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ACOUSTICS BULLETIN

in this issue...

How Heathrow expansion could influence UK aviation noise policy

plus... **Investigating novel solutions for natural ventilation – passive ventilation and metamaterials**

An introduction to sound power standards

Institute of Acoustics

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Volume 43 No 5 September/October 2018

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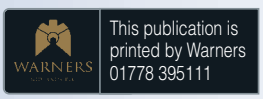

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The Institute of Acoustics in the UK's professional body for those working in acoustics, noise and vibration. It was formed in 1974 from the amalgamation of the Acoustics Group of the Institute of Physics and the British acoustical Society. The Institute of acoustics is a nominated body of the Engineering Council, offering registration at Chartered and Incorporated Engineer levels.

The Institute has over 3000 members working in a diverse range of research, educational, govern mental and industrial organisations. This multidisciplinary culture provides a productive environment for cross-fertilisation of ideas and initiatives. The range of interests of members within the world of acoustics is equally wide, embracing such aspects as aerodynamics, architectural acoustics, building acoustics, electroacoustic, engineering dynamics, noise and vibration, hearing, speech, physical acoustics, underwater acoustics, together with a variety of environmental aspects. The Institute is a Registered Charity no. 267026

Institute of Acoustics

WE MAPPED THE SOUNDS OF CHILE

With a population of around 17 million and roughly one-third of that living in Chilean capital of Santiago, traffic noise mapping wouldn't seem top of the urban research agenda.

Not so, last year a report stated that new car sales were up a staggering 27.3% in the country as the economy continues to improve. Santiago is also one of General Motors' manufacturing bases in South America. That's why Prof. Jorge Arenas undertook a two-year noise mapping study using equipment from Cirrus Research.

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Dear Members

By the time you read this I will have been confirmed as your new President, after serving two years on Executive and Council as President Elect. I come from an academic background, as a researcher and teacher in engineering acoustics, and I am now Professorial Fellow within the Acoustics Research Unit (ARU) at the University of Liverpool. This is a part-time appointment, which will give me time for IOA matters.

You may guess my age when I tell you that I joined the British Acoustical Society (BAS) in 1970 and have been a member of the IOA since 1974. During this period I enjoyed (and certainly benefited from) attending the spring and autumn conferences of the IOA, the former mainly dealing with research, the latter mainly on professional practice. I have been able to serve on the Educational Committee as examiner of the Diploma modules on Building Acoustics and on Noise Control Engineering.

After serving as ordinary member of Council for eight years, I thought any future active participation would not be required. It therefore was a pleasant surprise when Bridget Shields, then President, suggested that my name go forward as President Elect for 2016-18.

The last two years on the Executive has confirmed my opinion that the IOA is a major and unique institution. It is both a professional body and a learned society, and is a forum for researchers, consultants, designers and policy makers. Its membership is the largest in Europe and its educational portfolio has no equivalent in other chartered engineering institutes. I have been humbled by observing the willing contribution of member volunteers in committee activities: membership, meetings, education, engineering, publications and the regional branches etc.

What of the future?

Well, it has started with the move of the IOA office from St Albans to Milton Keynes. At the time of writing, the move is nearly complete and members are encouraged to visit our new home and enjoy its facilities. The move could not have been completed without the drive and expertise of Allan Chesney (CEO) and Russell Richardson (IOA Secretary) in particular, ably supported by the other members of Executive. We have had to deal with the loss of staff who were not able commute to the new office: Chantel, Hansa, Hazel and Sue. I was impressed by their professionalism in working 'flat-out' until the end of their contracts and in welcoming and mentoring new staff. However, Allan, Elaine Stray and Linda Canty have moved with us and it is a pleasure to welcome new staff members: Edith Borowicz (to be responsible for education) and Emma Lilliman (responsible for membership and engineering).

The office move and staff reorganisation has coincided with new realities and initiatives. I won't bore you with Brexit and its implications, if I only knew what they were, but acoustics needs to remain on the agenda and our Institute will be aiming to be flexible, pro-active and out-reaching to its membership and to external bodies and other institutions. We are in the business of ideas, innovation, knowledge exchange and skills enhancement and must develop our processes and systems accordingly.

UK Acoustics Network

Acoustics needs to enhance its profile. An important initiative is UKAN, the UK Acoustics Network, set up by Professor Kirill Horoshenkov of Sheffield University and Professor Richard Craster of Imperial College, and funded by the Engineering and Physical Sciences Research Council (EPSRC). The network aims to promote links between academics, practitioners, industry and other potential beneficiaries, towards identifying real-world problems and needs, and foster collaborations between researchers and practitioners in addressing them. Special interests groups (SIGs) have been set up for meetings and discussions (see **https://acoustics.ac.uk**). While UKAN's membership is in the hundreds and growing, the membership of the IOA is in its thousands. Why not join one or more SIGs relevant to you? Many of the activities are free and your voice will be heard in discussions on what should be the new directions in research and development; surely a win-win situation.

I am honoured to be President and look forward to some exciting times and new opportunities. In the immediate future, I look forward to meeting and working with you.

Barry Gibbs, President IOA

Engineering Division

By Blane Judd, Engineering Manager

The Engineering Division has established a pipeline of members who wish to join the growing number of engineers professionally registered with the Engineering Council. We are still maintaining our target of double figures, and we have a number of candidates going forward in September.

We have had some enquiries which date back a few years. This has proved difficult since we have not been able to maintain records for long periods due to data laws. We have done our best to support those who started the process and for a number of reasons did not pursue it at the time, but this has, in some cases led to having to ask for information previously supplied. If you made enquiries recently and supplied information, please be mindful that if you delay the process you may need to replicate past documentation. It is important therefore to keep copies of transcripts and certificates safe in case we need to ask for them again.

There has been a change in the team here at the Institute of Acoustics and Emma Lilliman has joined us in place of Chantel Sankey, who many of you will know and who did a great job supporting many candidates through the process. We remain just as dedicated to providing the necessary levels of support to assist members like you.

Interviews

Our next round of interviews will be in the early part of next year and we already have some candidates working towards that session. We hold a number of interview events throughout the year, depending on the number of candidates we have coming forward for registration. We can offer face-to-face interviews or by video link.

If you are interested in taking the next step to becoming a professionally registered engineer, contact us on **acousticsengineering@ioa.org.uk**

Routes to qualification

The requirements for academic qualifications for CEng and IEng changed in 1999. Pre-1999, an Honours Degree at 2:2 or above was required for CEng or a Higher Diploma/Certificate for IEng. Post-1999 this changed and for CEng a Masters Degree was required or an Ordinary Degree for IEng.

There are two routes: **standard route** if you have the appropriate EC-accredited qualification (also referred to as an exemplifying qualification) in acoustics and the **individual route**, which requires further preparatory work from you before submitting evidence of your competence. Remember we are here to help you get through the process and advice and support is offered to every candidate personally.

For the individual route, the Institute accepts a number of courses in relevant subjects such as audio technology, from certain academic centres, as being equivalent to accredited courses for the purposes of EC registration, without the need for further assessment.

The Institute recognises the IOA Diploma course and the several Masters courses linked to it as providing evidence if you are looking to gain CEng registration. You could also offer a PhD qualification, depending upon the content of the associated taught element. We can also offer support for registration via a 'technical report' route, if you do not have the relevant qualifications to help you demonstrate you are working as a professional engineer in acoustics.

Peer review process

The election process is overseen by the Institute's Engineering Division Committee, which is made up of volunteers from the membership, to whom we are extremely grateful. They represent the 300 or so members holding Engineering Council registration. They provide the essential peer review process that affirms that you are at the appropriate level for recognition as an Engineering Council Registered Professional Engineer.

The opportunity is there and we are ready to support you through it, so that you can become one of almost 225,000 registrants that hold international professional recognition.

Conference Programme

13 September (NEW DATE)
Organised by the Building Acoustics and Environmental Noise Groups
Acoustics of Places of Entertainment and Sports Venues
Salford
Followed by:
Institute of Acoustics AGM

20 September
Organised by the Physical Acoustics Group
Acoustic Materials and Metamaterials
Birmingham

4-6 October
Organised by Building Acoustics Group
10th International Conference on Auditorium Acoustics 2018
Germany

17 October
Organised by Measurement and Instrumentation Group
Ground Borne Vibration
London

24 October
Organised by the Musical Acoustics Group
Measurements and Modelling of Musical Instruments and Performance Spaces
Edinburgh

8 November
Organised by Noise and Vibration Engineering Group
Sustainable Engineering Design
Southampton

27-29 November
(Organised by the Electroacoustics Group)
Reproduced Sound 2017 – Putting Sound in its place
Bristol

For up-to-date information visit www.ioa.org.uk

Specialist Groups

The Institute reflects the broad spectrum of the science and application of acoustics and several Groups have been formed to foster contacts between members of the various specialist areas.

IOA Young Members Group

Each Specialist Group, Regional Branch and Standing Committee has a Young Members Representative (YMR) who also sits on the Young Members Group (YMG) committee. The YMR acts as a bridge between the committee and the YMG to represent the views of young members within the committee. It helps encourage young members to become more involved in IOA events by assisting with adapting conferences/one-day meetings to attract and engage with early career professionals.

The YMG committee has three telephone meetings and one physical meeting a year. The Specialist Group, Regional Branch and Standing Committees have additional meetings and commitments.

The individual should be an early career professional. Becoming a YMR is a great way of meeting new people and making new contacts, both within the YMG and more widely throughout the IOA.

IOA Young Members Representative vacancies

The following positions are currently vacant, along with details of the Chair, should you wish to be considered for the position:

Welsh Branch
Chair to contact: Mr David Hunter MIOA
dave@hunteracoustics.co.uk

Electroacoustics Group
Chair to contact: Dr Keith Holland MIOA
krh@isvr.soton.ac.uk

Noise and Vibration Engineering Group
Chair to contact: Dr Malcolm Smith MIOA
mgs@isvr.soton.ac.uk

Underwater Acoustics Group
Chair to contact: Dr Peter Dobbins FIOA
peterdobbins1@gmail.com

Membership Committee
Chair to contact: Mr Paul Shields FIOA
paul.shields@aecom.com

Young Members' Group Secretary
Chair to contact: Miss Ellen Harrison MIOA
ellen.harrison@wsp.com

Central Branch

By David Trew

The Central Branch has been busy hosting and arranging events for 2018. So busy in fact that we have neglected to let you know for a few Acoustic Bulletins what we have been up to.

Recent events have included the excellent presentation: 'The Perfect Expert Witness Report' from Mark Thomas of Thomas Sands Consulting Ltd. Not a topic directly related to acoustics, but clearly of interest to many members, evidenced by the very good attendance and feedback after the event. Our thanks go to Rachel Canham of Walker Beak Mason for organising it.

We have also had similarly well-attended events including a presentation from the ANC working group on Acoustics Ventilation and Overheating, by working group members, Nick Conlan (Apex) and James Healy (WSP). It's a bad pun that is repeated often (but this will not stop me) acoustics and ventilation is a 'hot topic' at the moment with recent research highlighting a regular conflict between overheating assessments (which almost always assume windows are open) and noise assessments (which regularly assume windows are closed). Nick and James presented the current ANC guidance document which is hoped to promote both good acoustic design and more co-ordinated design approaches for sites exposed to excessive levels of transportation noise. (**Turn to page 50 for the article, 'Investigating novel solutions for natural ventilation – passive ventilation and metamaterials' by By Paul Forster.**)

Our annual site visit was to the Schueco facility in Milton Keynes. Again, a very well-attended event, which offered an interesting insight from Stephen Newell, Architectural Project Manager, into design and European test facilities used by the company, which supplies aluminium windows and façades.

Forensic Analysis of Speech and Sound presentation

After the summer break our next event will be an evening talk on the 'Forensic Analysis of Speech and Sound' by Dr Jessica Wormald, in Milton Keynes, on **Wednesday 19th September**. Jessica is a consultant at J P French Associates, the UK's longest established independent forensic laboratory, specialising in the analysis of speech and audio recordings for legal proceedings. Thanks to Adam Baker of Jacobs for setting this up. This event should present a fascinating insight into the world of audio forensics and we hope to see you there.

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Eastern Branch

Audiology for acousticians

By Jody Blacklock

Eastern Branch members attended a very interesting presentation by Graham Frost of the IOA Speech and Hearing Group. We all knew the basics of the ear and how our ears help us to hear what we hear, but this presentation went into far more detail than most of us are exposed to generally.

Graham's presentation went into the fine detail about each part of the ear. He explained their respective functions and how they have developed over time to become sophisticated sound meters, which not only give us a guide on intensity and frequency content, but also help to distinguish the directionality of a sound source.

Much of the presentation was devoted to audiometry testing and the differences between each of the methods employed. As more tests are being performed for legal cases against employers, the swing seems to be away from subjective hearing tests and towards objective tests, which can be conducted on an individual without using a conscious response.

These objective tests can also be conducted on new born babies as an early warning diagnosis for the parents and doctors alike and hearing tests are also critical when investigating brain tumours, particularly the potentially fatal, acoustic neuroma. These are incredibly rare though – so don't lose any sleep…

Electroacoustics Group

RS 2018: Putting Sound in its Place

The Electro-Acoustics Group Committee is pleased to announce Reproduced Sound 2018, Putting Sound in its Place. The conference will be held at the Bristol Hotel, Prince Street, Bristol BS1 4QF on 27-29 November, 2018. The conference dinner will take place on Brunel's S.S.Great Britain.

Now in its 34th year, the conference represents the cutting edge of modern audio and acoustics in an informal environment that allows consultants, manufacturers, contractors, end users, academics and students to mingle and share insights and information.

The core-topics for this year's conference are:

- Live sound;
- Acoustics in rooms;
- Audio system design;
- Loudspeakers and microphones;
- Intelligibility;
- Measurement and evaluation;
- Cinema sound; and
- Case studies.

For further information visit **www.reproducedsound.co.uk or the IOA's event page.**

South West Branch

That rings a bell…

Members of the IOA South West Branch were treated to two separate visits to St Mary Redcliffe church bell tower and ringing chamber in May and June 2018. Special thanks to Gareth and Phil at St Mary's for accommodating us twice in order to allow the number of members interested to attend. With tours of the building and history of the bells discussed in detail on both occasions (and the bell tuner was present on one of those to provide further insight) was a pleasure. Listening to the ringing from within the ringing chamber itself, with explanations of how the ringers follow the patterns, what to listen for and how the peels are recorded as diagrams, made for fascinating trips. The ringers were welcoming and are happy for us to arrange further visits should more members be interested. Please contact Dan Pope at the South West Branch for more information.

In the St Mary Redcliffe church bell tower and ringing chamber (Image courtesy of Dan Pope)

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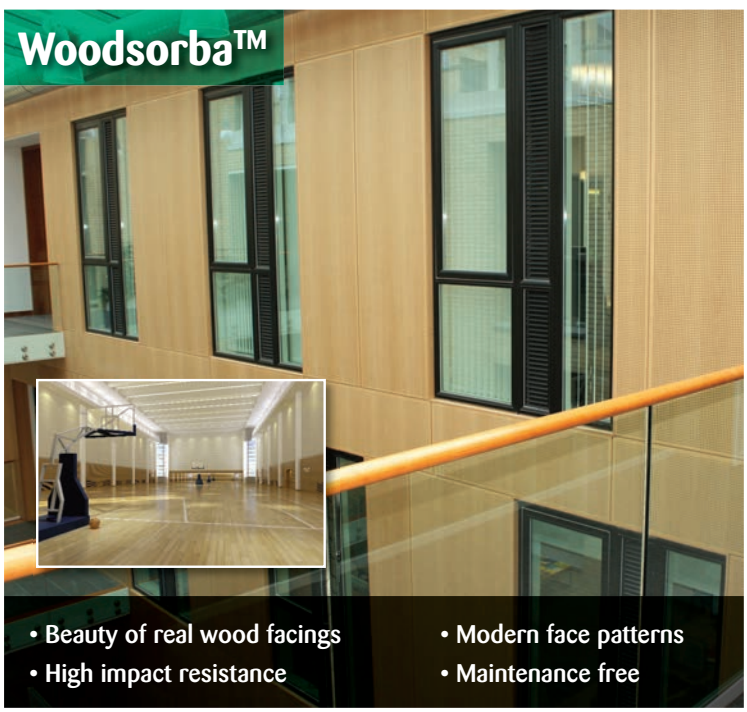

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Midlands Branch

Noise, ventilation and overheating

By Chris Bradley

In March, James Healey presented the draft ANC 'Guide to Acoustics, Ventilation and Overheating ('AVO' Guide) to members of the IOA Midlands Branch. The meeting was held at the WSP offices in Birmingham.

James explained that where residential developments rely on opening windows as a means to mitigate overheating, there can be a compromise between allowing excessive noise ingress with windows open, or excessive temperatures with windows closed. This problem is exacerbated by the move towards better insulated, more airtight buildings and the need, particularly in urban areas, to consider development on noisier sites.

James presented an overview of the draft guide together with some case studies of acoustically attenuated passive ventilation solutions. The AVO Guide recommends an integrated approach to acoustic assessments for new residential development that takes due regard of the interdependence of provisions for acoustics, ventilation, and overheating.

An energetic discussion of the draft guide followed the presentation and subsequent formal feedback was welcomed by the ANC during the consultation period.

The Midlands Branch would like to thank James for presenting and to WSP for hosting the event.

Dog boarding kennel noise impact and methods of assessment

By Heather Billin

In April, Dr John Pritchard, of the University of Derby, gave a well-attended presentation entitled 'Dog boarding kennel noise impact and methods of assessment'.

There are around 5,000 boarding kennels and 1,000 animal welfare facilities in the UK and Ireland, bringing a range of environmental impacts, including noise.

John's talk included an overview of noise impacts and common activities at boarding kennels which generate noise. A range of typical noise levels of barking dogs were presented from published data and the University's own measurements.

Following a summary of regulatory control and a review of recent planning conditions, it is apparent there is little consistency across the country in conditions imposed on kennel developments. John explored noise control options in terms of kennel design and layout and particularly, management control including feeding regime, exercising, visiting times and staff behaviour.

Many thanks to John for a comprehensive discussion of the topic and an entertaining evening. Thanks also to the University of Derby for hosting the event.

Musical Acoustics Group and Yorkshire and North East Branch

By Jemma Jones and Sonia Duarte, Arup

Adam Cox showing members around the Yorkshire Pianos workshop

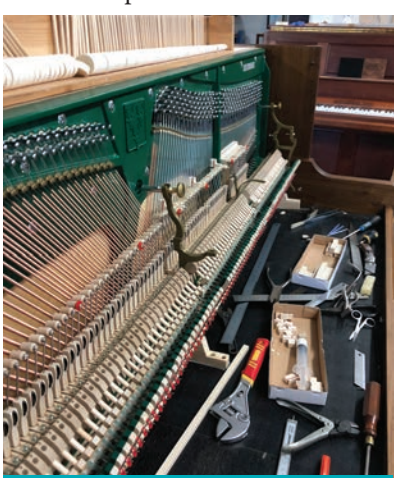
In July, members of the Musical Acoustics Group and Yorkshire and North East groups visited one of the few remaining piano makers in Britain, Yorkshire Pianos, makers of Cavendish Pianos, which was started in 2012 in Leeds by Adam and Charlie Cox. Adam talked about the history of piano making in the UK and the story behind Yorkshire Pianos.

At the turn of the century when piano playing was one of the main sources of entertainment in homes, there were many piano makers in Britain. As times changed and fewer people wanted pianos, the manufacturing trade declined and with it, many of the skills and templates used for making the traditional 'English-sounding' piano.

Adam explained the production and assembly of each element of the piano, discussing the different material properties of each part. Solid hardwood, such as walnut, is used for the cabinet whereas a close grain softwood, such as alpine spruce, is used for the soundboard. Douglas fir is used for the back-posts because of its tight and straight grain, which provides strength. Adam described how their pianos are hand-built, from the crowning of the soundboard to assembling the bridge.

He also discussed the different, mellower sound traditionally associated with English pianos, as opposed to the newer Japanese and continental manufacturers, and how the shape and choice of materials impacted on this sound.

There is a strong emphasis on quality and use of local skill where possible. Cavendish have created a craftsman's cooperative, bringing together skills from small businesses in the local area and the UK more widely. The hand-wound strings, satinwood veneer, felt and the cabinet are sourced from British suppliers and the bespoke metal frames are cast by a small foundry in Scotland.



The final stages of building a Cavendish piano

The presentation was followed by a tour of the workshop to see the pianos being built. Many thanks to Adam for hosting us.

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An introduction to sound power standards

By Mark Dowie, Application Specialist at Brüel & Kjaer

There are many reasons to perform sound power measurements and there are many standards to reflect this. This is a brief guide to the ISO standards available and what sort of measurement equipment is required.

The most commonly used sound power standards are:

- ISO 3744;
- ISO 3745; and
- ISO 3746.

These can be used for a very wide range of noise sources and are suitable for agricultural or construction machinery, pumps, generators and other industrial equipment. They would also be used to assess the sound power of domestic products like washing machines, vacuum cleaners, power tools and even dustbins. These three standards require a test area that is as close to a free-field as possible, the repeatability, due to background noise and reflections of the measurement environment will determine which of the three standards you are able to use.

An open area with minimal reflecting surfaces and a consistently low background noise; or a large room with a hard floor and some sound absorbing material on the walls would be sufficient for measurements to **ISO 3744:2010** (*Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free-field over a reflecting plane*). Good measurements can be performed in car parks after working hours and store rooms lined with office dividing panels.

If you have an anechoic chamber that is at least three times the width, length and height of your source, then you could use the precision method described in **ISO 3745:2012** (*Determination of sound power levels and sound energy levels of noise sources using sound pressure – Precision methods for anechoic rooms and hemi-anechoic rooms*).

The simplest method is **ISO 3746:2010** (*Determination of sound power levels and sound energy levels of noise sources using sound pressure – Survey method using an enveloping measurement surface over a reflecting plane*), this allows correction for almost any test environment but has the greatest measurement uncertainty. ISO 3746 is a useful method for acquiring real sound power data for use in environmental noise maps.

For each of these standards it is possible to use a Class 1 sound level meter, however, as the sound power calculation will require at least six measurement positions, it is much quicker to use a multichannel analyser with Type 1 microphones. If the source is not stable then it will be necessary to measure over a period that captures the range of levels produced by the source, for this, a multi-channel system will significantly reduce the test time.

All three methods describe various techniques for calculating the positions of the microphones, although the hemisphere shown in Figure 1 (below) is the most frequently used.

The calculations in these methods is based on the approximation to a free-field with little or no reflections, so that the measured level is only direct sound from the source.

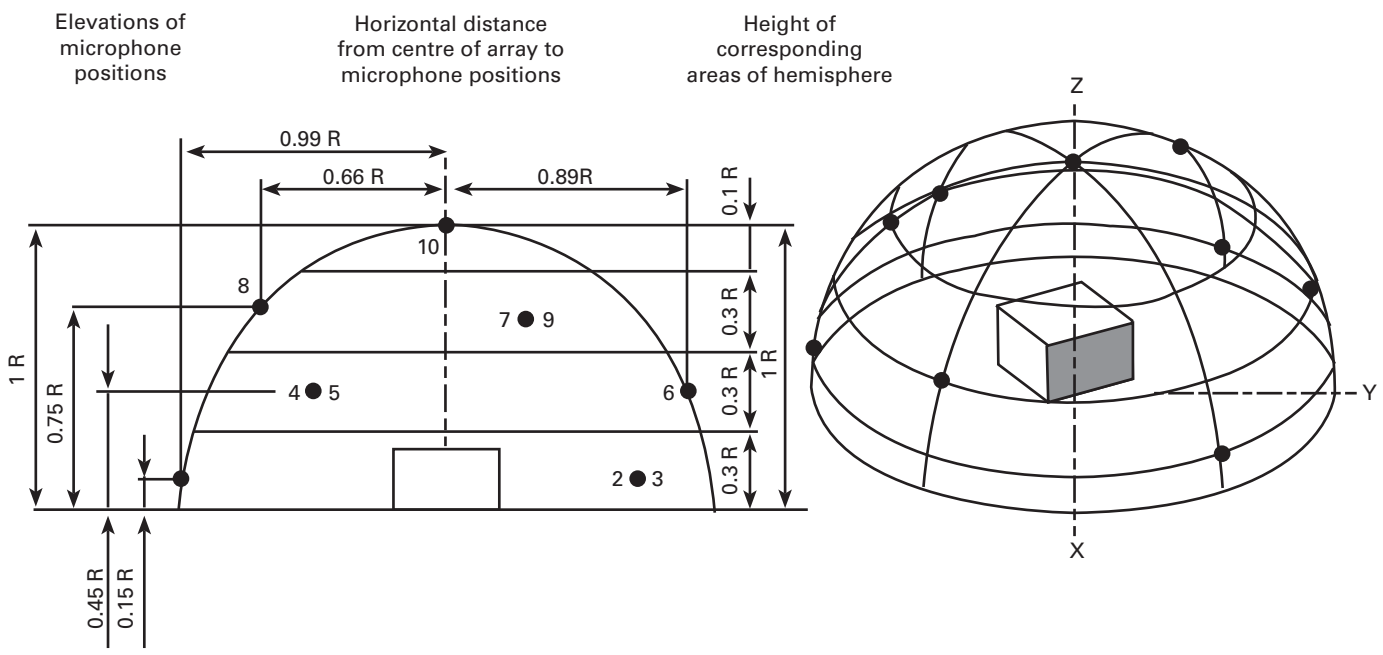

Figure 1 Microphone positions on equal areas on the surface of a hemisphere

Measurements in a reverberant chamber

The following standards provide methods for measurements in a reverberant chamber and would typically require random incident or diffuse field microphones. These methods either use multiple measurement locations or a rotating boom to take sample measurements of the stabilised sound field. For this reason, reverberation standards are best suited to sources that run at a consistent level.

ISO 3741:2010 (*Determination of sound power levels and sound energy levels of noise sources using sound pressure – Precision methods for reverberation test rooms*).

ISO 3747:2010 (*Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering/survey methods for use in situ in a reverberant environment*).

ISO 3743-1:2010 (*Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for small movable sources in reverberant fields – Part 1: Comparison method for a hard-walled test room*).

ISO 3743-2:2018 (*Determination of sound power levels of noise sources using sound pressure – Engineering methods for small, movable sources in reverberant fields – Part 2: Methods for special reverberation test rooms*).

Intensity-based methods

If you do not have access to a free-field environment with low background noise or a reverberant room, then you maybe be able use one of the intensity-based methods.

ISO 9614-1:1993 (*Determination of sound power levels of noise sources using sound intensity – Part 1: Measurement at discrete points*).

ISO 9614-2:1996 (*Determination of sound power levels of noise sources using sound intensity – Part 2: Measurement by scanning*).

ISO 9614-2:1996 (*Determination of sound power levels of noise sources using sound intensity – Part 3: Precision method for measurement by scanning*).

These work well for sources that can run in the steady state. Intensity systems tend to be less expensive than six or 10 channel systems used for ISO 3745 and 3744, and do not require a special acoustic environment. Intensity methods provide very quick, accurate results for small stable sources. By dividing the surface area of the source into squares (as per Figure 2) it becomes easy to perform reliable measurements even on large and complex sources such as diesel generators and industrial pumps. The scanning method allows for the intensity probe to be placed very close to the source – reducing the need for large test areas.

P16 ►

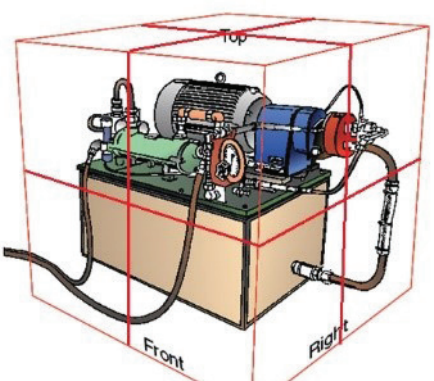

Figure 2 Virtual box over test object divided into squares

Figure 3 Rotating boom in reverberant chamber with acoustic diffusers

Heating, ventilation and air moving equipment testing

For manufacturers of heating, ventilation and air moving equipment, particularly if they need to test the several components as a system, then the following standards will apply:

ISO 5135:1997 (*Determination of sound power levels of noise from air-terminal devices, air-terminal units, dampers and valves by measurement in a reverberation room*). This has similarities to ISO 3741 and is usually performed using a microphone on a rotating boom (Figure 3). The analyser, which could be a sound level meter, measures for one full rotation of the boom. (This standard is about to be replaced by **ISO/NP 5135**).

ISO 13261-1:1998 (*Sound power rating of air-conditioning and air-source heat pump equipment – Part 1: Non-ducted outdoor equipment*).

ISO 13261-2:1998 (*Sound power rating of air-conditioning and air-source heat pump equipment – Part 2: Non-ducted indoor equipment*).

ISO 5136:2003 (*Determination of sound power radiated into a duct by fans and other air-moving devices – In-duct method*). This method requires a microphone, ideally pressure-field, to be placed in the flow of air inside the duct. To prevent wind induced noise on the microphone diaphragm it is necessary to use a nose cone or turbulence screen (Figure 4).

P18 ▶

Fans

There is also a set of standards specifically for fans:

ISO 13347-1:2004 (*Determination of fan sound power levels under standardised laboratory conditions – Part 1: General overview*).

ISO 13347-2:2004 (*Determination of fan sound power levels under standardised laboratory conditions -- Part 2: Reverberant room method*).

ISO 13347-3:2004 (*Determination of fan sound power levels under standardised laboratory conditions – Part 3: Enveloping surface methods*).

ISO 13347-4:2004 (*Determination of fan sound power levels under standardised laboratory conditions – Part 4: Sound intensity method*).

New detailed guide

Please be aware that the International Standards Organisation (ISO) is about to release **ISO/DIS 3740**, which will be a detailed guide to the ISO sound power standards. All the standards mentioned in this article are available from **www.bsigroup.com/en-GB/standards**

Figure 4 Microphone nose cone

The most commonly used sound power standards, ISO 3744, ISO 3745 and ISO 3746 can be used for a very wide range of noise sources and are suitable for agricultural or construction machinery, pumps, generators and other industrial equipment

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Sustained certificate course recruitment and a new opportunity for the CCBAM

By Keith Attenborough, Education Manager

The Certificate of Competence in Environmental Noise Measurement (CCENM) continues to be the most popular of the IOA Certificate courses. In May 2018 there were 90 candidates (including five resits) at 11 centres, of whom 85 passed. Feedback about the course administration received from a tutor will result in changes to some of the pro-forma documents.

There were 21 candidates at three centres for the March 2018 Certificate of Competence in Workplace Noise Risk Assessment (CCWPNRA) of which 15 were successful. Since applications have been relatively few in recent years, the management committee is considering ways of altering the course to make it more attractive. Moreover, we still seek a successor for the current Chairman (Dave Lewis). Expressions of interest should be sent to: **education@ioa.org.uk**

There were 11 candidates for the Certificate of Competence in Building Acoustics Measurement (CCBAM) at Solent University and nine have passed. The Air Tightness Testing and Measurement Association (ATTMA) plans to use CCBAM as part of its Building Controller approved accreditation scheme for pre-completion sound insulation testing and this will result in significantly more candidates. Insufficient recruitment for the Irish version (CCIBAM) meant that it was not run in spring 2018.

The Certificate of Proficiency in Antisocial Behaviour etc. (Scotland) Act 2004 Noise Measurements (ASBA) has not been run at Strathclyde University for some time but continues to be delivered by Bel Noise Courses and nine candidates passed in May 2018.

At present, the Certificate of Management of Occupational Exposure to Hand Arm Vibration (CCMOEHAV) is offered only once a year. In April 2018 it was passed by six candidates at two Centres (Leeds Beckett University and Institute for Naval Medicine). Sadly, the current Chair of the management committee, Tim South, retired in July 2018. Although he is receiving a distinguished service award from the IOA, in the context of this report I would like to express my thanks to Tim for his work in creating and managing CCMOEHAV. P22 ►

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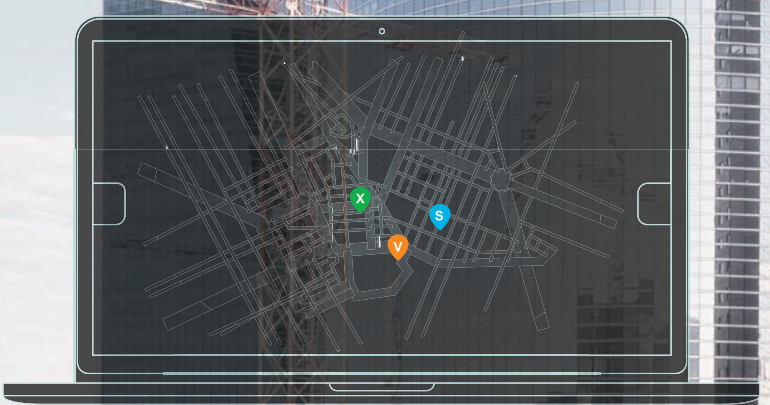

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Lists of successful candidates

ENVIRONMENTAL NOISE MEASUREMENT

Bel Noise Courses

B Aitken	K C Cheape	G W Massie
J A Murray	C D Myles	K Nolan
A Park	F Smith	

Colchester Institute

J F Bates	C Coker	L Ernest
M A Evans	K Gingell	K Goss
N D Goulding	L J Manning	M D G Meredith
B Mills	K Nixon	S Tomlins

University of Derby

K Abadie	M Alexander	S Dixon
A Dowden	N Mace	J Pope
A Williams		

EEF Sheffield

G Cunliffe	C W Richardson	B Sutton

Liverpool University

R Adewara	A D Anderson	S J Bewsher
C Cada	P Campini	P D Carr
A M Coward	J A Jordan	S Khan
N Mercieca	A Nagle	D O'Malley
S B Robinson	S M Ross	M Spiteri
M Walder		

London South Bank University

L Curtis	R Gopauloo	T Lincoln-Gordon
A R Love	M H Lynch	H E M Mainwaring
N Pigula	R O Webb	

Shorcontrol

P Codd	M P Horgan	V Lavigan
R Lynch	P McGarry	B McIntyre
S McKinley	M McMenamin	M McMenamin
D Naughton	J Spicer	

Shorcontrol Safety Ltd

S Clarke	A Culbert	N Hickey
S J McDermott	L McIntyre	V Mooney
H O'Hanlon		

Southampton Solent University

S Dickenson	L J Jennings	W P Le Lievre
C L Le Lievre	J W McLucas	S Paszek

Ulster University

U Barrett	K Conlon	A Faulkner
A J Graham	G Kelly	A E Poots
L Taylor	S Turkington	

WORKPLACE NOISE RISK ASSESSMENT

University of Derby

S Brown	M Burgin	A Connolly
D O'Malley	M J Padgett	N R Pratley
R J Silvers	V H Tuft	

EEF Sheffield

P J Gordon	I C Parry	W J Stephens

Shorcontrol Safety Ltd

P Carroll	O Hughes	S Manning Doyle
D Woods		

BUILDING ACOUSTICS MEASUREMENT

Southampton Solent University

TA Attieh	A Bhatt	M Hasan
M Hassett	A Jennings	M Malone
D McGilchrist	S Miller	M M Qartillu

ANTI-SOCIAL BEHAVIOUR NOISE ACT (SCOTLAND)

Bel Noise Courses

S T Currie	B Sim	I W Campbell
A Clark	N Hume	M R Jawniak
G Lightbody	A G McLean	C D Young

HAND ARM VIBRATION

Leeds Beckett University

P J Campbell

Institute of Naval Medicine

S F Arnold	D Burrow	J Carstairs
A J R Cormack	D A Wilson	

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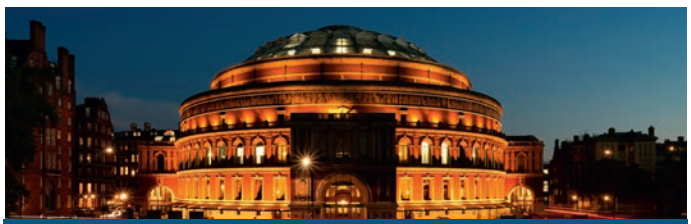
Theatres and live venues win protection from noise complaints

New policy means property developers in England will now have to ensure their buildings are protected from the noise of nearby live entertainment venues, in an update to planning policy hailed as a victory for the music and theatre industries.

Until now, theatres near new developments have faced the threat of restrictions to their licences or even closure, because of potential noise complaints from people moving into properties nearby that were granted planning permission after the live venues were established.

More robust measures to protect theatres from such threats, have led venues to call for the 'agent of change' principle – where the onus is placed on developers to ensure new buildings are soundproofed from any noise from existing venues – to be applied to planning decisions.

Local authorities are now legally bound to comply with the National Planning Policy Framework (NPPF) and therefore need to be mindful of it when considering planning applications.



Local authorities are now legally bound to comply with the NPPF

Early violins designed to mimic the sound of the human voice

New research carried out at the National Taiwan University has found that the sound of violins made by Amati and Stradivarius closely mimics the resonances of the human voice.

The design of the modern violin has barely changed since Andrea Amati began making his instruments in Cremona, Italy in the 16th century. And now scientists think they may have pinpointed why his design has endured for almost 500 years.

Stradivarius violin

It is well established that early violin makers strived to recreate the sound of the human voice. The Baroque violinist Francesco Geminiani (born in Italy in 1687) wrote in his work, 'The Art of Playing on the Violin', that the secret to performance was "giving the instrument a tone that shall in a manner rival the most perfect human voice."

Hwan-Ching Tai, Yen-Ping Shen, Jer-Horng Lin and Dai-Ting Chung used speech analysis techniques to look at the resonances of a number of violins. The study included two of the oldest to have survived: the 1570 Andrea Amati violin and the 1560 Gasparo da Salo violin.

They also analysed the sound of six Stradivari violins and seven Italian violins from the same period. The scientists compared the sounds of the violins with the sounds of eight female and eight male singers singing English vowels.

They found that the resonance of Amati instruments was very close to that of a male singing voice, while those made by Stradivari more closely resembled the sound of tenors and altos.

Ultrasound could help treat patients with dementia

Ultrasound waves applied to the whole brain improve cognitive dysfunction in mice with conditions simulating vascular dementia and Alzheimer's disease. The research, conducted by scientists at Tohoku University in Japan, suggests that this type of therapy may also benefit humans.

The team, led by cardiologist, Hiroaki Shimokawa, found that applying low-intensity pulsed ultrasound (LIPUS) to the whole brain of the mice improved blood vessel formation and nerve cell regeneration without having obvious side effects.

"The LIPUS therapy is a non-invasive physiotherapy that could apply to high-risk elderly patients without the need for surgery or anaesthesia, and could be used repeatedly," says Shimokawa.

Focusing LIPUS treatment on the hippocampus, which is involved in memory, has also been found to improve dementia in mice, but the details of how it does this need to be more fully investigated.

The researchers conclude that their study provides the first experimental evidence that whole-brain LIPUS therapy markedly improves cognitive dysfunctions without serious side effects by enhancing specific cells related to dementia's pathology.

The first clinical trials to evaluate the effectiveness and safety of the LIPUS treatment are already underway.

Whole-brain LIPUS therapy markedly improves cognitive dysfunctions without serious side effects

Sound Masking

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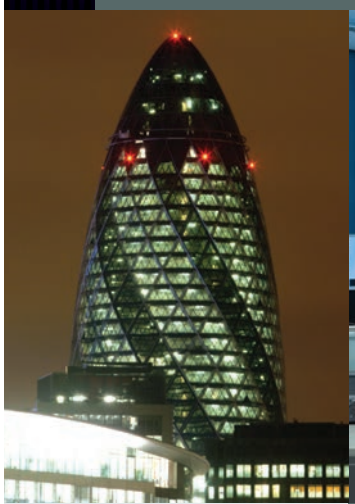

Cellular offices achieve better speech privacy with Sound Masking

Sound Masking is a cost effective solution to the problem of improving speech privacy in today's modern office environment. Best installed during office fit out but often installed as retrofit, Sound Masking from AET has improved the office environment for many international companies throughout Europe over the last 20 years.

In today's office speech privacy becomes a key aim and open plan offices can suffer from two speech problems:

- Other people's conversations can be an irritating distraction
- Confidential conversations can be almost impossible to conduct

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Sound Masking is also known as sound conditioning or white noise systems

New acoustic technology can monitor babies' movements in the womb

Monitoring the movements of babies in the womb is crucial to providing medical help when it's needed. At the moment, reliance is put on mothers-to-be noticing if their child has stopped moving around as much and then seeking medical help.

Dr Niamh Nowlan, from the Department of Bioengineering at Imperial College London, explains: "Foetal movements are an important sign of the baby's health. However, there is currently no way to monitor foetal movements outside of a hospital."

Acoustic sensors to detect foetal movements can account for movements of the mother

Now, Dr Nowlan with Dr Ravi Vaidyanathan, from the Department of Mechanical Engineering, and their collaborators have developed a sensor that can be worn for extended periods and tracks the baby through its movements and sound.

There have been previous attempts to create a system that could be worn over extended periods that have relied on accelerometers but these often couldn't tell the difference between the movements of the mother and those of the child. The new technology uses a combination of accelerometers with new acoustic sensors.

Dr Nowlan said: "Our device is the first to use acoustic sensors to detect movements. It can account for movements of the mother, which other previously proposed sensors cannot."

The device was tested for accuracy by checking its results against ultrasounds being run simultaneously, and was found to be effective in detecting strong, fast movements of the baby.

Noise on paediatric wards could limit quantity and quality of sleep

In paediatric wards with high levels of night noise, children slept around an hour less and had poorer quality sleep, compared with sleeping at home, according to a small study from Southampton Children's Hospital. This could affect the child's behaviour, recovery and pain tolerance, the researchers suggest.

Senior author, Dr Catherine Hill, Associate Professor of Child Health, Honorary Consultant Paediatrician in Sleep Medicine, said: "We've shown in the largest group to date that the general paediatric hospital setting has an adverse impact on sleep quantity and quality, and that it is noisier in hospital than at home. We know that hearing is our most attuned sense during sleep, and this is especially relevant in hospital with the high-pitched sounds of bleeps and similar."

Published in the July 17th edition of Archives of Disease in Childhood, the study found that the average median sound level recorded in hospital was 48.24 dB with a difference of around 8 dB between open bays and single occupancy cubicles. Of note, children were exposed to significantly higher noise levels than World Health Organisation (WHO) recommendations that state night noise in hospital should not exceed 30 dB, with peaks not exceeding 45 dB.

In this study, Hill and colleagues aimed to measure sleep quality objectively in both children and their co-sleeping parents admitted to medical wards at Southampton Children's Hospital and to compare this with their sleep at home.

Children aged between three and 16 years, and their parents who stayed overnight, had their sleep measured objectively using wristwatch 'actigraphy' for up to five consecutive nights in hospital and five nights at home. Sound levels were monitored overnight using a sound level meter at the patient's bedside for up to two nights in hospital and two nights at home. Sleep quantity and quality were assessed for 40 children and 16 co-sleeping mothers, and eight children had sound level monitoring. Sleep quantity at the two locations was compared for each child and parent.

Dr Hill explained that they did not measure the inter-relationship between sleep quality and noise levels, but that it was reasonable to infer that noise will have affected sleep – "the sleeping brain is highly attuned to sound, an important evolutionary defence to potential threat."

She noted that the research brought the importance of sleep to the attention of paediatricians and doctors generally. "Sleep is a 'black hole' in medical education, and doctors' understanding of the function and importance of sleep is very limited. But we need to remember that sleep sub-serves nearly all physiological functions, in particular, cognitive performance, endocrine health, and growth, but somehow this has not translated to medical knowledge.

"Wards are designed by default to disrupt sleep with routines, shift times, ward rounds, and meal times running like clockwork and they tend to be designed around adult sleep needs. Children's wards are very bright with pictures of clowns, therapy dogs, everything that appeals to children's minds, but we've lost sight of the fact that children also need to sleep."

The sleeping brain is highly attuned to sound

Shooing birds away with sound

John Swaddle, professor of biology at the College of William and Mary, Williamsburg, Virginia, has designed a sonic net to drive birds away from places where they're not wanted, for example, airports.

He explained: "We are broadcasting sounds that make it difficult for the birds to hear each other – if birds can't hear each other, they can't listen out for predators. And if birds can't listen for predators, they go somewhere else.

"The sound of aeroplane engines is not enough to drive birds away, they have a lower pitch than birdsong, so birds can still communicate over them."

Swaddle is also working on a different technology designed to warn birds before they hit structures. "Surprisingly, when birds are flying, they're not really looking where they're going," he said.

The sound of aeroplane engines is not enough to drive birds away

To solve this problem, the device (termed the 'acoustic lighthouse') would project a beam of sound about 100 metres in front of obstacles like wind turbines and buildings, giving birds a warning and a chance to fly around them.

Supermarket introduces 'quieter hour'

Morrisons have introduced a 'quieter hour' in all their stores – designed help customers who currently struggle with music and the other noise associated with supermarket shopping.

This new initiative was created with the support of the National Autistic Society and having carried out a trial earlier in the year in three stores, Morrisons identified improvements that could be made as well as the best time for the quieter hour to take place.

Now, every Saturday between 9.00am and 10.00am, the lights are dimmed, all music is switched off and are no Tannoy announcements. The movement of trolleys and baskets is kept to a minimum and checkout beeps are turned down.

Morrisons have introduced a 'quieter hour' in all their stores

Ultrasound can trigger and enhance cancer drug delivery

Scientists in the UK have shown for the first time that focused ultrasound from outside the body can improve the delivery of cancer drugs to tumours in humans. In the clinical trial, the team injected 10 patients with heat-sensitive capsules filled with a chemotherapy agent and then heated tumours with ultrasound. The technique could reduce the dose of toxic drugs needed to treat cancers and lead to news ways of dealing with tumours that are hard to treat with conventional chemotherapy, according to the researchers.

Delivering an effective dose of drugs to a tumour while minimising toxicity elsewhere in the body is a major challenge in cancer treatment. One promising idea involves using drug-filled nano-capsules. These capsules increase the half-life of chemotherapy agents in the body and are designed to accumulate – either passively or through active targeting – in tumours. But they do not always release their payload effectively.

In the latest study, described in The Lancet Oncology, Paul Lyon and colleagues at the University of Oxford conducted a 10-patient phase 1 clinical trial to test the safety and feasibility of using focused ultrasound to heat liver tumours and trigger the release of a chemotherapy drug from heat-sensitive, lipid-based carrier.

Temperature-sensitive carrier

All 10 patients had inoperable liver tumours. Under general anaesthetic, they each received a single intravenous dose of the chemotherapy agent, doxorubicin, encased in a temperature-sensitive liposomal carrier. A focused ultrasound device, operating at a frequency of 0.96 MHz, was then used to heat the target liver tumour to over 39.5°C – which is the temperature at which the capsule is designed to release the drug.

In six patients, the temperature of the tumour was monitored using a temporary implanted probe, and tumour biopsies were taken before and after drug infusion, and after ultrasound exposure to estimate drug concentration within the tumour at different treatment stages. In the remaining four patients, biopsies were only taken after ultrasound exposure. The researchers used predictive models to calculate the ultrasound parameters needed to heat the tumours to a temperature in the range of 39.5–43°C. The researchers say this procedure better reflects how the technique might be used in clinical practice.

Following focused ultrasound exposure, doxorubicin concentrations within the tumours increased by an average of 3.7 times. In seven out of the 10 patients there was at least a doubling of the drug within the tumour. One patient showed an estimated nine times increase in drug concentration within their tumour after ultrasound heating.

The researchers say that their results build on decades of promising preclinical research to demonstrate that it is possible to safely trigger the release of cancer drugs deep within the body using focused ultrasound. They add that the several-fold average increase in drug concentration seen, highlights the clinical potential of such techniques.

"Only low levels of chemotherapy entered the tumour passively. The combined thermal and mechanical effects of ultrasound not only significantly enhanced the amount of doxorubicin that entered the tumour, but also greatly improved its distribution, enabling increased intercalation of the drug with the DNA of cancer cells," explains Lyon.

This opens the way not only to making more of current drugs, but also targeting new agents where they need to be most effective.

Scientists use hydrophone to listen to methane seeps in ocean

A research team has recorded the sound of methane bubbles from the seafloor off the Oregon coast using a hydrophone, opening the door to using acoustics to identify (and perhaps quantify) this important greenhouse gas in the ocean.

The next step, researchers say, is to fine-tune their ability to detect the acoustic signature of the bubbles so they can use the sounds to estimate the volume of methane in the offshore reservoirs.

Results of the study have just been published in the journal, Deep-Sea Research II.

"The bubbles in the streams make sound, and the frequency of the sound is related to the size of the bubble," said Robert Dziak, an acoustics scientist with the National Oceanic and Atmospheric Administration and lead author on the study. "The smaller the bubble, the higher the pitch. And the larger the bubble, the lower the sound pitch, but the more methane it contains.

"Our ultimate goal is to use sound to estimate the volume and rate of methane gas exiting these seafloor fields," added Dziak, who has a courtesy appointment in Oregon State University's College of Earth, Ocean, and Atmospheric Sciences.

In recent years, scientists have found hundreds of bubble streams emanating from methane deposits off the Pacific Northwest coast, but they have no way to determine how much methane is stored there. Methane is found both as an icy hydrate deposit and in a gas phase within the sediments of the continental margins.

It potentially could be a new energy source, or it could pose a serious environmental threat as a greenhouse gas.

The research team used the remotely operated vehicle (ROV) Hercules from the Exploration Vessel (E/V) Nautilus, owned and operated by the Ocean Exploration Trust, to deploy a hydrophone about 10 kilometres off Heceta Bank on the Oregon continental margin in 1,228 metres of water. The acoustic signatures of the bubbles from the seep site are depicted in the hydrophone record as a series of short, high-frequency bursts, lasting two to three seconds.

The researchers then compared the sound record with still images from the ROV and found their estimates of bubble size from the hydrophone record matched the visual evidence.

Smiles have a sound and are contagious

People don't need to see a smile to perceive it

Smiles are a universal human signal understood across cultures and scientists have documented how the sight of a various facial gestures, including a genuine or 'Duchenne' smile, can trigger the same in its viewer.

In 2008, scientists in the UK found that people don't even need to see a smile to perceive it. We can pick out the 'sound' of different types of smiles when listening to someone speak.

Now new research suggests that not only can we identify what the study authors call the "spectral signature of phonation with stretched lips" or "the smile effect" in speech, but that it seems to register on an unconscious level. And it inspires imitation.

To conduct their experiments, the Paris researchers first recreated the smile's auditory signature digitally, creating software that adds a smile to any recorded voice. They attached electrodes to the facial muscles of their 35 participants to see whether they could detect the sound of a smile in recorded French sentences, some of which were manipulated to include the effect, others not.

Their results showed that not only could the listeners most often hear the enhancement, even when they consciously missed a smile, their zygomaticus-major muscles prepared to grin in response to it.

Admittedly, they acknowledge that they don't know how the experiment would have turned out had its participants not been asked to listen specifically for a smiling voice. Nevertheless, they argue in the paper that "the cognition of smiles is not as deeply rooted in visual processing as previously believed."

One day, this line of inquiry could help scientists more fully understand how people with autism comprehend or misinterpret emotions in speech, accorining to lead author, Pablo Arias.

His work exploring what he called "a profoundly deep gesture in the human repertoire," the smile, might one day improve computer-generated speech used by people with disabilities, Arias, an audio engineer and cognitive scientist at the Institute for Research and Coordination in Acoustics/Music, also said. (His team is now studying the sounds of anger in the same way.)

How or why people can hear smiles without realising it isn't clear. The authors speculate that the mechanism could have to do with the same automatic responses we use to understand words, for instance, or that we make an implicit "emotional appraisal," they write, that is "somehow not reaching conscious awareness."

The Hush City project and its relevance to planning policy

By Philip Dunbavin and Antonella Radicchi

Let me start with a little history.

Noise Policy Statement for England

In March 2010, the Department for Environment Food and Rural Affairs (DEFRA) published the Noise Policy Statement for England (NPSE). This was aimed at promoting good health and a good quality of life through the effective management of noise, within the context of Government policy on sustainable development.

National Planning Policy Framework

Then in March 2012, the Department for Communities and Local Government replaced over 1,000 pages of national policy with the National Planning Policy Framework (NPPF). The NPPF was some 50 pages long and left a vast vacuum; in that it did not contain any objective numbers. What it did contain, was a clear statement as to what planning policies should aim to achieve.

In the NPPF, at paragraph 123, the fourth aim is stated as: *"…identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

While this is clearly a desirable objective there is no guidance on how to identify, let alone protect, these areas of tranquillity. The development of soundscape clearly has the potential to do just that. However, full soundscape studies are not cheap to undertake and very few planning authorities have the budget for an extensive number of them.

Soundscape

In 2014, the ISO norm on soundscape definition and its conceptual framework was published, and a new ISO norm to standardise soundscape data collection and reporting requirements is under preparation (1). These ISO norms are fundamental to the achievement of data quality and to the development of consistent and robust comparative studies in soundscape research, and they can contribute to the establishment of the emerging soundscape science.

At Euronoise 2018, in Crete, Antonella Radicchi presented a paper on the use of mobile applications in soundscape research (2). This was a bit of a 'eureka moment' because that paper has enormous implications for the protection of tranquil areas. The Environmental Noise Directive (END) results in maps of noisy or non-tranquil places and this is driven by road, railways and airports. Even laypersons would expect the sound levels caused by those transportation methods to be far less than tranquil. This app does something new – it helps planning authorities to locate areas that are tranquil in places they may never have thought to look. Even more significant, is that this can be achieved at virtually no cost to planning authorities

A screening of mobile apps available on the market to crowdsource and produce noise and sound maps was conducted through a literature and market review by Dr Antonella Radicchi, at the Technical University of Berlin, Germany. She found that 28 mobile apps had been available between 2008 and the end of 2016. The full list of these apps is given in her paper (2) presented at Euronoise 2018.

Out of these 28 apps, 16 are noise meter-based applications and 11 are audio recorder-based ones. Only SoundOfTheCity works both as a sound recorder and as a noise meter, even if the data collection process of audio recordings and noise measurements is not sequential.

This state of the art reflects the current dichotomy between the two main approaches applied nowadays to analyse and evaluate the sonic environment: the noise-based approach and the soundscape approach.

The former relies on quantitative indicators (e.g. acoustical indices) and the usual remedy is to apply anti-noise strategies to noise sources. The latter focuses on the "acoustic environment as perceived, experienced, and/or understood by people, in context" (3) and it applies more qualitative and interdisciplinary measures to evaluate and (re)design the sonic environment.

Clearly, there was a lack of an app that could enable the simultaneous and sequential collection of complex mixed data, to effectively integrate the soundscape approach with the noise-based one to reach a holistic and mixed approach, as indicated by the European Environment Agency, especially in the framework of research on quiet areas (4).

Methods to identify areas of tranquillity

As reported in (Radicchi 2017; Radicchi et al. 2017)(6), the END draws the attention of protecting and planning quiet areas as an effective measure to reduce noise pollution, and it defines the concepts of a 'quiet area in open country' and a 'quiet area in an agglomeration', by applying noise indicators and thresholds, which should be set up by the respective Member States.

However, END does not provide any common methodology to protect and plan quiet areas. Consequently, the Member States and academic scholars have experimented with diverse methods, mainly based on:

- Acoustical criteria, such as 'noise indicators' defined by the Member States;
- Distance-based criteria; and
- Mixed criteria: composed of acoustical, size-based and land use-based criteria, or the integration of acoustical criteria with accessibility-based criteria, the SLOPE indicator, the TR indicator – to name only a few.

Although in professional and academic environments, a growing interest towards the inspection of qualitative definition of concepts like quietness and tranquillity has been registered, especially in the frame of research in quiet areas, experimentation with digital new media to favour public participation and the collection of people's preferences is still at the very beginning, with few examples available.

Taking inspiration from citizen science trends in the use of GPS-equipped smartphones as sensors in data collection, and evaluations in the field of environmental noise, the idea P32 ►

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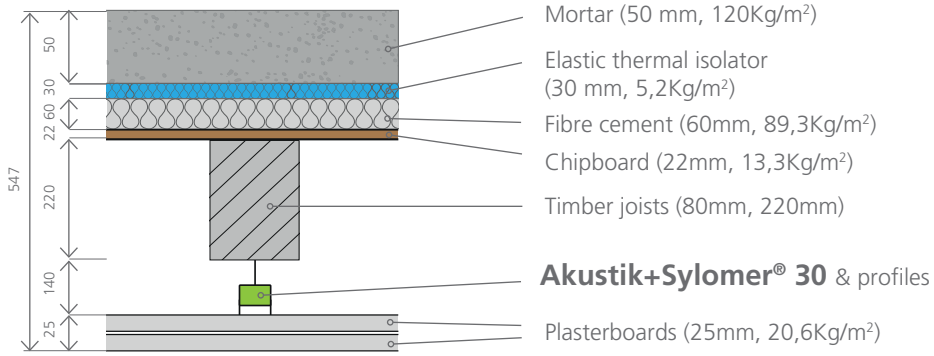


SCAN FOR FULL REPORT

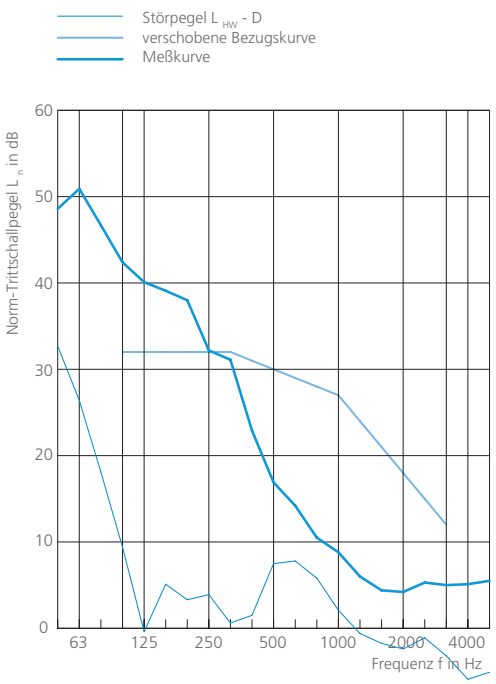
IMPACT NOISE

$L_{n,w}$	**30 dB**
$L_{n,w,*}$	**30,0 dB**
max Abw.	10,4 dB / 100 Hz
Summe	31,8 dB

Norm	DIN EN ISO 717
$L_{n,sum,\ 100\text{-}2500}$	46,6 dB
$C_{I,\ 100\text{-}2500}$	2 dB
$L_{n,sum,\ 50\text{-}2500}$	54,6 dB
$C_{I,\ 50\text{-}2500}$	10 dB

f(Hz)	L_n (dB)	L_{HW}-D	L_b
50	48,6	-	-
63	50,9	-	-
80	46,7	-	-
100	42,4	-	-
125	40,1	-	-
160	39,1	-	-
200	38,0	-	-
250	32,2	-	-
315	31,1	-	-
400	22,9	-	-
500	16,9	x	x
630	14,2	x	x
800	10,5	x	x
1000	8,8	x	x
1250	6,0	-	x
1600	4,4	-	2,6
2000	4,2	-	4,0
2500	5,3	-	4,2
3150	5,0	-	5,0
4000	5,1	-	6,1
5000	5,5	-	6,9

Probekörper Nr. 44694/19 Klima 10°C, 61%



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x <=> Wert korrigiert
99.9 <=> Korr.= +1.3 dB

AIRBORNE NOISE

R_w	**82 dB**
$R_{w,*}$	**82,3 dB**
max Abw.	11,1 dB / 100 Hz
Summe	27,9 dB

Norm	DIN EN ISO 717
$C_{100\text{-}3150}$; $C_{tr,100\text{-}3150}$	-4;-11
$C_{50\text{-}3150}$; $C_{tr,50\text{-}3150}$	-17;-31
$C_{100\text{-}5000}$; $C_{tr,100\text{-}5000}$	-3;-11
$C_{50\text{-}5000}$; $C_{tr,50\text{-}5000}$	-16;-31

f(Hz)	R (dB)
50	27,7
63	34,6
80	43,2
100	51,9
125	64,4
160	64,1
200	69,0
250	72,4
315	77,0
400	80,5
500	79,6
630	82,8
800	83,9
1000	86,5
1250	89,3
1600	87,8
2000	87,9
2500	85,5
3150	86,7
4000	90,0
5000	87,5

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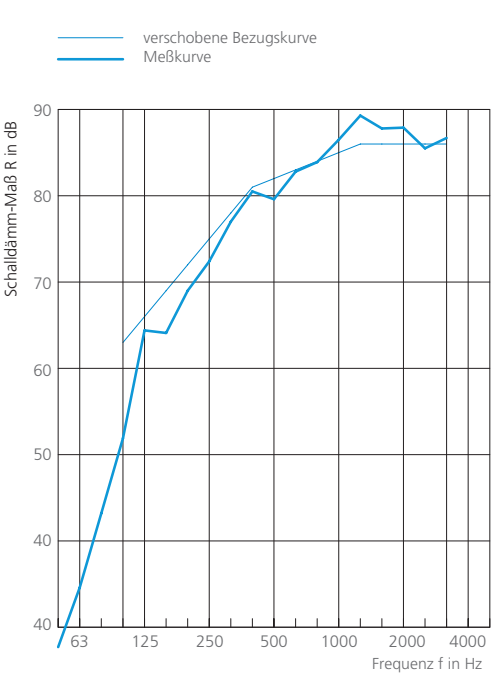

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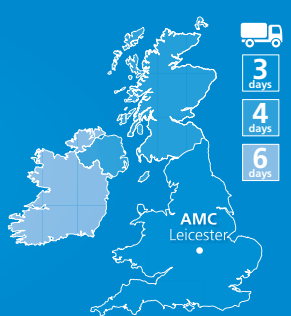

of using a mobile app to identify, map and evaluate 'everyday quiet areas' seemed to be appropriate, as it can be used by means of smartphones and carried out by citizens in their everyday life, independently of the researchers.

After reviewing the state of the art, the option to re-use an existing app was discarded, because there was no mobile application on the market that enabled the simultaneous and sequential collection of mixed data, such as audio recordings and related noise pressure levels, pictures of the place where the sounds are recorded, user feedback on the location where the sounds are recorded, and that addressed a variety of issues, such as the quality of the sonic environment and of the overall location, sense of security, accessibility, user behaviour, weather conditions and many others (see below for more details). Consequently, the Hush City app was developed from scratch.

The Hush City app

The Hush City app was developed to fill this gap. It is a novel, free mobile application, launched in April 2017 as a tool to crowdsource, evaluate and map everyday quiet areas (5).

The Hush City app (re)places people at the core of the sonic environment evaluation process and it is aimed at understanding what quietness is for people. It goes beyond the definitions of quiet areas, applied within the context of EU-funded research projects, which are mainly based on quantitative criteria – such as acoustical indicators, land use criteria, size-based criteria or a combination of the above (5).

The most innovative aspects of the Hush City mobile application include both the data collection and the data consultation processes. In regard to innovation in data collection, the Hush City app allows the sequential collection on the same location and by the same user of a complex set of mixed data in a limited timeframe (approximately three minutes). The mixed data collectable consists of audio recordings and related sound pressure levels, pictures of the place where the sounds are recorded and user feedback on the location where the sounds are recorded.

User feedback is collected by means of a predefined questionnaire, structured in three sections; soundscape, general issues and issues related to activities.

Questions are designed to explore the correlation between the soundscape and the following topics:

- emotional responses;
- semantic descriptors;
- perceived quietness;
- positive and negative sounds;
- level of oral interaction and social communication;
- sense of the place;
- landscape quality;
- level of maintenance and cleanliness;
- sense of security; and
- accessibility to the location.

Additional information collected through the questionnaire regards major sound sources, user status, weather conditions, number of people in the area and major activities performed in the area.

How the Hush City app works

By clicking on the button 'Map the quietness around you', users are guided through data collection of their favourite 'everyday quiet areas'. The first action required is to record the sound of the chosen area by clicking on the button 'Record', the app starts recording and it automatically stops after 30 seconds. Secondly, users are asked to click on the button 'Analyse' and the app calculates and displays the sound pressure levels of the sound recorded. Thirdly, users are asked to take a picture of the place where the sound was recorded, and finally they are invited to evaluate the soundscape and the surroundings by replying to a pre-defined questionnaire. The sequence is shown below: P34▶

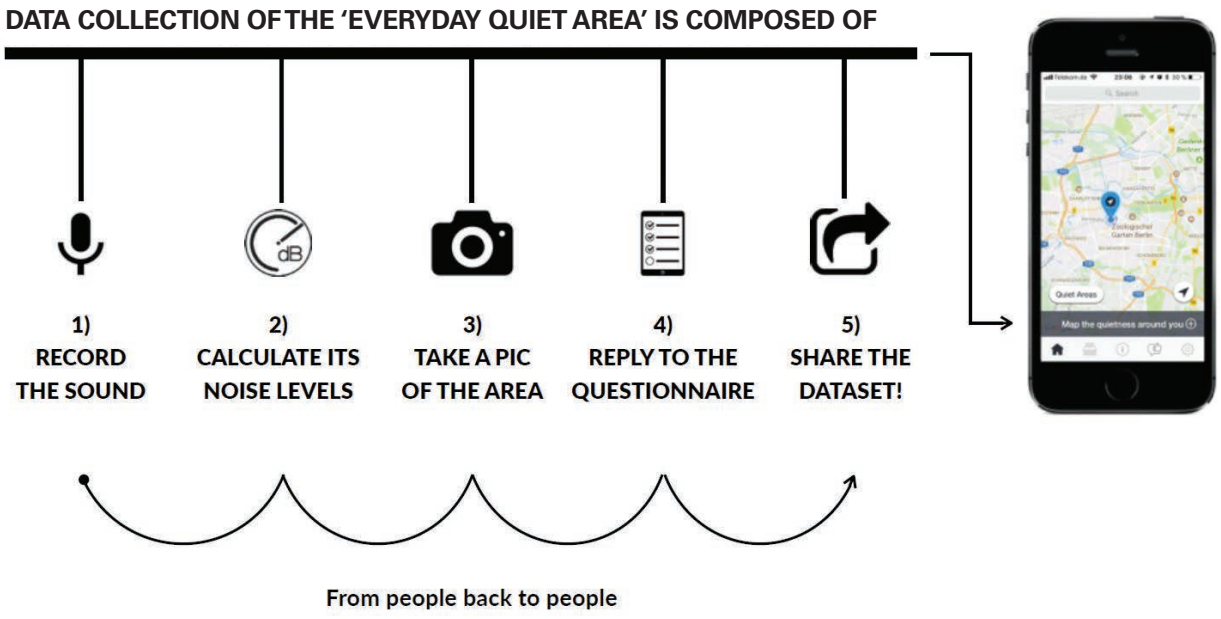

Figure 1. Image displaying the data collection sequence of the Hush City app (Image source © Antonella Radicchi 2018)

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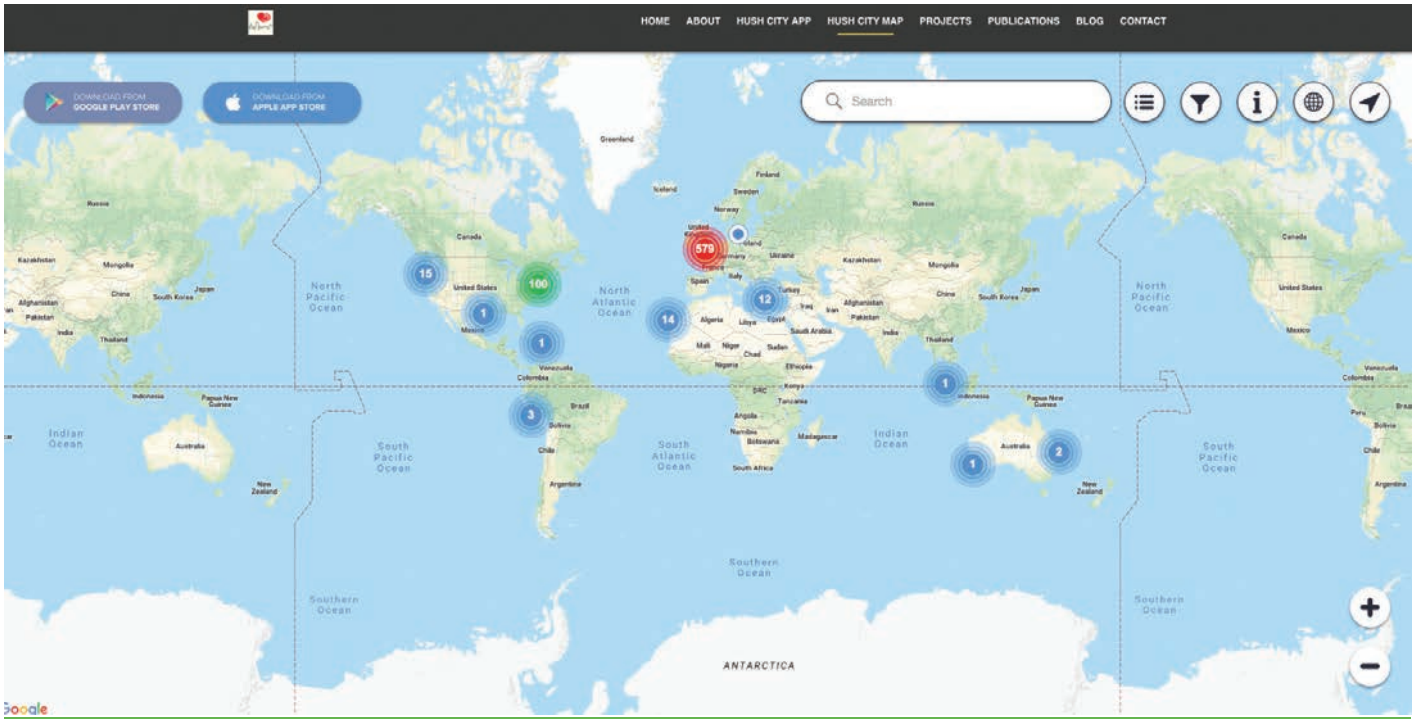


Figure 2. Image displaying the Hush City Map, accessible online at: **https://map.opensourcesoundscapes.org/view-area**

The Hush City map

When the map view mode is active, colour markers are displayed on the dark background map. Colours are automatically assigned to the markers by the Hush City application, according to the sound pressure levels of each sound recorded. For example, light green markers indicate that in these spots, sound pressure levels were approximately between 35-40 dB(A). So clearly, planning authorities can use the Hush City map to locate areas of tranquillity that they need to protect.

The data that has been submitted has been checked to ensure that it is of a good quality, so that there will be no garbage in the datasets. Once datasets are submitted by the users, the researchers evaluate the datasets in order to ensure their quality. Datasets which clearly originate from user tests are deleted. Datasets that contain inappropriate data are also deleted. Inappropriate data is considered when:

1. Pictures depict private rooms, personal objects and/or profile pictures; and
2. Recordings and comments contain messages and/or sounds, which do not relate to the project's aim.

The everyday quiet areas collected with Hush City app are now accessible to everyone online at this website: **https://map.opensourcesoundscapes.org/view-area**

The Hush City map of Berlin

The QGIS (open source geographic information system) elaboration of the Hush City map of Berlin is shown below (updated to February 2018). The light green areas are those identified as urban recreation areas by the official Plan of Quiet Areas of Berlin. These were the obvious areas of quietness, but the surprise is that the Berlin Everyday Quiet Areas are generally not in the same places as the urban recreation areas. This means that there are many more areas of quietness than was previously thought.

Filters can be applied to the map to select areas using a range of descriptors including perceived quietness, landscape quality and accessibility to the areas etc. This is in addition to the sound levels, which makes this a valuable tool for planning authorities, environmental health officers and acoustic consultants.

The implications for the United Kingdom

The Hush City app has the potential to assist planning authorities to comply with their duties under the NPPF, more importantly, it will also, wherever possible, contribute to the health and quality of life.

How to get involved

Simply follow this link to download the free app for either IOS or Android. **http://www.opensourcesoundscapes.org/hush-city/**

What next?

The more people that can be encouraged to use the Hush City app; the better our knowledge of where the truly important tranquil places are will be, and Environmental Health Departments should encourage the general public to get involved. If we all get behind this approach, we might just end up protecting the quiet and tranquil areas for future generations.

Planning authorities can use the Hush City map as a tool when planning their noise policies and local plans. It will also help developers to identify where not to plan new developments, thereby aiding the protection of these tranquil areas.

When a local authority receives a planning application, they can use the Hush City map to see if there is likely to be a problem with that development in that particular location. Local authorities currently use the END noise maps to determine if a noise survey will be required, so the Hush City map could be a logical extension of that approach at the quieter end of the acoustic spectrum. They can use the Hush City P36 ►

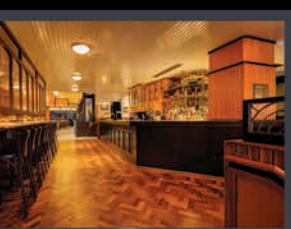
Dishoom gets the acoustic treatment

Set in Kensington's beautiful Grade II listed Barkers Building, Dishoom was designed by interior architects Macaulay Sinclair's with the aim of transporting dinersback in time to Jazz Age Bombay.

This design incorporated stone floors, marble stairs & polished plaster walls; all finishes that on their own, would turn the space into a sonic battleground.

Macaulay Sinclair specified Oscar Acoustics' trowelled SonaSpray fcx finish onto plasterboard at 12mm thick for the ceilings; enough to take the edge off the noise & make speech clearer but not enough to kill the atmosphere.

Unlike the majority of acoustic finishes, it is possible to adjust the SonaSpray range's depth so as to fine tune the acoustics to suit every project & brief.



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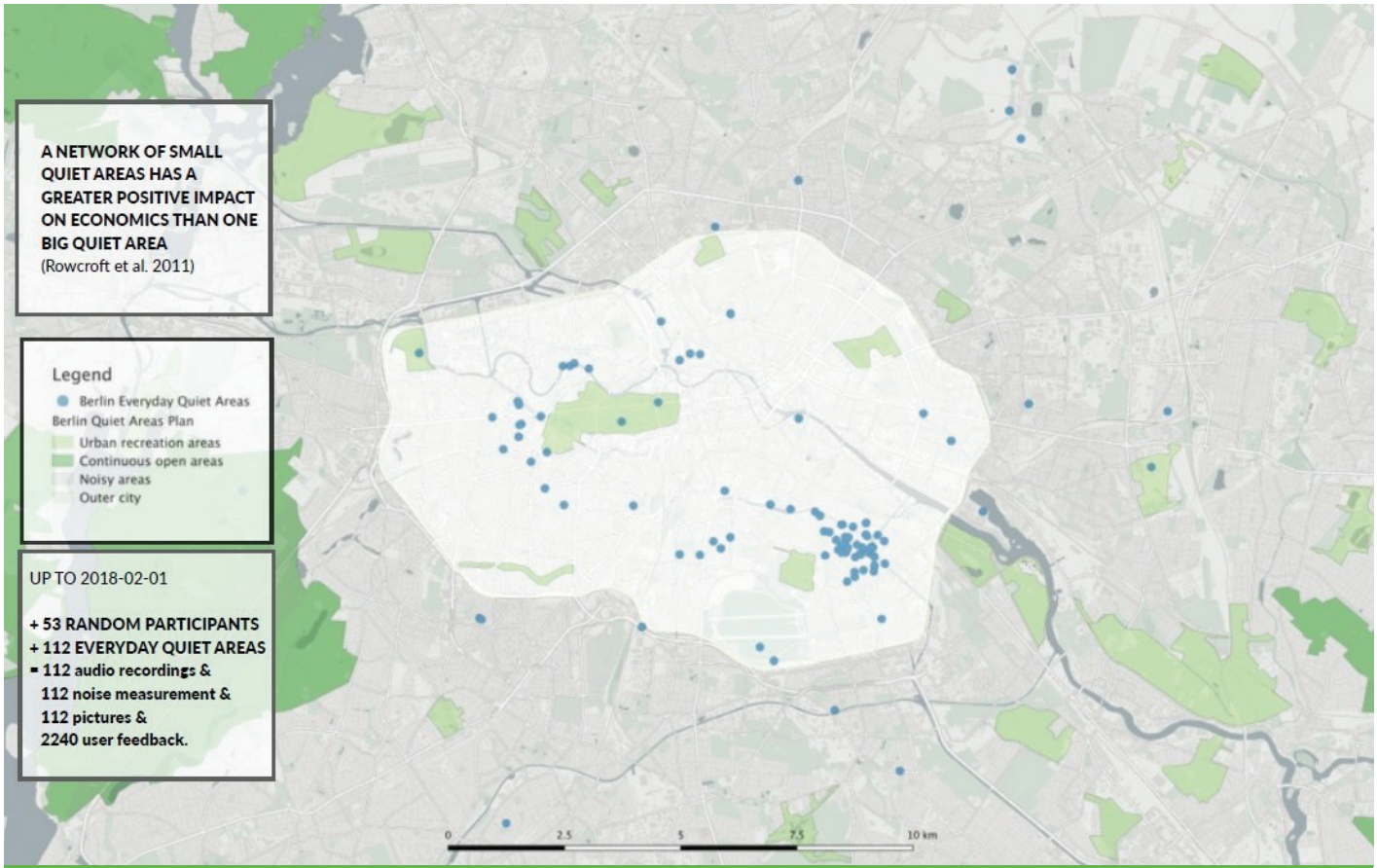

Figure 3 Image showing the 'everyday quiet areas' overlapping the quiet areas identified in the official Plan of Quiet Areas of Berlin (Image source © A. Radicchi 2018)

map to determine if a full soundscape survey will be required to determine the acceptability of any given planning application, helping to make the best possible use of authorities' resources.

Surprisingly, even in big cities like Berlin, there are many areas of tranquillity in some of the densest areas of development. Protection of these areas is clearly going to have significant health benefits for many of our citizens who live in highly developed areas and cities.

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This technical contribution also contains elements that are more appropriate for an industry update. Although the article focuses on one product, we have placed it as a technical contribution in order to draw attention to the wider soundscape and tranquillity issues described and to keep readers up-to-date with the approach used and potential applications.

Authors

Philip Dunbavin is the Managing Director of PDA Ltd. He is a Fellow of the Institute of Acoustics, a Member of the Society of Environmental Engineers and a past Chairman of the Association of Noise Consultants. He is Chairman of the BSI committee EH/1/3 on environmental acoustics and also Chairman of the BSI's overarching EH/1 committee on Acoustics.

Philip is the convenor of ISO/TC43/SC1/WG54 on soundscape and also of the newly formed ISO/TC43/SC1/WG62 for social and socio-acoustics surveys.

Antonella Radicchi is an associate soundscape researcher and HEAD-Genuit Foundation fellow at TU Berlin Institute of City & Regional Planning, where she has established and led the Hush City Mobile Lab. Dr. Radicchi is a registered architect and holds a Ph.D. in Urban Design and Territorial Planning, with doctoral studies conducted at MIT (Cambridge, USA) and at the University of Firenze (IT).

She also acts as Lead Editor of the special issue 'Sound and the Healthy City' for the Cities & Health Journal.

Her publications and projects on soundscape are available at: ***www.opensourcesoundscapes.org***

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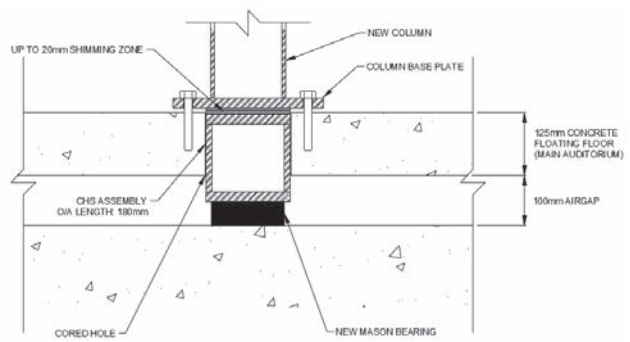
Royal Opera House Piaza entrance ▶



▲ *Sectional view of the new bearing assembly through the existing floating floor*

The main scope of the Mason UK works was to investigate the existing 20 year old Mason floating floor bearings and assess whether the new loadings from the steel structure were still suitable. On review, additional bearings were required to satisfy the additional new loads despite the existing bearings being in good condition. Redundant jacks were disengaged and holes were cored through the floating slab at new column locations for bearings and steel extension sleeves to be inserted; the structural steels where then constructed upon the sleeves.

In addition to the main auditorium, a new waterproofed floating floor was required in the lift pit. The floor was designed and supplied by Mason UK along with a bespoke column baseplate design which enabled the existing lift columns to be preloaded onto the floor. The bearings were selected to satisfy the 12Hz acoustic requirement as well as the high loading and emergency conditions that are common with lift design.

The Royal Opera House project is typical of how Mason UK are able to not only provide high quality acoustic solutions, but also able to assist in the design and installation of complex, bespoke arrangements.

Steel columns being loaded onto the floating floor

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Heathrow expansion influences UK aviation noise policy

The Government's preferred scheme for meeting the need for additional airport capacity in the south-east of England is to build a new north-west runway at Heathrow Airport.

Plans for a third runway at Heathrow have been in the news for many years, with the Government now backing the decision to build this. Given that noise from Heathrow remains a controversial topic, the Institute asked John Stewart of HACAN for his opinion on how the debate on noise at Heathrow is shaping noise policy in the UK.

A project as large and controversial as a third runway at Heathrow will inevitably drive developments in noise policy – indeed, it has already done so.

P40 ►

A Singapore Airlines Airbus A380 on approach to Heathrow

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Level of aviation noise allowed in the UK

The Civil Aviation Authority (CAA) says that noise is regulated to some extent at all UK airports. This can include noise limits and restrictions on operations. The specific restrictions will differ from airport to airport, reflecting the types of aircraft that operate there, how busy the airport is and what the flight paths are.

Although maximum noise limits are set for occupational noise exposure, there is no limit defined for environmental noise, including aviation noise. However, in order to assess the significance of aircraft noise in the UK, it is generally assumed that if the average noise level in an area from 7.00am to 11.00pm is more than 57 dBA Leq it will be 'significantly annoying' to the community that lives and works there. The EU has established a corresponding policy threshold of 55 dB Lden, resulting in two different measures being used to inform policy at present.

This doesn't mean that noise above these levels will not be allowed. But it does mean that noise will be an important factor in planning decisions within that area and that there may be support available for noise mitigation (such as double-glazing).

The catalyst for change in policy

A third runway could increase the total number of aircraft using Heathrow by over 700 a day. The current cap of 480,000 on the annual number of movements permitted at the airport was imposed as a condition when Terminal 5 was given the go ahead in 2001. This figure has never been exceeded and in recent years, the number of aircraft using the airport has hovered round 475,000. A three runway Heathrow could accommodate 740,000 flights a year.

I believe the recent changes in aviation noise policy can be traced back to 2010 – the year that the Coalition Government dropped Heathrow's original plan for a third runway. After that setback, both the aviation industry and the Department for Transport (DfT) took a couple of years to reassess their approach to expansion at Heathrow. They concluded that, if they were ever to get permission for a third runway, more attention would need to be paid to its local impacts including the key issue of noise.

In 2012, the Government set up the Airports Commission under Sir Howard Davies, to assess the need for new runways in the UK and, if it felt they were needed, where they should be.

Davies was also given responsibility for reassessing aviation noise policy, and he and his team brought fresh eyes to the issue. He questioned accepted wisdom and in his final report, published in 2015, Davies announced a third runway at Heathrow was his favoured option for expansion, but he also made a number of far-reaching noise recommendations, which were to influence future Government policy.

Davies suggested that a suite of metrics should be used to signify noise annoyance rather than sole reliance on the 57 dBA Leq contour. He stressed the importance of respite from the noise for communities; promoted the concept of a national independent noise regulator; and, if a third runway was built at Heathrow, argued that there should be a longer ban on scheduled night flights, and that a Community Engagement Board be set up to oversee the consultation on any new runway.

Airspace strategy: a new approach to noise

Many of these proposals were taken up by the DfT when it published its airspace strategy in 2017; it replaced the 57 dBA Leq contour with the 54 dBA Leq contour as the indicator of 'the onset of community annoyance'. Indeed, it went further: It included a 51 dBA Leq contour as one of the suite of metrics that airports could use in assessing noise annoyance.

P42 ▶

"The May 2017 report prepared by Anderson Acoustics for Heathrow Airport, called 'Respite from aircraft noise: Overview of recent research'[1] outlines the need for a better understanding of what 'respite' from aircraft noise actually means and how to deliver it."

P44 ▶

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This was based on the findings of the SoNA Study (Survey of Noise Attitudes) that the DfT had commissioned from the CAA. SoNA had found that for 7% of the population 'the onset of community annoyance' from aircraft noise started at 51 dBA Leq. In percentage terms this is quite small but in numerical terms, in a densely populated city like London it is significant.

The suite of metrics outlined in the DfT's airspace strategy also included 'N' metrics (which measure the number of flights that fly over an area and how many of them are over a given decibel level). Additionally, it endorsed Davies' view that periods of respite from the noise for communities were important. This marked a significant move away from the Government's previous emphasis on reducing the number of people impacted by concentrating flights over particular areas, and the strategy bought into the concept of an independent noise regulator.

Heathrow moves noise debate forward

Meanwhile, Heathrow was doing its own work on noise annoyance. It came to understand that when it went for a third runway 10 years earlier, it simply had not engaged sufficiently with communities or their noise concerns. It has now set up community noise forums and is committed to using a variety of metrics when assessing noise annoyance, including 'N' metrics and, for the first time, metrics that are wind specific, so for example; in areas which just get aircraft when an east wind is blowing (about 30% of the year in London) a metric will be used which just includes these days. Heathrow's levels of compensation will be based on these metrics.

Heathrow has also done a lot of work looking at how respite can be provided to many more communities. At present, only people in west London get a predicable period of relief when planes landing over London switch runways each day at 3.00pm. A longstanding objective of communities has been for this respite to be extended to more areas. Heathrow involved community representatives in a study it commissioned from Anderson Acoustics, into what meaningful respite would entail. The study has provided a useful basis that further work can build upon.

Meaningful respite

The May 2017 report prepared by Anderson Acoustics for Heathrow Airport, called 'Respite from aircraft noise: Overview of recent research'[1] outlines the need for a better understanding of what 'respite' from aircraft noise actually means and how to deliver it.

There is currently no single acoustic metric that can adequately describe respite, but 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.

Heathrow is committed to the principle of respite when its flight paths change and this proposed change would be the biggest since the airport opened in 1946. It is being driven by Performance Based Navigation (PBN), the new technology that enables aircraft to be guided more precisely, rather than the third runway per se.

Heathrow has also broken new ground in the way it is consulting on its flight path changes, its first round of consultation earlier this year asked people about the design principles that it should adopt in designing its new flight paths. The three main options were:

1. Avoid new areas;
2. Concentrate flight paths as narrowly as possible so as to affect the fewest number of people; or
3. Provide as much respite as possible.

The results of the consultation haven't been made public yet, but Heathrow tells me that most respondents where keen to avoid new areas followed closely by the respite option with all-day concentration a distant third.

Heathrow will use the results to help it draw up 'noise envelopes' and then the flight paths themselves. Communities have been invited to shape the consultation in a way that, to my knowledge, has not yet happened elsewhere, my guess is that Heathrow will go for a respite option that minimises the impact on new areas.

National Policy Statement: legal noise requirements

As the third runway is deemed a project of National Strategic Importance, the Government has used a National Policy Statement (NPS) to push it through. Parliament backed the NPS by a majority of 296 this summer. The NPS contained the noise proposals (some of them in a modified form) which Davies outlined when he recommended the third runway as the Airport Commission's preferred option in 2015:

- a suite of noise annoyance metrics;
- a 6½ hour night (up from the current 5 hours);
- the principle of respite;
- a community engagement board; and
- nationally, an independent noise regulator.

Since the NPS is a legal document, these will become part of the legal conditions that must be complied with if a third runway is to be built.

Would these significant noise changes, effectively amounting to a new aviation noise policy, have come about if a third runway had not been in the offing? Some of them might have, but the main driver for change was the desire for a third runway. Heathrow and the Government understood that they had to develop a much better noise package than had been on offer previously if they were to get backing for a third runway. Although focused on the new runway, and driven by it, the new policy will have important implications across the UK.

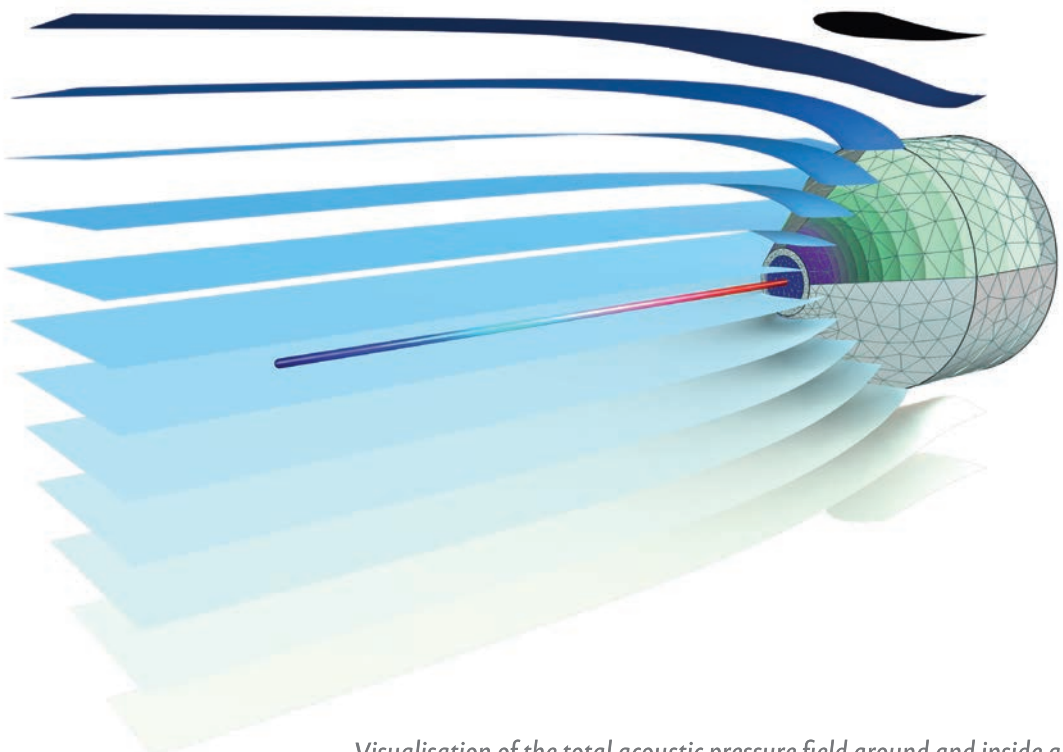
New National Aviation Strategy

National aviation noise policy will be developed further in the Government's new Aviation Strategy, which the DfT is working on now. The strategy, which assumes a third runway at Heathrow, is expected to be published in the first half of next year, with a Green Paper to be released for consultation this autumn.

A key focus of the strategy will be to find ways of dealing with the environmental impacts that the expected growth at airports over the next 30 years could cause. As far as noise is concerned, the early signals are that the DfT would like to find ways of reducing it while allowing expansion. It has asked the CAA to look at whether some sort of national noise reduction target may be feasible.

My own belief is that whether the targets are national or local, the word 'significantly' is critical. Even with growth P46 ►

Hearing aids can't solve the cocktail party problem...yet.



Visualisation of the total acoustic pressure field around and inside an elastic probe tube extension attached to a microphone case.

Many people are able to naturally solve the cocktail party problem without thinking much about it. Hearing aids are not there yet. Understanding how the human brain processes sound in loud environments can lead to advancements in hearing aid designs.

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it is probably possible to reduce the number of people impacted by noise by using the new technology to concentrate all the flights along narrow corridors. However, those living under the flight paths would be *significantly* affected. They would be living in what Andrew Haines, the outgoing Chief Executive of the CAA, called "noise sewers".

This could have health implications. At a time when the evidence of the health impacts of noise generally is gaining strength, the Government will recognise the dangers of going down the path of pure concentration.

If cutting the number of people who are impacted is possible, reducing the numbers *significantly* affected in an era of growth represents a big challenge for the DfT. The solution probably revolves around sharing out the noise as the big concern for most communities is the number of planes which fly over them. They are less worried about the overall growth of an airport or even how many runways it has – it is the number (and to some extent, the height) of the planes going over them that counts.

If the number of planes flying over individual communities could be kept to manageable levels through the widespread introduction of respite, the number of people *significantly* affected could be held steady or even reduced. It might involve introducing noise to some new areas and that would needed to be managed sensitively, but, if the Government remains committed to the levels of growth predicted, it may be the only way to deal with the numbers who would be significantly affected, with all the health and quality of life implications that would have.

The impact of quieter planes

The Government will also be looking at the introduction of quieter planes to mitigate the noise impacts of expansion on communities. Individual aircraft do continue to get less noisy but there is not a step-change on the horizon over the coming decades to match the one which has taken place over the last 40 years. The industry-based body, Sustainable Aviation, points out for example, that the design noise footprint of the A320neo is nearly a square kilometre smaller than older A320 aircraft, and the Boeing 737 MAX noise footprint is more than 1.7 square kilometres smaller than the 737 NextGen.

Since 2013, UK airlines have invested £37bn in next generation aircraft, but this has had less impact on communities than might have been expected. I suspect there may be three reasons for this:

1. At busy airports the growth in flight numbers is off-setting some of the improvements;
2. The tendency to concentrate flight paths over certain communities means they are worse off; and
3. Some of the quieter aircraft have performed less well in practice – for example, A380s departing Heathrow, full of passengers, cargo and fuel struggle to climb rapidly.

If Howard Davies' lack of previous involvement with the aviation industry enabled him to bring a fresh perspective to noise policy, it proved a handicap in assessing the impact of quieter planes and improved operational practices if a third runway was built. He endorsed Heathrow's view that they would result in fewer people being impacted by noise than at present.

The statistics don't bear this out, because the estimated number of new people who could be impacted if a third runway is built has been put at just over 90,000 by the DfT and at 200,000 by Transport for London. This means that the overall number within the 55 dB Lden contour would range from 800,000 to around 950,000. Those numbers would be expected to fall a bit by 2040 and 2050, as quieter planes and improved operational practices kick in.

The impact of the changed noise policy

I've discussed how the desire for a third runway has driven change to national aviation noise policy in this article. Now the final question to consider is the impact that this new policy could have on residents under the Heathrow flight paths; the communities that could be getting a third runway. It would be indeed an irony if those were the people who lost out from the changes.

The tens of thousands who could be under flight paths for the first time as a result of the third runway may feel that any improvements in aviation noise policy pales in comparison compared with the impact that the new flights have on them.

For most people though, the new policies could at the very least mitigate the impact of the new runway:

- a longer night period;
- respite extended to new communities;
- higher levels of compensation and mitigation available;
- more meaningful metrics;
- better community engagement by Heathrow; and
- the setting up of an independent noise regulator.

Some residents, such as those who want respite extended to their areas, are disappointed that they might need to wait another seven years until the new runway opens. This includes the people of Windsor who don't get any relief on the days the planes land over the town. This is because of the Cranford Agreement, which didn't allow aircraft to take off over Cranford, the closest settlement to the airport in Hounslow, because in the 1950s, planes were so loud on departure. The Cranford Agreement has been abolished but the taxiway and other works needed to allow planes to take off from the northern runway have been incorporated into the plans for the third runway. So Windsor won't see relief on this until the new runway opens.

Conclusion

My conclusion is that the need to get permission for a third runway acted as the catalyst for change to aviation policy. Of course other things – such as the controversies over the flight path changes at airports like London City and Gatwick; some of the new metrics being mandated by the EU and the improvements to aircraft technology – have played a role but the evidence suggests it is the desire for a third runway that has been the main driver of policy change.

It is too soon to assess what impact these changes to aviation noise policy may have on wider noise policy. Some of the changes are probably aviation-specific, but it is possible to see how a new approach to metrics or the setting up of an independent regulator could affect policy towards other sources of noise.

The third runway may well be remembered for the controversy that has surrounded it, but it also deserves to be seen as the catalyst for, and driver of, real change in UK aviation policy.

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Photographer: Gordon McAvoy

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Link to the full NPS:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/713354/airports-nps-new-runway-capacity-and-infrastructure-at-airportsin-the-south-east-of-england-web-version.pdf

DfT Summary of the NPS:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/713661/proposed-expansion-of-heathrow-summary.pdf

Chris Grayling's Statement to Parliament:
https://www.gov.uk/government/speeches/proposed-heathrow-expansion

Effects of noise on human health

The draft Environmental Noise Directive Noise Action Plan 2019-2023[2], produced by Heathrow Airport, acknowledges that noise can have a significant and disruptive effect on everyday life.

The Government continues to research the effects of noise on human health and Heathrow supports the desire to understand these effects better. They recognise that human response to noise is extremely complex and varies between people and places and is influenced by many non-acoustic factors.

References

[1] https://www.heathrow.com/file_source/HeathrowNoise/Static/Respite_research_overview_and_technical_report.pdf
[2] https://www.heathrowconsultation.com/wp-content/uploads/2018/05/FINAL-DRAFT-NAP-2019-2023.pdf

Author

John Stewart is Chair of HACAN, a campaign group established in the 1970s that represents communities living close to Heathrow airport and its flight paths. It seeks to bring an end to all-day flying with the introduction of multiple routes, rotated to give each community a meaningful break from the noise.

It also wants to see aircraft flying as high as possible over the area, an end to night flights and no third runway at Heathrow.
http://hacan.org.uk/

Investigating novel solutions for natural ventilation – passive ventilation and metamaterials

By Paul Forster

Introduction

A hot house sited on a noisy road or railway is becoming a frequent problem for many city-dwelling residents. The dilemma facing such people may have been especially felt during this summer's hot weather – should I open a window and cool the house down and allow the din from outside in; or swelter, in relative peace, inside the bedroom? Neither option is conducive to a good night's rest, and the negative health impacts of sleep deprivation are well documented.

With ever-increasing pressure on the housing market in the UK, it is likely that more residential properties could be located close to sites that generate noise in urban environments. The Housing Act 2004 sets out the framework to assess hazards in the home including noise, excess heat and ventilation (damp and mould), but this is generally a retrospective process. Eliminating foreseeable problems is critical at the planning phase, and holistic and sustainable options ought to be pursued. In practice, however, the planning system has not connected very effectively with other areas of expertise in Building Control and Environmental Health to design out overheating and noise problems in residential properties.

This issue has recently been featured via the release of new draft guidance by the Association of Noise Consultants (ANC) entitled: 'Acoustics, Ventilation and Overheating – Residential Design Guidance'. No doubt a step in the right direction.

In this study, novel ventilation solutions to allow the ingress of fresh air, while keeping noise out, were investigated via the use of modified acoustic metamaterials.

The aims of the study were:

1. To design and build acoustic metamaterial designs, using additive manufacturing techniques;
2. To test the properties of each design, in particular the transmission loss, using an impedance tube under laboratory conditions; and
3. To conduct an air flow test on two of the designs created.

The overall success of the metamaterials tested were judged by their ability to stop sound transmission but allow air to pass through relatively unimpeded. These two characteristics are traditionally at odds with each other – i.e. something that allows good airflow will also allow noise break-in.

What are acoustic metamaterials?

Acoustic metamaterials are artificially-made structures capable of changing the natural properties of sound. They consist of composite materials that enable manipulation of the dispersive properties of vibrational waves [1]. Such properties include the attenuation and 'bending' of acoustic waves. They have also proved to be effective at low frequency by breaking the mass law and providing significant attenuation with less mass [2].

What can metamaterials can be used for?

Metamaterials can be designed to manipulate electromagnetic, acoustic or elastic waves in ways not normally encountered, enabling new functionalities such as invisibility cloaking [3], focusing and sub-wavelength resolution enhancement [4]. Possible applications for metamaterials can be found in the fields of communications, optics, energy and acoustics.

The potential impact of metamaterials may be vast, if the benefits of tailoring and manipulating waves can be realised. This can lead to significant decreases in the size and weight of components, devices and systems, along with enhancements in the performance of such systems [5].

Basic concepts

Mass density and bulk modulus are two key concepts that influence whether a metamaterial is effective. **Mass density** represents the mass (or number of particles) per unit volume of a substance, material or object. **Bulk modulus** is the measure of a substance's resistance to uniform compression.

The interest in metamaterials with these concepts relates to what is known as the *negative* form.

- Negative bulk modulus is the phenomenon whereby acoustic particles expand under applied pressure.
- Negative mass density can be considered as the acceleration of the acoustic particles in a direction opposite of the applied force.

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Figure 1 Labyrinthine Mark I

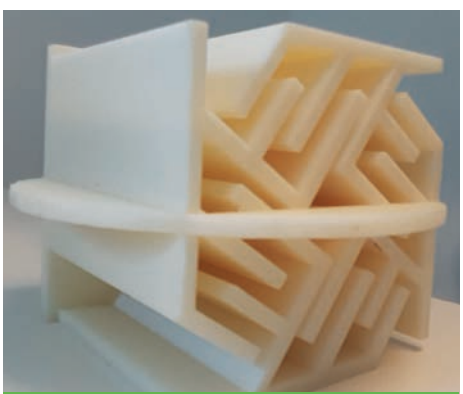

Figure 2 Labyrinthine Mark II

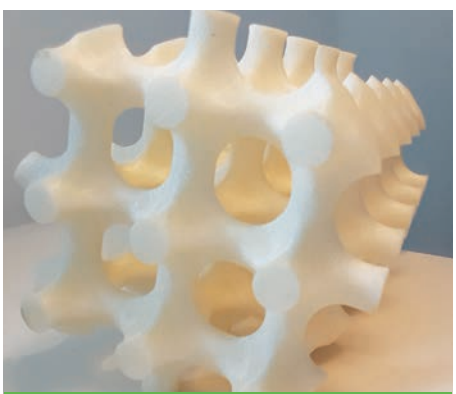

Figure 3 Cubic Lattice

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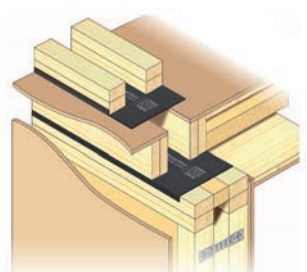

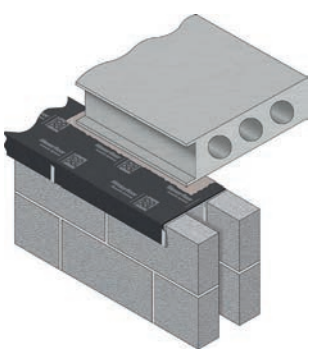

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Figure 4 MDF shaped to match the Mark I and Mark II designs

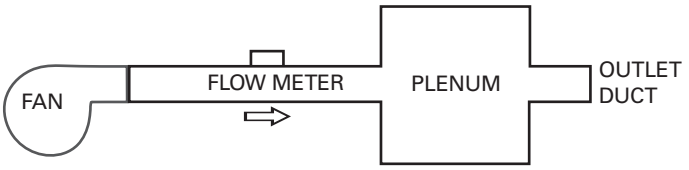

Figure 5 Air flow test rig

The investigation of negative effective mass density involves studying the mechanism associated with local resonances that cause wave attenuation. Both are significant when analysing the unique properties of metamaterials and are occurrences that can be described as 'anomalous' or 'unusual'.

Designs

Using additive manufacturing techniques, also commonly known as 3D printing, three designs were created in the rapid prototyping workshop at London South Bank University. The metamaterials were based on existing designs from different academic studies carried out in the United States [6] [7].

The first design was made with the use of a 3D printer and consisted of plaster of Paris, with a hardened epoxy resin and had a 'horn-port' labyrinthine structure (Figure 1). This is known as the **Labyrinthine Mark I** design (weight 248g).

The **Labyrinthine Mark II** design (Figure 2) consisted of acrylonitrile butadiene styrene (ABS) and was an enhancement of the Mark I version (weight 149g). This was altered to fit snugly in the 100mm diameter impedance tube and eliminated the gaps to the sides that were problematic with the Mark I design. It should be noted that the design is not isotropic and therefore results are dependent on the direction or orientation of the design during measurement.

A radical departure from the composition of the Labyrinthine metamaterials can be observed in the structure of the third design, the **Cubic Lattice** (Figure 3), which was also the lightest, weighing 134g. This was also made of ABS and based on a structure created by MIT students in 2008 [6]. They, in turn, took the design from what is known as Schwarz's P surface. These were first described by the mathematician, Hermann Schwarz, and have a cubic symmetry that allows a unit cell to be connected to form a Cubic Lattice.

For the purpose of comparison with the Labyrinthine metamaterials, two pieces of MDF were also shaped to match both the Mark I and Mark II designs (Figure 4), to the extent that they are the same shape when observed from the noise-facing orientation in the impedance tube. The purpose of this was to gather further information as to the influence of air gaps during transmission loss testing.

Impedance tube and air flow tests

An impedance tube was used to measure the transmission loss of each design. The test for each metamaterial followed BS EN ISO 10534-2:2001 'Acoustics. Determination of sound absorption coefficient and impedance in impedance tubes. Transfer-function method'.

Air flow tests were completed using facilities at the Building Research Establishment (BRE) in Watford. An air flow test was carried out on the Cubic Lattice and Labyrinthine Mark II unit designs. A test rig (Figure 5) was set up with a fan driving air through 100mm diameter plastic ducting to a mass flow meter (the 100mm diameter is a standard industry size for ventilation ducting). This was further connected to a plenum chamber and outlet duct. The test procedure used was based on two documents, namely:

1. Ventilation for buildings. Experimental determination of mechanical energy loss coefficients of air handling components'; and
2. The Building Regulations Approved Document F.

Table 1 – Averaged octave metamaterial and MDF transmission loss in dB 63 – 1600 Hz

Frequency (Hz)	Cubic Lattice	Labyrinthine Mark I	Labyrinthine Mark II	MDF Circle	MDF Square
63	1.1	1.2	1.7	12.8	1.1
80	1	1	1.8	12.8	1
100	1	1	1.9	13.1	0.9
125	1.1	1	2.1	13.4	0.8
160	1.2	1.1	2.4	14	0.9
200	1.2	1.2	2.6	13.3	0.9
250	1.4	1.2	3.2	13.7	0.9
315	1.6	1.4	3.8	15.3	0.9
400	1.8	1.6	4.7	17.5	1.1
500	2.6	1.6	5	19.2	0.9
630	1.5	2	5.4	19.9	1.2
800	1.4	2	5.1	19.8	1.5
1000	1.1	1.9	3.4	22.3	1.8
1250	1.4	20.8	8.1	23.5	2.3
1600	2.1	11.4	27	25.4	2.8

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Figure 6 – Metamaterial transmission loss in dB

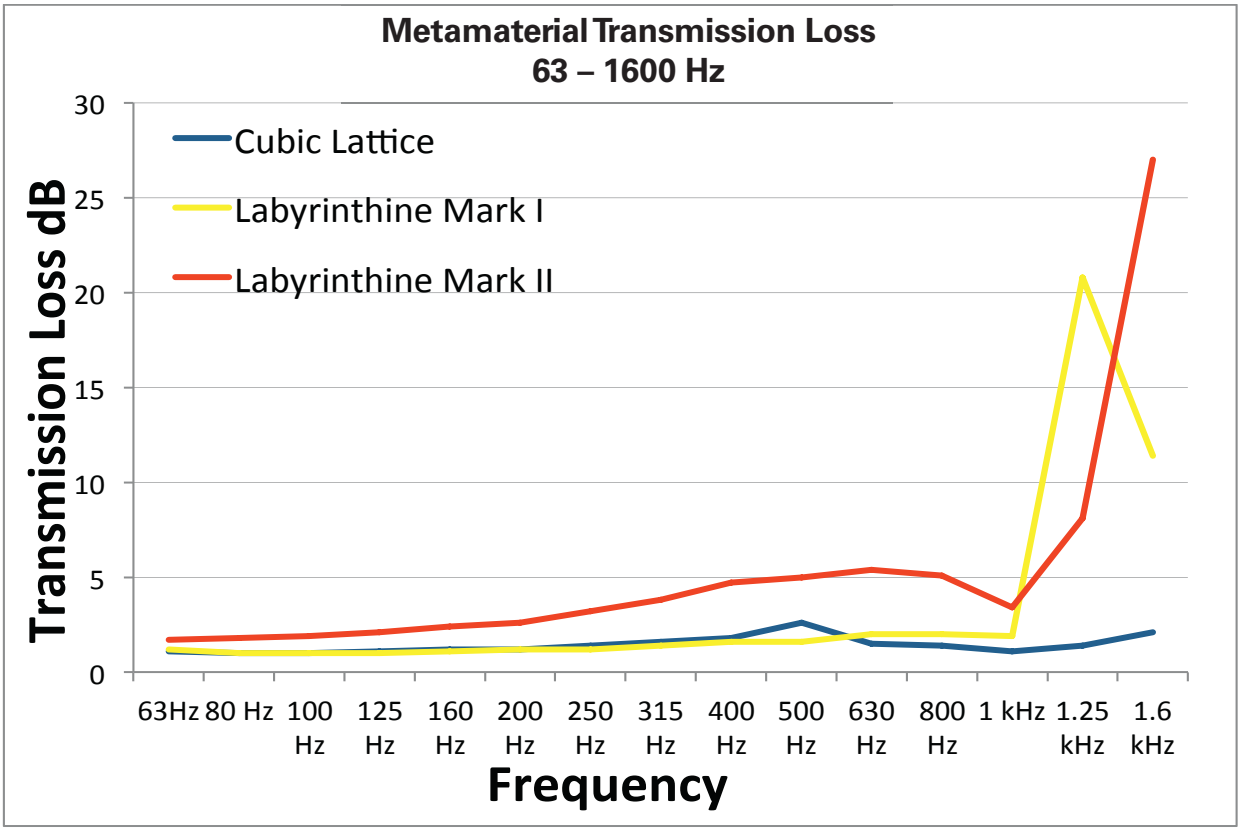

Figure 7 – Full frequency range – comparison of metamaterial and MDF shapes transmission loss

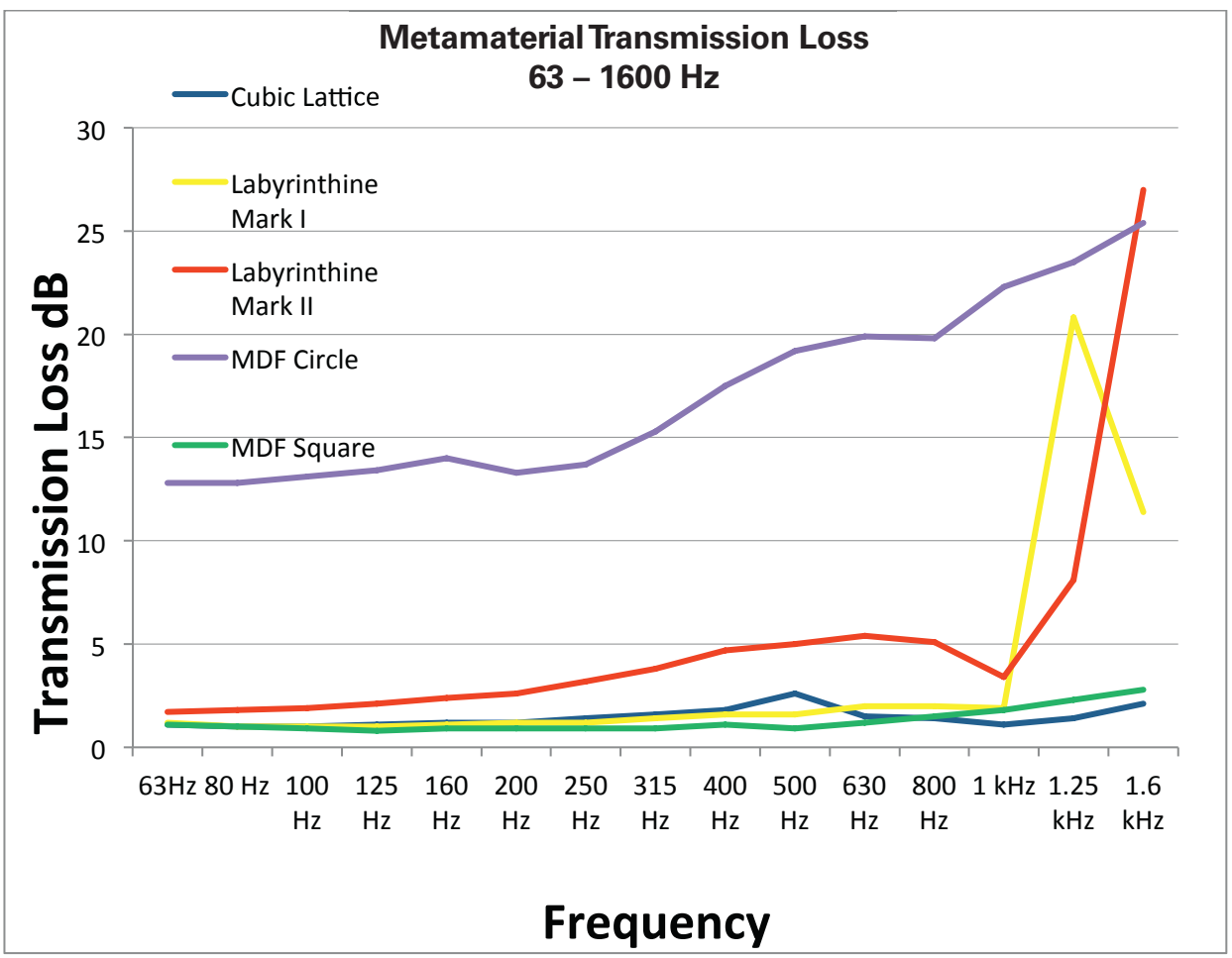

Table 2 – Air flow test results* – pressure (Pa)

Flow Rate litres/s	No Fitting	Cubic Lattice	Labyrinthine Mark II
1	0	0.12	8.8
2	0.07	0.53	28
3	0.16	1.36	58
4	0.33	2.6	96
5	0.51	4	140
6	0.75	5.65	
7	0.99		
8	1.29	9.85	
9	1.61		
10	1.99	14.65	
12	2.8	21.2	
14	3.78	28	
16	4.8	36.9	
18	5.97		

Results

Impedance tube metamaterial test – LSBU Acoustics Laboratory
Peak insertion losses were observed at 500 Hz for the Cubic Lattice design, 1.25 kHz for the Labyrinthine Mark I and 1.6 kHz for the Labyrinthine Mark II.

Air flow test – Building Research Establishment

*Note: It was not possible to measure pressure at all 18 flow rates for the Lattice and Labyrinthine designs. Where no measurement was made, the corresponding box is blank.

Discussion

Attenuation of sound was found to be more successful in the Labyrinthine structures compared to the Cubic Lattice. The Labyrinthine Mark II had the best overall transmission loss performance of the three metamaterial designs. Between 63 Hz and 1000 Hz the Mark II design consistently outperformed the others by a margin of 1 – 3 dB (Table 1 and Figure 6).

The results for transmission loss for the Mark I Labyrinthine design show that this success was more locally resonant, rather than broadband, in its attenuation characteristics. This is can be seen most prominently at 1250 Hz. Local resonances may well have contributed to the peak insertion loss of 20.8 dB at this frequency for the Mark I design. This local resonance may lead to negative effective dynamic mass density and bulk modulus and therefore to their unusual dispersion at this frequency [1].

Such a result for the Mark I design is significant, as performance at this frequency has not been degraded despite the air gaps surrounding it. Although in the original study, this design used a one-dimensional waveguide and commercial finite element analysis (FEA) solver [7], some of the results are comparable. The original study found that the

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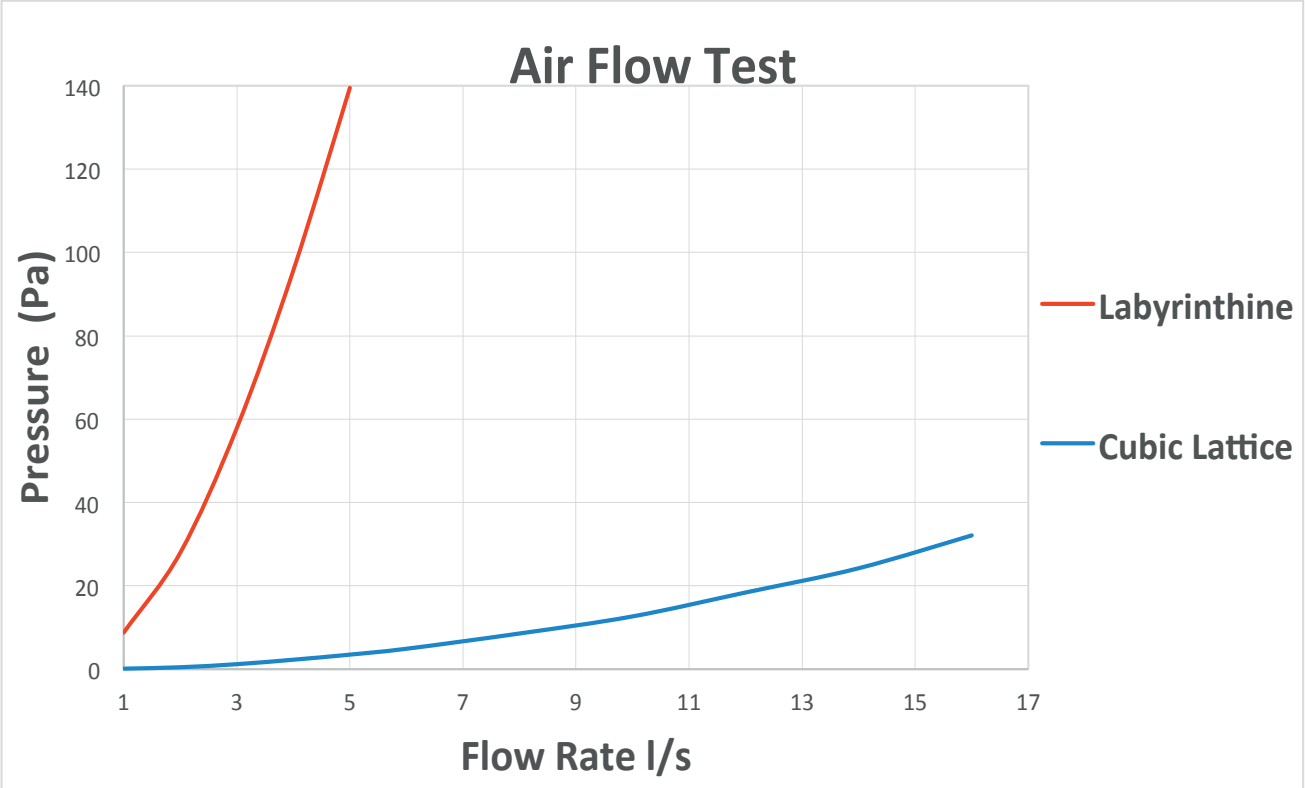
Figure 8 – Air flow comparison of Labyrinthine Mark II v Cubic Lattice



Labyrinthine design displayed a refractive index (that is the 'bending' of acoustic waves) and a resonance peak around 3.2 kHz [7]. Given that the Mark I design was approximately 2.6 times larger than the original, it's resonance at 1.25 kHz is roughly proportional when observing the magnitude and wavelengths involved (3200 Hz / 2.6 = 1230 Hz). This means the larger Mark I design is able to achieve a lower frequency resonance – with sub-wavelength attenuation, which defies mass law. This supports the concept that the *structural geometry* was the deciding factor when it came to matching the results between the two studies.

Transmission loss peaked at 27 dB for the Labyrinthine Mark II at 1600 Hz and this was significantly higher than any other level observed for this particular design – the closest being 8.1 dB at the neighbouring frequency of 1250 Hz (Table 1). More impressive was that this result was achieved while having a density 1/3 less than the Mark I. In the frequencies lower than 1250 Hz there was a steady increase in transmission loss from 1.7 dB at 63 Hz to 5.4 dB at 630 Hz and then a slight dip in the intervening frequencies until 1250 Hz, where the results were more impressive.

It is unfortunate that testing of frequencies above 1600 Hz was not possible, as this may have indicated whether the characteristics of the peak insertion loss of 27 dB was related to local resonance or not. However, it could be theorised that the addition of the semi-circular fins to the four sides of the design could have maintained a superior performance at these higher frequencies (due to reflection of the smaller wavelengths) when compared with the Mark I and Cubic Lattice designs.

Table 1 and Figure 7 show the full range of results including those of the MDF pieces, which were added for comparison. The MDF Circle made a tight fit within the impedance tube and the lack of air gaps contributed to the excellent transmission loss across all frequencies – from 12.8 dB at 63 Hz to 25.4 at 1600 Hz. Although the air flow around the piece is non-existent, it is a worthy demonstration of how air gaps can detrimentally affect the performance of a 'normal' material or building element. For the MDF square, results can be seen to be similar to those obtained for the Cubic Lattice. Although neither of the MDF pieces were tested for air flow performance, it can be safely suggested that the circle would have allowed virtually no air to pass by, while the large gaps around the four sides of the square would have been much more conducive to air flow.

For the Cubic Lattice, the best performing frequency in terms of transmission loss was at 500 Hz with 2.6 dB (Table 1). The results obtained for the Lattice design show that this would be an unfavourable design to use as a passive air vent in the frequency range tested. A Swiss cheese-like, porous composition was likely to be the primary contributing factor in this poor performance. It allowed sound waves to travel through the design relatively unimpeded and the structure did not show any special characteristics that would lead it to be defined as exhibiting negative bulk modulus or density.

Further factors to consider for the poor performance of the Cubic Lattice are the alterations to the final structure that were made to ensure a tight fit in the impedance tube. These alterations meant that each unit cell was not uniformly identical to the last and this could have had an impact on the performance of the design. It could be theorised that the longer length of the Cubic Lattice might have allowed the emergence of characteristics found in previous studies that used a similar repetitive structure, nevertheless, this was not found to be the case.

Air flow

As expected, the air flow test demonstrated the more complicated and contorted internal structure and the presence of the semi-circular fins of the Labyrinthine Mark II design did not permit as much air through when compared to the P58 ▶

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Cubic Lattice. In fact, the magnitude of difference was marked, with the Cubic Lattice 40 times more effective at allowing air to flow through at a reference point flow rate of 5 l/s (Figure 8). In terms of Building Regulation ventilation rates, the test found that the Cubic Lattice would be compliant.

Although the Mark I design was not able to be tested in this case, it could be safely predicted that the air flow would be superior to that of the Mark II and would be likely to meet Building Regulation requirements for passive ventilation.

The results also show that the Labyrinthine Mark II metamaterial would fail Building Regulation ventilation requirements and therefore leave this design, in its current state, unsuitable for use as a passive vent.

Limitations and critical assessment

A limitation in the transmission loss testing of the metamaterial designs is the use of plane waves, travelling in a single direction in the impedance tube test. In operational conditions, which would involve the installation of a passive acoustic vent in an existing dwelling, acoustic waves would be incident at various angles. This would therefore slightly reduce the strength of the transmission loss evidence collected during testing.

The presence of the high transmission loss results for the both the Labyrinthine metamaterials above 1 kHz suggests a possibility of the existence of negative mass density and/or bulk modulus. Confirmation of this is, however, beyond the scope of this study and could therefore be considered a limitation, albeit something that could be solved in future investigations.

It is also recognised that the Cubic Lattice design used for this study was chosen somewhat arbitrarily. The original MIT study used was developed more towards the development and fabrication of 2D and 3D lithographic structures and this may be partly why the design did not show any great results of note. The structure was also altered from the original study so that it could fit tightly into the impedance tube.

Finding a balance between air flow and noise attenuation is crucial when assessing whether any of the designs from this study would be useful as a 100mm passive vent. If a design were to be truly sustainable, it would need to minimise the adverse noise impacts in addition to not exacerbating any other hazard found in a building – such as poor ventilation. To that end, further study and alterations to the design structures, such as an expansion to an acoustic lintel, would be needed.

Improvements to the designs could include introducing materials of different impedance to encourage the phase differential. For example, creating a composite metamaterial using soft rubber combined with a hard surface, such as ABS.

Conclusion

This study successfully demonstrated the design, 3D printing and testing of three designs based on existing metamaterials. Transmission loss results produced were more promising for the Labyrinthine designs, however these were most impressive above 1 kHz. The Labyrinthine Mark I showed a remarkable result at 1250 Hz, with a transmission loss of 20.8 dB, in spite of its apparent handicap with the gaps to each side during testing. The best performing frequency for Mark II was 1600 Hz with a transmission loss of 27 dB.

For the Cubic Lattice as a vent that aims to reduce unwanted noise entering a dwelling, it does not appear to be effective. The Cubic Lattice exhibited more broadband attenuation characteristics, with fairly steady results throughout the frequency spectrum. A clear benefit of this design was observed with the air flow results, which would allow enough air into a dwelling to satisfy Building Regulation requirements for residential dwellings. Due to the superior flow rate, future studies could focus on the use of the Cubic Lattice in HVAC systems. The shape of lattice would be well-suited to standard 100mm ventilation ducts.

The results obtained for the Lattice indicate no special features that would allow it to be referred to as an acoustic metamaterial. This is tempered somewhat by the frequency range tested – i.e. performance above 1600 Hz remains unknown. A natural extension to this study would be to continue the investigation above 1600 Hz in the frequency spectrum, for all the designs.

Further study would also warrant closer analysis of which components of each metamaterial structure contributed to the overall prevention of acoustic transmission. Altering dimensions of the designs, introducing phase differences and use of computer modelling would be the most likely options in this case.

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Link to full thesis: *https://www.researchgate.net/publication/321723914_INVESTIGATION_OF_3D_PRINTED_ACOUSTIC_METAMATERIALS*

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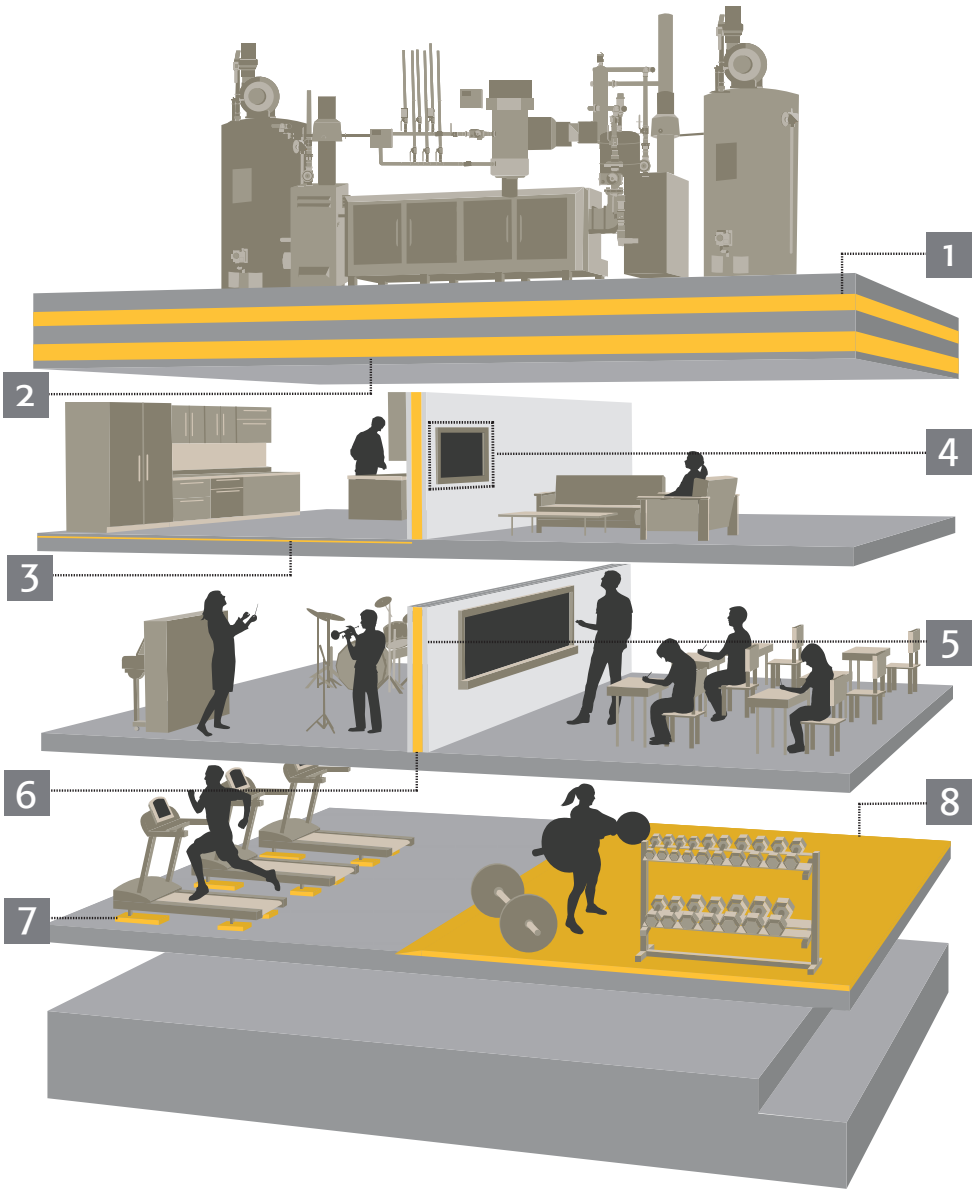

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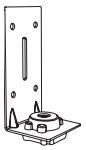

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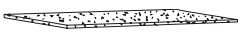

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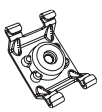

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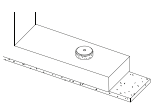

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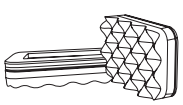

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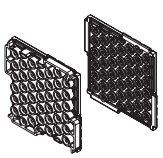

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ANC award for 'Best IOA Diploma Project'

At the ANC Acoustic Awards 2018 held in June, Barry Weldon won the IOA Best Diploma award.

The awards promote and recognise excellence among UK acoustic consultants and look for examples of work that display innovation and originality in acoustic design or approach to a particular project.

Barry's award was presented by Dr Hugh Hunt, Cambridge University Reader in Engineering Dynamics and Vibration, and included the book 'Vibration-based Condition Monitoring' by Robert Bond Randall.

Minimising noise during construction project

RBA Acoustics' work on controlling noise from a construction site using a temporary site enclosure was highly commended in the Smaller Project category at the same awards.

As part of the refurbishment of a mews property in central London, RBA Acoustics were tasked with controlling noise from major demolition/construction activities to minimise disturbance to neighbouring properties. The site is surrounded by residential buildings in a quiet mews, overlooked on all sides and noise limits were agreed with local residents at the nearest noise sensitive window, which was approximately 1m from the site boundary.

From RBA Acoustics' assessment of the planned piling and break out works in the garden area, the acoustic enclosure was expected to give at least Dw 21 dB reduction in noise levels at the nearest noise-sensitive residential windows. The temporary enclosure actually provided a greater noise reduction performance than predicted.

Barry Weldon (centre) receiving his award from (on the left) Jack Harvie-Clark, ANC Immediate Past Chair) and (on the right) Dr Hugh Hunt, guest speaker at the ANC Awards

Gareth Davies of RBA Acoustics presented with the Highly Commended award by Dr. Hugh Hunt, Cambridge University Reader in Engineering Dynamics and Vibration

Campbell Associates Charity Acoustic Cup 2018

The Campbell Associates annual five-a-side charity football tournament raised £2,720 for Prostate Cancer UK.

Teams from Anderson Acoustics, Bickerdike Allen, Campbell Associates, Cole Jarman, MLM, Pace Consult, RBA, Sixsense, Stansted Environmental, Vanguardia and WSP played in three groups to decide who would go on to play for the cup and the plate trophies.

The cup was won by the Vanguardia team with the Bickerdike Allen team as runners-up. Sixsense won the plate and runners-up were Campbell Associates.

The Player of the Tournament award went to Alex 'the cat' Londers, the Vanguardia goal keeper and the Golden Boot award went to Sean Graham of the Bickerdike Allen team.

To enter a five-a-side team for next year's Acoustic Cup, please contact **john@campbell-associates.co.uk**

To see all the teams visit: **http://www.campbell-associates.co.uk/acoustic-cup-2018-0**

The Campbell Associates Charity Acoustic Cup 2018 teams

Enbox wins innovation award

Enbox won the Rightway Award for Environmental Innovation of the Year 2018 for its role in the Thames Tideway Project.

Neil Anderson, who received the award on behalf of Enbox, said: "As one of the largest construction projects in the UK, Tideway was always going to be a challenging project for us, with multiple monitoring sites and varying criteria across the locations.

Enbox has been involved with the project since early 2016, helping to simplify the process, saving analysis and reporting hours and giving live status updates. These have been crucial in minimising S61 consent exceedances and further enabling compliance with the project's noise insulation and temporary re-housing criteria."

Neil Anderson collected the award on behalf of Enbox

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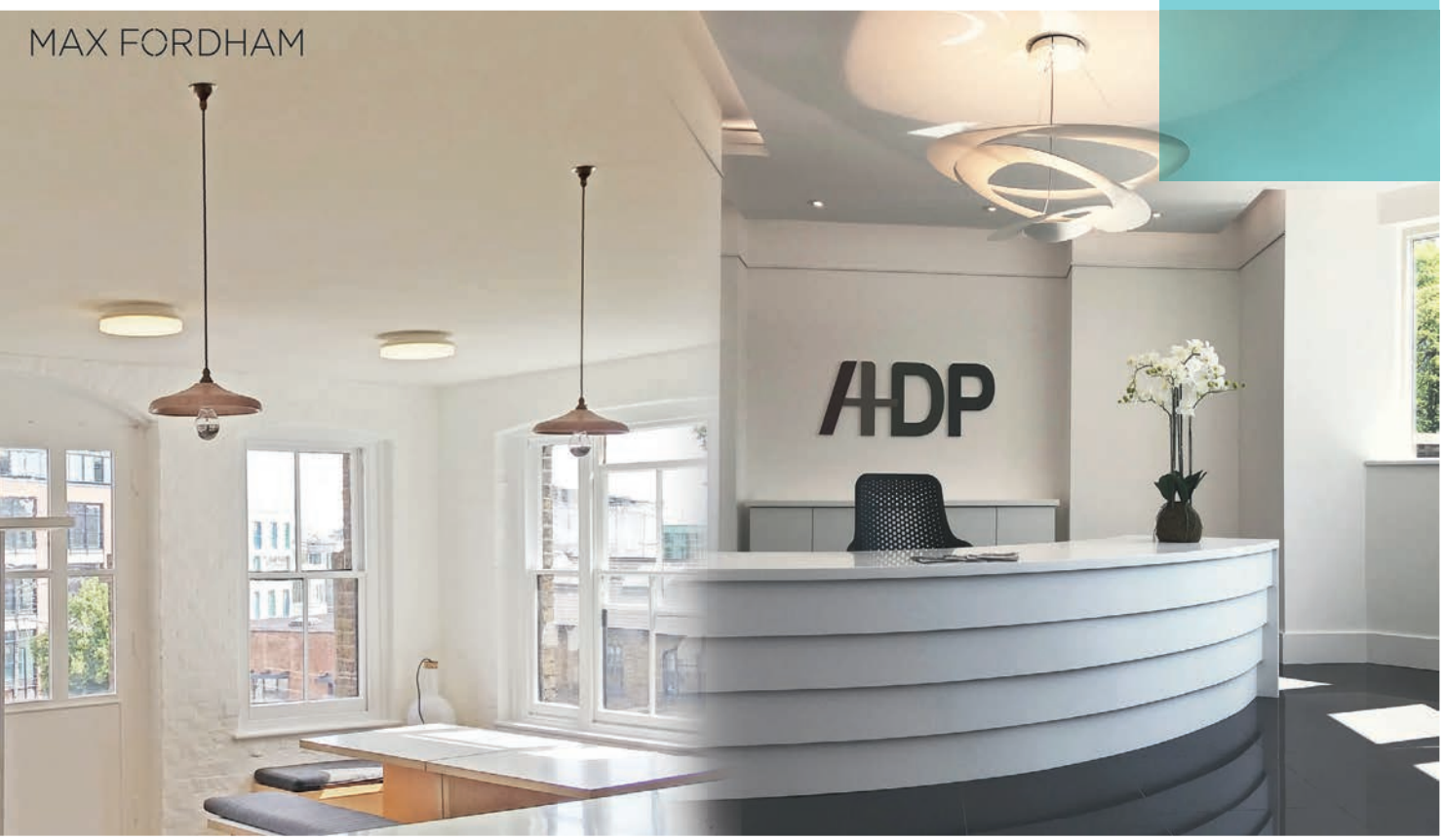

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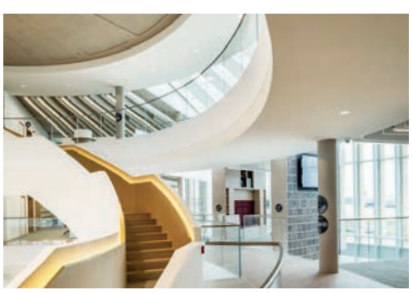

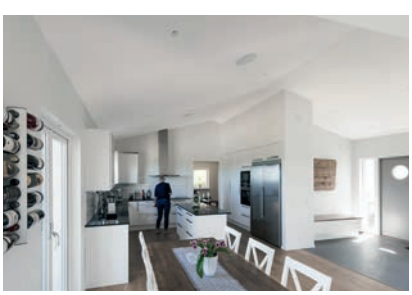

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How Local Authorities investigate noise complaints

An important appeal was heard in the summer, which saw a council noise abatement notice overturned, due partly to the lack of scientific measurement evidence.

Westminster Magistrates' Court upheld an appeal against the notice issued by Westminster Council for an alleged statutory nuisance. The complaint was against a neighbour for playing loud music, but it was the Council's evidence – or lack of it – that came under scrutiny and raised questions on the interpretation of the 1990 Environmental Protection Act.

Acoustic consultant, Richard Vivian, was called by the appellant to give expert comment. He found that the allegation was based on just one visit by an environmental health officer, who observed noise for less than 15 minutes.

"I find it hard to understand why Local Authorities don't take advantage of technological advances to record and present noise evidence that could prove or disprove an allegation, and save them thousands of pounds of public money in court proceedings," he said.

"Noise nuisance is dealt with by the Environmental Protection Act 1990 (EPA 1990) and although the Act does not actually stipulate that noise recordings are required, common sense would dictate if you have the technology to help prove your case then why not use it?

"That's somewhat at odds with our scientific world: motorists are not fined for looking as if they might be going too fast, scientific measures are put in place to quantify speed. Similarly, Environmental Health Officers would not expect to subjectively assess the temperature of food being stored, they would use a thermometer.

"I understand that council officers are reluctant to put people forward in court to argue what they see as technical data – if they don't take readings they don't have to defend them – but technology has progressed so much, almost anyone could take out a modern sound level meter and get accurate readings. We live in a scientific world and it is time to change these out-of-date practices."

In court, the judge was critical of the Council for not taking any noise recordings of the incident. Rather than relying solely on the 1990 legislation, noise practitioners should look to the more recent Chartered Institute for Environmental Health and DEFRA management guidance on neighbourhood noise, alongside the lean Neighbourhoods and Environment Act of 2005.

After hearing the evidence, the judge upheld the appeal on three rounds, finding:

- That there was no statutory nuisance given the absence of corroborative evidence; the fact that the notice was served following a single incident and the finding that the holding of occasional parties was a reasonable use of a domestic property, which did not constitute a nuisance;
- That there was a defect in the notice in that the requirement to 'abate the nuisance' was insufficiently certain in circumstances where the nuisance was so loosely defined in the notice. The judge distinguished the case of Cambridge City Council v Douglas [2001] Env LR 41, where a notice requiring the owner of a pub to 'abate the nuisance' from amplified music had been upheld, partly on the basis that the case had related to commercial rather than domestic premises. Given that the breach of the notice constituted a criminal offence, the recipient had fairly to be told what she must do to avoid criminal sanction;
- That the requirements of the notice were unreasonable in that they disproportionately interfered with the appellant's right to family and private life. Given the uncertainty in the notice, the only way in which the appellant would be able practically to comply was by not playing music in her home. That was unreasonable.

Vivian, who is Managing Director of Big Sky Acoustics Ltd, said: "This is not an isolated case. I was involved in another case in the magistrates' court and, although witness statements were submitted by six officers, there was no substance to their evidence. They all relied entirely on vague and subjective assessments of the noise levels and there was no consistency between them.

"The key issue here was that the EPA 1990 allows trained officers to do this: simply to subjectively assess – some may say guess – if something is a nuisance or not. The officers were actually disadvantaged because they could not say the noise in the flat increased by 'x' decibels at key times. The lead officer was adamant that scientific sound measurement would have only made matters more confusing, which I found an incredible argument from a senior technical officer – and the court agreed."

Cirrus Research Marketing Manager, Thomas Shelton, commented: "I find it incredible that noise abatement notices are being issued without any scientific evidence to back them up. It is no wonder we are seeing challenges in the courts and these notices quashed.

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Customised acoustic wall panels mimic brickwork and windows

Customised acoustic wall panels by Armstrong Ceiling Solutions were specified for the refurbishment of Grade II listed Hackney Town Hall.

The folded bronze anodised aluminium panels were selected by Hawkins\Brown architects for the end walls of two underused interior service courtyards, that have been transformed into full-height, multi-functional atria as part of the redevelopment.

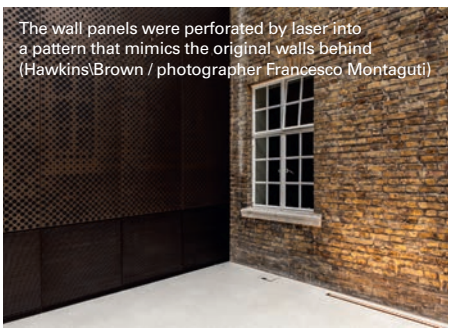
The bespoke wall panels were perforated by laser into a pattern that mimics the original walls behind, including aged brickwork, Crittall windows, drainpipes and services. They serve to conceal new ducts linked to the smoke ventilation system and feature an acoustic fleece behind the panels to absorb sound.

Some 110m² of the 1.5mm WH-1000 2m x 1m panels, which also feature a butterfly effect, where random perforations have been fabricated into 'wings' to dapple the light, were installed onto a lightweight steel framing system on the walls at the eastern ends of the north and south atria.

Hawkins/Brown Associate Director, Chloe Marshall, said: "We wanted a standard, proprietary acoustic wall cladding system that we could customise with the perforation pattern to create a new feature within the rooms, rather than a dominating plain rear wall. A bronzed finish was chosen to link to the historic building materials of the 1930's interior, the London Stock brickwork and painted steel structure of the new ETFE (Ethylene Tetra Flouro Ethylene) roof."

Built in 1937 to an Art Deco-style design by architects, Lanchester and Lodge, Hackney Town Hall has been the subject of an exhaustive 12-year and 12,500m² restoration and refurbishment programme.

Armstrong Ceiling Solutions' bespoke wall panels at Hackney Town Hall (Hawkins\Brown / photographer Francesco Montaguti)



The wall panels were perforated by laser into a pattern that mimics the original walls behind (Hawkins\Brown / photographer Francesco Montaguti)

Taking noise off the menu

If visiting a restaurant with loud music leaves a bitter taste in your mouth, Oxford University experimental psychologist, Charles Spence, could have an explanation for that. His research has revealed strong links between noise and taste, meaning dining out is not just about food.

Certain sounds enhance tastes, for example, classical music may add to the perceived quality of wine and food. Loud background noise can suppress sweet and salty tastes. High pitched notes bring out the perceived sweetness of food, while base notes affect bitter flavours.

A lot of unwanted noise can overwhelm the senses and become a distraction. It might mean you're less able to taste your food.

Intrusive background noise is becoming a major problem in restaurants, cafes and pubs. 35% of customers surveyed by charity, Action for Hearing, write reviews on websites after dining out – and half of these reviews mention high noise levels. An earlier report found that 79% of those surveyed had left a restaurant early because of excess noise.

Intrusive background noise is becoming a major problem in restaurants

The trend for using reverberant building materials in restaurant design can add to the problem.

Case study

Rockfon Mono Acoustic, a Class A sound absorbent ceiling, has transformed the atmosphere in the Dublin restaurant, Bewley's Grafton Street. The interior features mahogany panelling, stained-glass windows and mosaic floors that could generate distracting background noise. Rockfon Mono Acoustic controls the level of reverberation and integrates with the building's period features.

Irwin Carr, Consulting Senior Consultant Acoustician at Malachy McAlister, advised on improvements to the acoustics at Bewley's. He said: "We were able to determine the additional absorption provided by the new ceiling by undertaking acoustic tests before and after its installation. Our measurements show Rockfon Mono Acoustic reduced the reverberation time from 1.1 seconds to 0.7 seconds, a 35% reduction in sound reverberation."

Case study – Highest Point Festival

Chris Selkirk is a specialist acoustic consultant overseeing the monitoring of sound levels at outdoor festivals, events and venues across the UK. He is no stranger to the headaches they can bring to local residents who live within shouting or singing distance.

His latest project, however, have him a slight feeling of déjà vu but with four times the acoustic headache to contend with.

Two years ago, Chris was working on the Hacienda Classical concert in Williamson Park in Lancaster. The event comprised an orchestra playing sets from the Hacienda's classic 90s house music hits to a 3,000 strong crowd.

The concert was such a success that promotors wanted to return to the city with a bigger and better event – The Highest Point Festival.

The challenges that faced Chris the first time around – a outdoor setting surrounded on all sides by around 10,000 homes within 1km (the nearest being just 150m away) still stood, but they were compounded by the event stretching over three nights and two days, incorporating four stages, family activities and food and drink outlets.

As the site's acoustic expert, Chris began talks with the Lancaster City Council to map out what the acoustic limitations and expectations would be. This was followed by planning and site visits leading up to the event.

Over the festival weekend, he used the Invictus outdoor noise monitor and Optimus Green sound level meter to allow him to be in more than one place at a time for measurements, and with four stages of sources of noise, his noise mapping technology and pre-planning paid off.

Chris explained: "Williamson Park is surrounded by residential properties as close as 100-150m in all directions. We designed an acoustic noise model using SoundPLAN software, which enables accurate 3D spot height data to be used, this allowed us to see how we could use the park to the best advantage to reduce off-site propagation and the best orientation of stages and speakers.

Cirrus Research Invictus Portable Noise Monitor

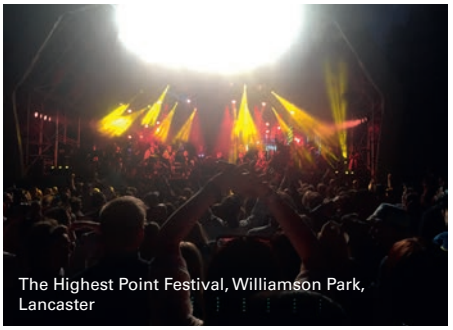
"We used the topography of the park, acoustic barriers and cardioid speaker set ups to create effective acoustic shadows to minimise off site noise propagation as well as any interference between the four stages on-site."

Noise clashes across the site from various sound sources not only affect the quality for the audience but do not allowing any respite for those who want to take a bit of time out or who live nearby.

Chris said: "Often at festival events, there can be a significant issue with having multiple stages in the same environment, which causes stages to have significant sound clashes, especially with quieter stages competing with a main stage. This also creates sound clashes in areas in between stages, where you can hear several stages at once.

"With careful acoustic design, layout and planning, it is possible to not only reduce off-site noise for residents, but also reduce onsite noise issues and create an enjoyable environment, in all areas of the festival site.

"The control measures in place and offsite monitoring devices enabled us to provide excellent on-site music levels for the audience whilst minimising any inconvenience to residents. With stages operating up to 95-100dBA on the park, this was an excellent result."



The Highest Point Festival, Williamson Park, Lancaster

Optimus Green handheld sound level meter

Of the Cirrus Optimus Green and Invictus kits' performance, Chris says both were simple to use and allowed him to see all data simultaneously of both live measurements and previous measurements. "This is critical in a live monitoring situation where circumstances change quickly, and you need access to the data in order to make the right decisions efficiently," he explained.

He went on: "The Invictus remote monitoring equipment enables multiple log ins, so all acoustic staff, event managers or the local authority, can see the live data from the event. While the Invictus is usually placed permanently at noise hotspots, it is also easily portable to move to new locations as required. You can simply log in via any internet device and see all the noise data from each device on the single screen.

"The audience wants and deserves the right quality and level of sound from the performance, local residents don't want their lives disrupted above acceptable levels and the Local Authority want to ensure regulations are met and, ideally, no noise complaints to have to deal with during or after the event.

"At this event we achieved that, and the Council were delighted they only received one complaint. In fact, another resident living immediately next to the park spoke to me and said the noise was no louder than having a quiet radio on in the garden."

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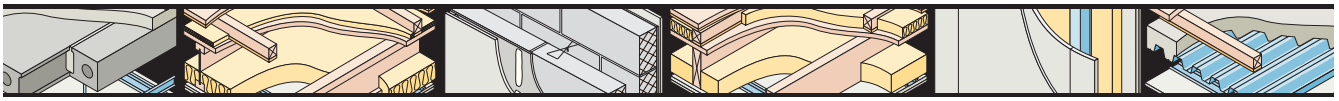

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As an initial guide, applicant organisations must be UKAS accredited or ANC registered for sound insulation testing of dwellings for Building Regulation purposes. They must also employ one or more acousticians who: are at least corporate members of the Institute of Acoustics; are competent to carry out sound insulation testing and diagnose performance; and, in the case of ANC registered organisations, are ANC registered individuals.

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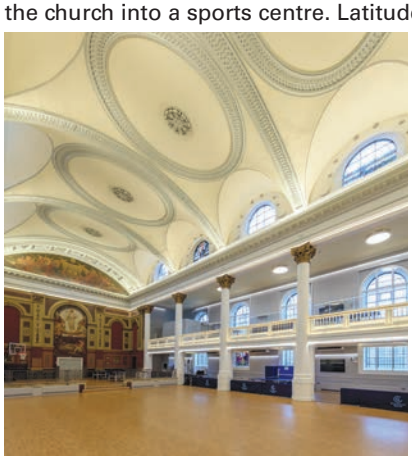
A deprived building and local community receive something to go 'ping-pong' over

35 Cosway Street, was granted a Grade II* Listing in 1954. It is a distinctive deconsecrated church in the Lisson Grove Conservation Area. Greenhouse Sports was founded in 2002 as a sports coaching charity and initially set out to provide deprived young people something positive to do in the school holidays. Recently, they acquired 35 Cosway Street, located in one of the most deprived wards in London, and have refurbished the building into a state-of-the-art sport centre that enables them to extend their sport development model into the community.

A radical and sensitive transformation was required to turn the church into a sports centre. Latitude Architects was engaged to work on the plans for the renovation, which were undertaken in consultation with Historic England.



Surrounded by local shops, residential areas and community buildings – including a school; sound insulation was imperative to stop noise escaping and disturbing local residents. The original single pane stained glass windows could not be changed, so did little to prevent the outbreak of noise. Therefore, Latitude Architects specified the use of secondary glazing to provide sound insulation; a reduction of 46 dB was required. In addition, it improved the thermal properties of the building and provided guarding in certain areas.

Cosmur Construction (London) Ltd, experts in sensitive renovations of listed buildings, were appointed as the main contractor, who approached Selectaglaze to discuss the treatment and scheduling of secondary glazing works to the windows.

In total, 88 units were manufactured and installed, which were a combination of Series 42 fixed lights with curved and standard heads, as well as Series 80 3HS contra sliding units. Some of the Series 80 were 1.9m (h) x 2.3m (w) and weighed over 130kg when all assembled, so fixing points had to be checked for their strength to maintain integrity of the installation. The units came in three separate panes to enable manual handling and accessing the specific areas for installation.

Established in 1966 and granted a Royal Warrant in 2004, Selectaglaze is the leading specialist in the design, manufacture and installation of secondary glazing. Selectaglaze has vast experience in working on all building types.

For further information, please contact Selectaglaze on
Tel: **01727 837271**
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Armacell appoints new Regional Sales Manager

John Bradley has been appointed as the new Regional Sales Manager for Armacell, covering their Central territory.

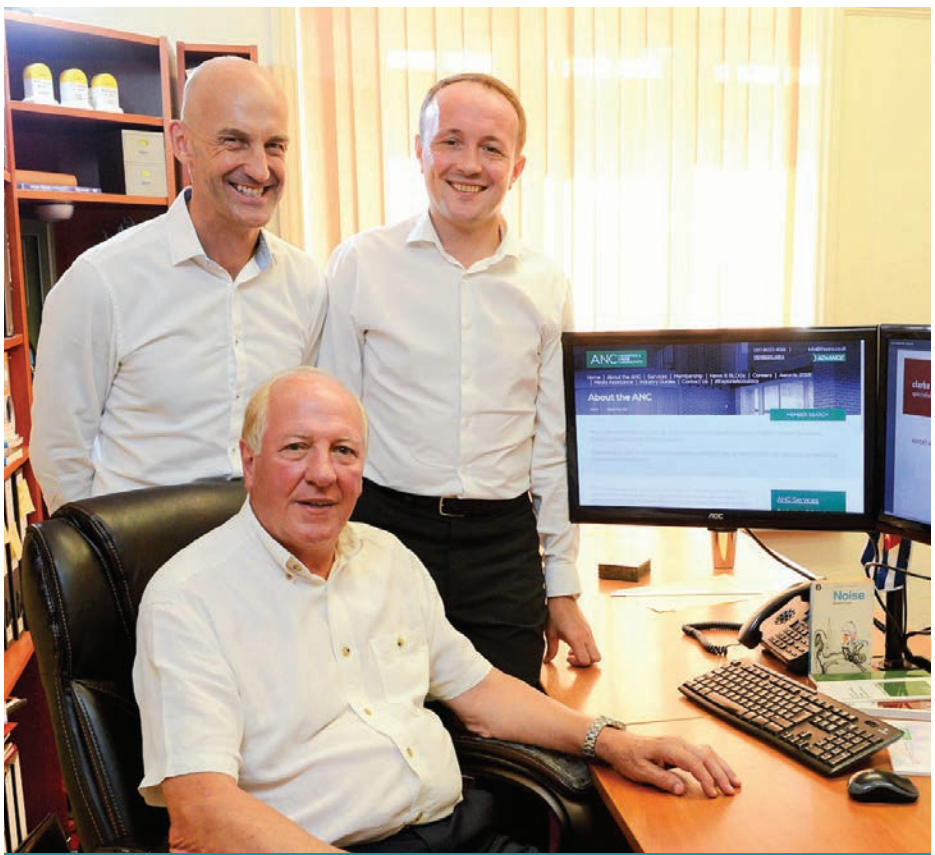
He brings with him a decade of industry experience, having worked in merchanting and manufacturing since 2008 for Jewson and Kingspan respectively.

"Armacell is an innovative manufacturer of engineered foam solutions and I look forward to contributing to the ongoing success of the brand", said John.

www.armacell.com/uk

John Bradley

Clarke Saunders Associates take third trade association role



Back row, (L-R) Ed Clarke and Dan Saunders, front row, seated, Alan Saunders

Acoustics specialist Clarke Saunders Associates is upholding a family and business tradition with the election of Company Director, Dan Saunders, to Chair of the Association of Noise Consultants (ANC).

He follows in the footsteps of his father, Alan Saunders, and colleague, Ed Clarke, both fellow directors of Clarke Saunders Associates, in taking up the position.

Dan said: "This is a time of political and financial uncertainty and it is important that the ANC offers a strong and compelling voice to set out the importance and value of acoustics in modern society.

"I am particularly keen to explore the ANC-funded research to benefit the membership.

"I am also keen to continue the excellent work of the previous Chair, Jack Harvie-Clark, and those in the role previously, in the preparation and issue of Good Practice documents.

"Finally, it is important to raise awareness of acoustics to encourage more people from across society into the industry."

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Committee meetings 2018

DAY	DATE	TIME	MEETING
Tuesday	26 June	10.30	ASBA (Edinburgh)
Tuesday	3 July	10.30	CCENM Examiners
Tuesday11	3 July	1.30	CCENM Committee
Tuesday	3 July	10.30	CCBAM
Thursday	5 July	11.00	Meetings
Thursday	9 August	10.30	Membership
Wednesday	14 August	10.30	Executive
Thursday	20 August	10.30	Diploma Moderators Meeting
Wednesday	26 September	10.30	Council
Thursday	11 October	11.00	Meetings
Thursday	18 October	11.00	Publications
Thursday	1 November	10.30	Membership
Thursday	15 November	10.30	Research Co-ordination (London)
Tuesday	20 November	10.30	CCWPNA Examiners
Tuesday	20 November	1.30	CCWPNA Committee
Wednesday	21 November	10.30	Diploma Tutors and Examiners
Wednesday	21 November	1.30	Education
Thursday	22 November	10.30	CCENM Examiners
Thursday	22 November	1.30	CCENM Committee
Thursday	22 November	10.30	CCBAM Examiners
Tuesday	27 November	10.30	ASBA Examiners (Edinburgh)
Tuesday	27 November	1.30	ASBA Committee (Edinburgh)
Wednesday	28 November	10.30	Executive
Wednesday	12 December	10.30	Council

Refreshments will be served after or before all meetings. In order to facilitate the catering arrangements it would be appreciated if those members unable to attend meetings would send apologies at least 24 hours before the meeting.

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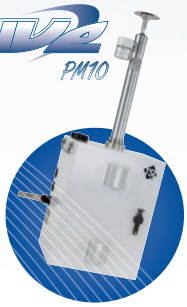

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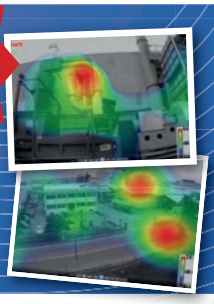

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