOU HAVE HEARD THE CONTEXT TO THIS EXERCISE.

Q7a. Please look at these nine options involving aircraft <u>during weekdays</u> and rank them in order of preference for you and your household. Aircraft noise at the weekends would remain as now.

[RECORD RANK ORDER OF OPTIONS]:

1st - Option _____

2nd - Option _____

3rd - Option _____

4th - Option _____

5th - Option _____

6th - Option _____

7th - Option _____

8th - Option _____

9th - Option _____

Section 4a: Valuing Continuous Alternation

PLEASE WAIT UNTIL YOU HAVE HEARD THE CONTEXT TO THIS EXERCISE.

Q8a

Please consider this additional option [Option X] – which, rather than have defined blocks of 'noisier' and 'quieter' periods, would alternate continuously throughout the 16 hour operational day. Please insert it within your current ordering of preferred (blue) options for a WEEKDAY – so, if you think it better than all the nine previously ranked options then you would place it <u>first</u>; and if you think it worse than all the nine previously ranked options then you would place it <u>tenth</u>.

Position of Option X: _____ [1st , 2nd 3rd, 4th, 5th, 6th, 7th, 8th, 9th, or 10th]

Q8b

Please now consider two more options [Options Y and Z] – which would also alternate continuously throughout the 16 hour operational day but have a different money situation compared with Option X. Please insert Options Y and Z within your ordering of options.

Position of Option Y: _____ [1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th or 12th]

Position of Option Z: _____ [1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th or 12th]

Q9. If you could decide which hours of the WEEKEND, aircraft use the more distant route, and when aircraft use the near route – which hours would you choose?

PLEASE TICK BELOW WHEN YOU WOULD LIKE THE 8 'QUIETER' HOURS.

WEEKENDS

7-8 am	
8-9	
9-10	
10-11	
11-12	
12-1 pm	
1-2	
2-3	
3-4	
4-5	
5-6	
6-7	
7-8	
8-9	
9-10	
10-11	

Q10a. Would it be useful to you to know when the airport's managed 'quieter' periods are for <u>your</u> area?

Yes	1	PLEASE ANSWER Q10b.
Maybe	2	PLEASE ANSWER Q1Ob.
No	3	PLEASE SKIP TO Q11.

Q10b. And what would be the best way that the airport could advise you of when the quieter periods would be? Please write in below:

_____

_____

Q10c. Please imagine that you were reading an article in your local newspaper, and it said that Heathrow Airport had changed its operations to create 'quieter' periods that reduce average aircraft noise by a small amount (e.g. only 2-3 decibels, *which is much less than the 10 decibel difference which we demonstrated in Q4 a few minutes ago*) – and which our research suggests that most people might not find particularly noticeable. Which one of these general sentiments do you think you would feel?

Annoyance that the airport had wasted resources achieving little of actual impact	1
A more positive view of the airport, than otherwise, as it shows that they are trying to improve things for its neighbours	2
No feelings either way	3

Q10d. Which <u>one</u> of these Heathrow Airport activities would please you the most? [Tick one only]

More funding of community projects (such as building schools or hospitals)	☐1
More resident insulation schemes – offering (super-effective) triple-glazing at a discounted cost for those very close to the airport	☐2
Creating 'quieter' periods that reduce average aircraft noise by a lesser amount (e.g. only 2-3 decibels) which people might not find particularly noticeable, but which would nevertheless reduce overall noise levels for particular communities.	☐3
Contributions by Heathrow Airport that reduce your local Council Tax (i.e. you pay less) by £50 every year	☐4
Other (please specify _____)	☐5

Q10e. Do you have any other comments you would like to add? Please write in below:

_____

_____

Section 5: Demographics

Finally, some questions to help us analyse the results of this survey. All your answers will be kept strictly confidential and anonymous.

Q11a. Overall, how would you describe the area where you live? [TICK UP TO 3]

Very nice	☐ 1
Peaceful/quiet	☐ 2
Green spaces/countryside	☐ 3
Village/community feel	☐ 4
Good facilities	☐ 5
Good transport access	☐ 6
Other positive (please specify _____)	☐ 7
Noisy	☐ 8
Too much (road) traffic	☐ 9
Anti-social behaviour	☐ 10
Air pollution	☐ 11
Other negative (please specify _____)	☐ 12

Q11b. Overall, how much do you think your judgements about time of day preferences for 'quieter' periods were influenced by the times of day <u>when you and/or your household</u> are usually at home?

Very influenced by times when usually (or not) at home	☐ 1
A bit influenced by times when usually (or not) at home	☐ 2
Not at all influenced by this / We're at home most times	☐ 3

[Q11b = 1 OR 2 ANSWER Q11c OTHERWISE PLEASE GO TO Q12]

Q11c. And how much do you think your judgements about time of day preferences for quieter periods might have been influenced by thinking about people in <u>your area</u> (but not at your home) who might be at home when you are away and vice-versa?

Very much influenced	☐ 1
A bit influenced	☐ 2
Not at all influenced	☐ 3

Q12. How much does noise from different sources in the local neighbourhood affect your quality of life?

[Please give one tick per row]

Noise from:	Affect Quality of Life?		
	Not at all	A little bit	Quite a lot
People in the street	☐1	☐2	☐3
Animals	☐1	☐2	☐3
Road traffic	☐1	☐2	☐3
Aircraft	☐1	☐2	☐3
Trains	☐1	☐2	☐3
Alarms	☐1	☐2	☐3
Other (pls specify _____)	☐1	☐2	☐3

Q13a. Thinking about the last 12 months or so, when you are here at home, how much does noise from aircraft bother, disturb, or annoy you?

Not at all	☐1
Slightly	☐2
Moderately	☐3
Very	☐4
Extremely	☐5

[IF Q13a = 2, 3, 4 OR 5 ANSWER Q13b OTHERWISE PLEASE GO TO Q14]

Q13b. Is there any time when does aircraft noise becomes particularly annoying? [TICK UP TO 3]

Early in the morning	☐1
Late at night	☐2
At the weekends	☐3
In the summer	☐4
When I'm out in the garden or when windows open	☐5
When I'm watching TV/on the telephone/doing a particular activity	☐6
Other 1 (please specify _____)	☐7
Other 2 (please specify _____)	☐8
Aircraft noise is not annoying at any time	☐9
Aircraft noise is annoying the whole day	☐10

Q14. Do you have double-glazing in your home?

Yes in all rooms	☐1
Yes in some rooms	☐2
No	☐3

Q15. For how many years have you lived close to Heathrow or close to a flight-path?

Less than a year	☐1
More than 1 year, but less than 4 years	☐2
More than 4 years, but less than 11 years	☐3
More than 11 years, but less than 20 years	☐4
More than 20 years	☐5

Q16. Do you, or a family member work at Heathrow?

Yes	☐1
No	☐2

Q17. Do you, or other household members, ever use Heathrow?

Yes, several times a year	☐1
Yes, once a year or so	☐2
Yes, but seldom	☐3
No, never	☐4

Q18. Are you a member of a community, or amenity, group that is involved in aviation issues (such as HACAN)?

Yes	☐1
No	☐2

Q19. What is the total annual income of your household (before tax)?

Less than £10,000	☐1
£10,000 - £19,999	☐2
£20,000 - £29,999	☐3
£30,000 - £39,999	☐4
£40,000 - £59,999	☐5
£60,000 - £79,999	☐6
£80,000 or more	☐7
Don't Know	☐8

Q20. Do you own your home, or are you a tenant?

Own home, or have a mortgage	☐1
Tenant	☐2

Q21. What is the occupation of the chief income earner of the household?

Occupation title: _____

Position/Grade and No. of Staff Responsible for: _____

Industry/Type of Company: _____

Qualification/Degrees/Apprenticeships: _____

Thank You

Date: _____ Questionnaire B Session Time: _____

Community Noise Questionnaire: Hounslow

Section 1: Profile Information

Thank you for agreeing to participate in this research with residents around the airport, on behalf of Heathrow Airport.

Q1a. Which of those listed best fits your current working status?

Work (full-time, 30+ hours a week)	☐1
Work (part-time, <30 hours a week)	☐2
Student	☐3
Retired	☐4
Looking after the home	☐5
Permanently/temporarily unemployed	☐6
Sick/Infirm	☐7

Q1b. [Q1a = 1 OR 2] Do you mainly work at home?

Yes, mainly work at home	☐1
No, mainly don't work at home	☐2

Q1c. [Q1a = 1 OR 2] Do you work night shifts once a week or more?

Yes, often work night-shifts	☐1
No	☐2

Q2. GENDER

Male	☐1
Female	☐2

Q3. Which age group are you in…?

18-24	☐1
25-34	☐2
35-44	☐3
45-54	☐4
55-64	☐5
65+	☐6

Please wait before turning over.

Section 2: Valued Quiet Periods

PLEASE WAIT UNTIL AFTER YOU HAVE LISTENED TO TWO SEQUENCES OF AIRCRAFT SOUNDS.

We will play you a sequence of 6 aircraft taking off from Heathrow - this is what they do when there are Easterly winds, and this is when aircraft fly closest to where you live. *[When there are westerly winds, which is around 75% of the time over the year, aircraft take-off in a westerly direction but veer off before they reach Windsor].* The aircraft we will play you will vary in type and be typical of the variation in aircraft at Heathrow. The aircraft sounds will occur every 60 seconds or so for 6 minutes. They will sound like they do when outside in Hounslow, such as when in your garden.

We will then play you a second sequence of 6 aircraft over 6 minutes. These will be of the same types of aircraft but travelling along a route further away, *so will be quieter*. We would like to know whether you think the second noise environment would be much better for you and your family than the other (i.e. does it make any difference which route they use).

[AFTER BOTH SEQUENCES HAVE BEEN PLAYED]

Q4. Did you notice that the second sequence was quieter than the first?

Yes	1	PLEASE ANSWER Q5
No	2	PLEASE SKIP TO Q6

[If YES]

Q5. Which, of the following three judgements, best reflects your personal view of the difference between the two sequences, if they were to fly like this throughout the operational day?

Compared with the first aircraft sound sequence, …	
… the second sequence would be of CONSIDERABLE benefit to me and my household	1
… the second sequence would be of SOME benefit to me and my household	2
… the second sequence would be of NO benefit to me and my household	3

Q6a
If you could decide which hours of the day, aircraft use the more distant route, and the hours of the day when aircraft use the near route – **which hours would you choose?**

Please first consider WEEKDAYS. You can choose any particular hours that you like – they do not have to be sequential, but you cannot have more than 8.

PLEASE TICK BELOW WHEN YOU WOULD LIKE THE 8 'QUIETER' HOURS.

WEEKDAYS

7-8 am	
8-9	
9-10	
10-11	
11-12	
12-1 pm	
1-2	
2-3	
3-4	
4-5	
5-6	
6-7	
7-8	
8-9	
9-10	
10-11	

Q6b. **How would having less aircraft noise benefit you and your household?** [For example, which activities would benefit the most?] Please write in below:

_____

_____

Section 3: Valuing Quiet Periods by Time of Day [DURING THE WEEK]

PLEASE WAIT UNTIL YOU HAVE HEARD THE CONTEXT TO THIS EXERCISE.

Q7a. Please look at these nine options involving aircraft <u>during weekdays</u> and rank them in order of preference for you and your household. Aircraft noise at the weekends would remain as now.

[RECORD RANK ORDER OF OPTIONS]:

1st - Option _____

2nd - Option _____

3rd - Option _____

4th - Option _____

5th - Option _____

6th - Option _____

7th - Option _____

8th - Option _____

9th - Option _____

Q8. If you could decide which hours of the WEEKEND, aircraft use the more distant route, and when aircraft use the near route – which hours would you choose?

PLEASE TICK BELOW WHEN YOU WOULD LIKE THE 8 'QUIETER' HOURS.

<u>WEEKENDS</u>

7-8 am	
8-9	
9-10	
10-11	
11-12	
12-1 pm	
1-2	
2-3	
3-4	
4-5	
5-6	
6-7	
7-8	
8-9	
9-10	
10-11	

Section 4: Preferred Noise Environment at WEEKENDS

PLEASE WAIT UNTIL YOU HAVE HEARD THE CONTEXT TO THIS EXERCISE.

Q9. Still thinking about <u>weekends</u>, please look at these nine options involving aircraft and rank them in order of preference for you and your household. Aircraft noise during the week would remain as now.

[RECORD RANK ORDER OF OPTIONS]:

1st - Option _____

2nd - Option _____

3rd - Option _____

4th - Option _____

5th - Option _____

6th - Option _____

7th - Option _____

8th - Option _____

9th - Option _____

Q10a. Would it be useful to you to know when the airport's managed 'quieter' periods are for <u>your</u> area?

Yes	1	PLEASE ANSWER Q10b.
Maybe	2	PLEASE ANSWER Q1Ob.
No	3	PLEASE SKIP TO Q11.

Q10b. And what would be the best way that the airport could advise you of when the quieter periods would be? Please write in below:

_____

_____

Q10c. Please imagine that you were reading an article in your local newspaper, and it said that Heathrow Airport had changed its operations to create 'quieter' periods that reduce average aircraft noise by a small amount (e.g. only 2-3 decibels, *which is much less than the 10 decibel difference which we demonstrated in Q4 a few minutes ago*) – and which our research suggests that most people might not find particularly noticeable. Which one of these general sentiments do you think you would feel?

Annoyance that the airport had wasted resources achieving little of actual impact	1
A more positive view of the airport, than otherwise, as it shows that they are trying to improve things for its neighbours	2
No feelings either way	3

Q10d. Which <u>one</u> of these Heathrow Airport activities would please you the most? [Tick one only]

More funding of community projects (such as building schools or hospitals)	☐1
More resident insulation schemes – offering (super-effective) triple-glazing at a discounted cost for those very close to the airport	☐2
Creating 'quieter' periods that reduce average aircraft noise by a lesser amount (e.g. only 2-3 decibels) which people might not find particularly noticeable, but which would nevertheless reduce overall noise levels for particular communities.	☐3
Contributions by Heathrow Airport that reduce your local Council Tax (i.e. you pay less) by £50 every year	☐4
Other (please specify _____)	☐5

Q10e. Do you have any other comments you would like to add? Please write in below:

_____

_____

Section 5: Demographics

Finally, some questions to help us analyse the results of this survey. All your answers will be kept strictly confidential and anonymous.

Q11a. Overall, how would you describe the area where you live? [TICK UP TO 3]

Very nice	☐1
Peaceful/quiet	☐2
Green spaces/countryside	☐3
Village/community feel	☐4
Good facilities	☐5
Good transport access	☐6
Other positive (please specify _____)	☐7
Noisy	☐8
Too much (road) traffic	☐9
Anti-social behaviour	☐10
Air pollution	☐11
Other negative (please specify _____)	☐12

Q11b. Overall, how much do you think your judgements about time of day preferences for 'quieter' periods were influenced by the times of day <u>when you and/or your household</u> are usually at home?

Very influenced by times when usually (or not) at home	☐1
A bit influenced by times when usually (or not) at home	☐2
Not at all influenced by this / We're at home most times	☐3

[Q11b = 1 OR 2 ANSWER Q11c OTHERWISE PLEASE GO TO Q12]

Q11c. And how much do you think your judgements about time of day preferences for quieter periods might have been influenced by thinking about people in <u>your area</u> (but not at your home) who might be at home when you are away and vice-versa?

Very much influenced	☐1
A bit influenced	☐2
Not at all influenced	☐3

Q12. How much does noise from different sources in the local neighbourhood affect your quality of life?

[Please give one tick per row]

Noise from:	Affect Quality of Life?		
	Not at all	A little bit	Quite a lot
People in the street	☐1	☐2	☐3
Animals	☐1	☐2	☐3
Road traffic	☐1	☐2	☐3
Aircraft	☐1	☐2	☐3
Trains	☐1	☐2	☐3
Alarms	☐1	☐2	☐3
Other (pls specify _____)	☐1	☐2	☐3

Q13a. Thinking about the last 12 months or so, when you are here at home, how much does noise from aircraft bother, disturb, or annoy you?

Not at all	☐1
Slightly	☐2
Moderately	☐3
Very	☐4
Extremely	☐5

[IF Q13a = 2, 3, 4 OR 5 ANSWER Q13b OTHERWISE PLEASE GO TO Q14]

Q13b. Is there any time when does aircraft noise becomes particularly annoying? [TICK UP TO 3]

Early in the morning	☐1
Late at night	☐2
At the weekends	☐3
In the summer	☐4
When I'm out in the garden or when windows open	☐5
When I'm watching TV/on the telephone/doing a particular activity	☐6
Other 1 (please specify _____)	☐7
Other 2 (please specify _____)	☐8
Aircraft noise is not annoying at any time	☐9
Aircraft noise is annoying the whole day	☐10

Q14. Do you have double-glazing in your home?

Yes in all rooms	☐1
Yes in some rooms	☐2
No	☐3

Q15. For how many years have you lived close to Heathrow or close to a flight-path?

Less than a year	☐1
More than 1 year, but less than 4 years	☐2
More than 4 years, but less than 11 years	☐3
More than 11 years, but less than 20 years	☐4
More than 20 years	☐5

Q16. Do you, or a family member work at Heathrow?

Yes	☐1
No	☐2

Q17. Do you, or other household members, ever use Heathrow?

Yes, several times a year	☐1
Yes, once a year or so	☐2
Yes, but seldom	☐3
No, never	☐4

Q18. Are you a member of a community, or amenity, group that is involved in aviation issues (such as HACAN)?

Yes	☐1
No	☐2

Q19. What is the total annual income of your household (before tax)?

Less than £10,000	☐1
£10,000 - £19,999	☐2
£20,000 - £29,999	☐3
£30,000 - £39,999	☐4
£40,000 - £59,999	☐5
£60,000 - £79,999	☐6
£80,000 or more	☐7
Don't Know	☐8

Q20. Do you own your home, or are you a tenant?

Own home, or have a mortgage	☐1
Tenant	☐2

Q21. What is the occupation of the chief income earner of the household?

Occupation title: _____

Position/Grade and No. of Staff Responsible for: _____

Industry/Type of Company: _____

Qualification/Degrees/Apprenticeships: _____

Thank You

SYSTRA provides advice on transport, to central, regional and local government, agencies, developers, operators and financiers.

A diverse group of results-oriented people, we are part of a strong team of professionals worldwide. Through client business planning, customer research and strategy development we create solutions that work for real people in the real world.

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