Volume 47 No 2 March/April 2021

ACOUSTICS BULLETIN

Institute of Acoustics

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Acoustics Bulletin Volume 47 No 2 March/April 2021

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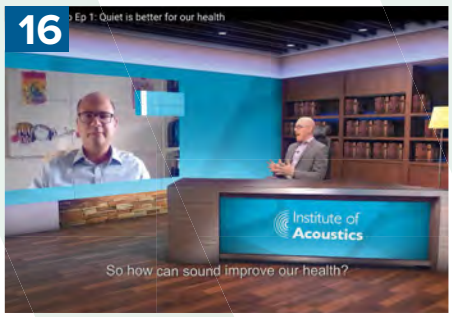
Institute affairs

General news

Features

Regular



Technical articles review procedure

This review picks up key points that may need clarifying before publication, and is not an in-depth peer review.

The Institute of Acoustics is 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, governmental 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

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Dear Member

I need to start this letter with a 'thank you' and an apology.

Membership renewal 2021

The thank you is to all of you who have renewed your membership for 2021. One of the responsibilities of the President, supported by the Executive Committee and Chief Executive, is to manage the finances of the Institute. And having some certainty over revenue is essential to being able to plan what we can do for the membership in terms of events, CPD opportunities and general outreach such as our STEM activities.

The apology is for the confusion I have caused by trying to sort out a problem that I know some members have encountered at the start of each year. Previously, your membership certificate showed that your membership in any year was valid until 31 December. The usual pattern was for the membership renewal to go out in January, and on receipt of the relevant membership fee, the certificate would be reissued for the new year. However, for those in consultancy, some clients require proof of IOA membership when considering commissioning some work. If that happens in early January (which I understand does occur), the relevant member cannot demonstrate that they are a current member because the certificate has expired and the renewal process has not yet been completed for the new year.

To address this issue, I suggested that we should simply extend the validity of the membership certificate until 31 March, to avoid that hiatus. Unfortunately, many members have interpreted this change as meaning that subscriptions are not now due until 1 April. **THIS IS NOT THE CASE.**

Our membership year runs from 1 January to 31 December each year, and subscriptions fall due as soon as the renewal notice is received in January. If you have not yet renewed because I confused you in this way – please would you accept my apologies and renew your membership as soon as possible. Thank you.

The profession of acoustics

We are hugely privileged to work in this great profession. Not only do we have our own interest in the field of acoustics that occupies us daily, but we are each linked through our IOA membership to other members who are involved in very different, diverse and fascinating topics. The acoustics of speech, hearing, loudspeakers, microphones, motor vehicles, aircraft engines, buildings, ultrasonics and underwater are all part of our family.

Ironically, one of the advantages of our enforced on-line presence is that it is easier for each of us to log in to a talk on a subject that is not part of our day-to-day activity. Doing so not only provides an opportunity for learning about other aspects of acoustics, but attending the meeting can be noted as part of our CPD. I attended an underwater acoustics lecture a couple of months ago and am still amazed at how a stream of bubbles can effectively be used as a noise barrier when building off-shore structures.

We do, though, each have a responsibility to our profession, and, in particular, to behave appropriately and with integrity. The IOA has a Code of Conduct and our Membership Committee follow a very rigorous process when faced with an allegation that a member has broken the Code of Conduct. One of the key elements of the Code of Conduct is the responsibility on each of us not to work beyond our own competence. If we do, we not only run the risk of letting ourselves down, but also letting down all our colleagues in the profession. If you have not done so recently, have a look at our Code of Conduct to remind yourself of our obligations: **www.ioa.org.uk/about-us/our-members-code-conduct**

National Apprenticeship Week (NAW)

NAW occurred between 8 and 14 February 2021 and our colleagues in the Association of Noise Consultants have published the videos produced for their 2020 virtual awards ceremony. The videos showcase a variety of acoustics projects and are part of the #exploreacoustics campaign supporting the profession's STEM outreach work. The videos are on the ANC twitter feed @TheANC1973, whilst others are on their You Tube channel: **www.youtube.com/channel/UCVfSsvvu3rhV-ZojoSw-b0Q** Do have a look at them.

Finally, when you read this letter, the days will be getting longer, and we will be emerging from the latest lockdown. I am sure we are all hoping that the vaccination programme will mean that we will soon be able to go back to enjoying time with friends and family again. It has been good hearing from those members who have had their first COVID vaccination (as I have).

In the meantime, stay safe
With best wishes,

Engineering Division

The IOA Engineering Division will support you through the process to help you become one of almost 225,000 registrants that hold international professional recognition.

By Blane Judd BEng FCGI CEng FIET FCIBSE, Engineering Manager

We held some more interviews in mid-February but the results came too late for this edition's deadline, look out for profiles in the next issue though, subject to the candidates being successful. I always say to candidates that we won't put them forward unless we think they will be successful, but it's down to candidates on the day to show how they meet the UK-SPEC competencies.

We have already started to draw up the new documentation to comply with the new UK-SPEC version four and are looking to start implementation in the middle of the year. For those who are already working on their submission you will be able to use UK-SPEC version three submissions up to the end of the year. From July onwards, however, we will be encouraging candidates to work to version four. As I said in my last report, the Engineering Council expects us to have made the transition by December 2021. Since, on average, it takes six months to complete the process, July is considered to be a suitable start point for transition.

Emma Lilliman continues to do a great job supporting candidates and keeping people on track and Neil Ferguson is helping us with academic equivalence support for those candidates who do not have exemplifying qualifications. You can check for yourself if your qualifications meet the required specification by visiting the Engineering Council website **www.engc.org.uk**. But please don't panic if your specific qualification is not listed, as we can still help you through the process on the individual route.

Interviews

Our next round of interviews will be later in the year and, as usual, we have candidates working towards interview dates. We hold a number of interview events through the year, depending on the number of candidates we have coming forward for registration. If you are interested in taking the next step to becoming a professionally registered engineer, email **acousticsengineering@ioa.org.uk** sending a copy of your CV and copies of certificates and transcripts of your qualifications. It is important that we have all of your further and higher education certificates, not just your highest attainment.

Academic qualifications

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 master's degree was required or an ordinary degree for IEng.

There are two routes:

1. **standard route** if you have the appropriate EC-accredited qualification (also referred to as an exemplifying qualification) in acoustics; and the
2. **individual route**, which requires further preparatory work from you before submitting evidence of your competence.

Remember that 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.

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 EC 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.

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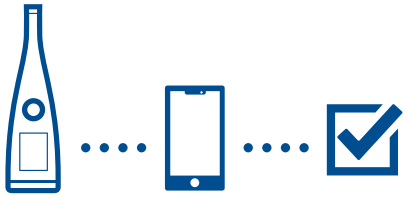

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2021 Conference programme

Understandably, the 2021 conference programme is likely to be affected by the COVID-19 virus, so always check the details.

HEAR FOR TOMORROW
6 October 2021
Royal Academy of Music, London
Organised by IOA and Hearing Conservation Association

ACOUSTICS 2021
11-12 October 2021
Crowne Plaza Hotel, Chester

REPRODUCED SOUND 2021
16-18 November 2021
The Bristol Hotel, Bristol
Organised by the Electroacoustics Group

INTERNATIONAL EVENTS

BNAM2020 E-CONFERENCE (Baltic-Nordic Acoustics Meeting)
3-5 May 2021
Oslo, Norway
www.bnam2021.org

AIA, 47th NATIONAL CONFERENCE OF THE ACOUSTICS SOCIETY OF ITALY E-CONFERENCE
24-28 May 2021
Matera, Italy
www.acustica-aia.it/en/event/47th-aia-national-conference-online

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ICBEN 13th CONGRESS ON NOISE AS A PUBLIC HEALTH PROBLEM
14-17 June 2021
Sweden
www.icben2021.se

ICSV2021, INTERNATIONAL CONGRESS ON SOUND AND VIBRATION
11-15 July 2021
Prague, Czech Republic
www.icsv27.org

INTER-NOISE 2021
1-4 August 2021
Washington, USA
www.internoise2021.org **(See more details on page 58)**

DAGA 2021, 47th ANNUAL CONFERENCE ON ACOUSTICS
15-18 August 2021
Vienna, Austria
www.daga2021.eu/en

FIA 2020, 12th IBEROAMERICAN CONGRESS ON ACOUSTICS
29 August-1 September 2021
Brazil
fia2020.com.br

EURONOISE 2021, online
25-27 October 2021
www.daga2021.eu/en

NOVEM 2021 (NOISE AND VIBRATION: EMERGING METHODS)
13-15 December 2021
Auckland, New Zealand
www.novem2021.ac.nz

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IOA STEM activity

Here, we explore some of our acoustics ambassadors' top tips on producing and presenting acoustics activities for a new online STEM audience.

By IOA STEM Ambassadors, Nikhil Mistry and Alex Krasnic

During the pandemic, face-to-face STEM events are being curtailed across schools and other venues across the British Isles. Where physical STEM Club activities and Big Bang Fairs were once common events, STEM Learning (the not-for-profit organisation which manages the registration of STEM Ambassadors) is determined not to let the crisis undermine the tens of thousands of outreach activities organised by volunteers each year, so they have been actively encouraging new ways of delivering STEM activities to remote audiences.

This article follows the home-schooling and remote teaching trend by offering anyone (not just STEM Ambassadors) our top tips for formulating, planning and delivering online activities (in no particular order and with additional input from the Institute's STEM Committee members: Vicky Stewart and Matthew Muirhead).

Above: IOA STEM Ambassador, Nikhil Mistry

Below: A 2019 STEM event

Top five digital tips for online content:

1. Consider investing in reasonable quality audio-visual hardware. This will enable you to get the best out of your presentations.

- **Alternatively, you can make small improvements for free, by thinking about your recording environment and effective use of your equipment. How about placing your microphone close to soft furnishings or recording in a controlled environment (e.g. in a car or facing into a filled wardrobe), or acquiring a few low-cost absorption panels. 'Audacity' is good freeware and has a noise reduction feature, which you can use post-recording.**

2. Split your presentation up into easy-to-follow sections. Consider starting with a 30-second 'hook' using accessible language, which connects your work to the audience's interest, letting them know the real-world benefits, thereby grabbing their attention from the start. P12

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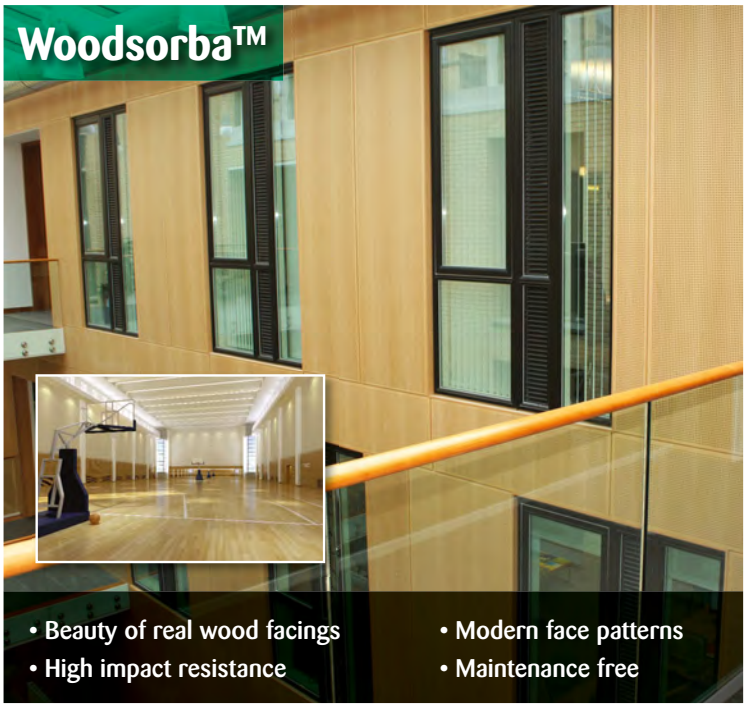

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Left: While in-person STEM events are on hold, there are still plenty of ways to reach audiences

- **For schools, a run-down of any activity instructions/raw materials for use by pupils, a step-by-step guide for your presentation and a discussion of outcomes learned/achievement of educational objectives, are greatly welcomed by teachers.**

3. Stuck for inspiration? Explore the wealth of examples by other STEM Ambassadors, giving a flavour of how and what your presentation can borrow from. Use the links at the end of this article as a starter.

- **Draw inspiration from others around you to shape your online content. Don't be afraid to reach out to other creators for advice or collaboration.**

4. While we're all stuck at home using our digital devices more than ever, your worldwide audience is now available 24/7. Platforms like: YouTube, Twitter, Instagram, Facebook etc. allow a quick and easy means of achieving the farthest and greatest reach with your work. They're also a great way of finding out what your audience wants, open the floor to requests and respond to them.

5. Head down, reading endless presentation notes from your desk will likely result in a rapid loss of interest. Enthusing your audience with your passion and transferring that to your activity/presentation (without resorting to long notes), makes A world of difference to your audience's reaction and participation levels.

- **Try to keep technical jargon and equations to a minimum; use your presentation as an aid to your speech. Using non-technical vocabulary is not 'dumbing down', it should make your presentation more accessible.**

Top five general tips for remote presentations:

1. For schools: make preparations before the day of the event. Liaise with the teacher(s) in the class you are presenting to, furnishing them with session notes so they know what to expect over the course of the session. Remember that teachers can act as your 'eyes and ears' in the classroom without you being there, so establishing a two-way communication to the class is essential.

2. Consider preparing supporting material to generate interest before your session; consider a video demonstration of a simple acoustics experiment to do at home/school.

- **This acts as a great way of marketing your digital platform, exposing them to all your other content.**

3. Open-up with a brief talk about yourself and your day-to-day academic/professional role. This will help put your audience at ease, helping them connect more easily. Your audience will learn about how your role makes the world a better place and instil a sense of inclusivity and diversity.

4. Choose a topic that is dependent on acoustics in some way which your audience can resonate with, again, avoiding jargon where possible. Consider topics such as music, sports, arts and nature. For example, highlight the acoustics of a recording studio, how acoustics is used to design the inside of a football stadium or how marine mammals hunt and communicate.

5. Keep the level of scientific detail appropriate to your audience. Remember which year group you are presenting to in schools. This will help adjust your level of technical language accordingly.

- **It is important to link the schools' curriculum with careers and how they would use the science in the future, as this is a benchmark upon which schools are judged in their careers advice and support (one of eight Gatsby Benchmarks).**

We hope you have found these tips useful but if you're looking for further information, STEM Learning have produced some insightful 'how to' guides, to provide STEM Ambassadors with additional pointers on presenting remote sessions through outreach activities, as well as a host of other online resources, including the IOA's own blog pages.

Below: Nikhil Mistry, IOA STEM Ambassador

The following links can be accessed via the digital version of this article:

- IOA Blog: **www.ioa.org.uk/ioa-blog**
- ISVR YouTube Channel: **www.youtube.com/c/isvrsouthampton**
- Tips and Support from STEM Learning: **www.stem.org.uk/stem-ambassadors/supporting-schools-colleges**
- Tips from University of the Highlands & Islands: **www.thinkuhi.com/stem/page_06.htm**
- STEM Learning YouTube Channel: **www.youtube.com playlist?list=PLhgK74tFscGXY0C3MVvv9S1MLEhDrK6cF**

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CPD – What it is, how to get started and why you must do it

Would you be comfortable taking advice from a professional that had not bothered to keep up to date in their specialism? The same applies to acousticians.

Prepared on behalf of the CPD Committee

Information about the IOA Continuous Professional Development (CPD) scheme has been made available to our members for several years. However, there still seems to be a problem getting the message across to a few acoustic practitioners about why CPD is important – if not essential. There is also a misapprehension by some members that CPD is onerous, difficult and time-consuming (update – it really isn't).

Information about the current scheme is available on the IOA website at: **www.ioa.org.uk/membership/professional-development-scheme**

The information set out on the IOA website is not repeated in this article, but please note that there are a number of helpful downloads available including:

- full information and details about the CPD scheme, the process and the CPD plan and record sheets;
- an example guide to getting started;
- a handy one-page CPD summary document, to be used as an aide-memoire;
- examples of completed CPD records (for an academic, consultant, consultant/director and EHO); and
- a blank Excel sheet for your own use.

IOA members, like professionals in all other disciplines, need to ensure they are aware of and correctly use current information, equipment and practices as appropriate. An IOA member who fails to maintain their competency could bring themselves and the Institute into disrepute and, potentially, expose the member to legal action.

In short, if you are not keeping up-to-date, you shouldn't be working in acoustics. In addition to the Institute's requirement, you may also have a duty to do so for other reasons e.g. being a Chartered Engineer/scientist.

For those who think they don't do CPD or haven't got the time to do CPD – but are keeping up-to-date in their field, you are very probably doing CPD on a regular basis. Are you attending in-house technical meetings, IOA branch meetings, on-line conferences/seminars? Are you keeping informed about technical standards, revised calculation methods, new equipment? Are you renewing your skills or learning a new skill relating to your role in acoustics? These are all CPD activities.

Keep accurate records

All that the IOA asks is that you keep records about what you do that relates to CPD.

For many acoustic practitioners it is second nature to keep a note of what particular project they are working on. The trick is to do the same for CPD activities so get into the habit of noting down what you have done that is CPD-related. The initial setting up of your CPD plan may take a couple of hours, but once that has been done, keeping it current should be part of your regular routine.

Note that IOA members are under an obligation to maintain and extend their professional knowledge and competencies under the Institute's Membership Code of Conduct. If you are seeking upgrade to MIOA or FIOA, you will need to include your CPD plan and records as part of the application process.

IOA reviews members' CPD plans

The IOA aims to review around 10% of corporate members' CPD plans annually. Some of these will be reviewed automatically as part of the application process for MIOA and FIOA, the rest will be chosen from active corporate members of the Institute. Submitting CPD records of an insufficient standard or refusal to submit any documents at all indicates a failure to comply with the Code of Conduct that applies to your membership of the Institute.

However, with the resources that are available to you from the IOA, there really is no excuse not to get your CPD plan and records started and keep them updated.

If you have any questions or would like help please contact your local branch, or if you have difficulty with this, you can email: **membership@ioa.org.uk**

New acoustics apprenticeship gears up for launch

A pioneering apprenticeship in acoustics is planning to take its first intake of trainees later this year.

The Acoustics Technician Level 4 Apprenticeship has been developed as an employer-led, industry initiative, with support from the Association of Noise Consultants (ANC) and the Institute of Acoustics.

It is hoped that the first students can start the apprenticeship in September with work-based training, coupled with study.

Richard Grove, Acoustics Director at BDP, is Chairman of the working group which has developed the apprenticeship and he said: "We have had a great deal of interest in the programme and are delighted that we are now in a position to welcome the first apprentices later this year.

"The new apprenticeship will help deliver the acousticians of the future, which are needed across a range of industries to meet demand.

"The apprentices will have a clear, defined career path and the programme will offer opportunities for diversity and inclusion within the acoustics industry.

"It will also bring benefits to the higher education sector, by acting as a feeder for degree and other courses.

"In the future, it is hoped that as more employers show support for the scheme, other education providers will be able to offer the training for this apprenticeship too."

The trailblazer group behind the new apprenticeship has produced a FAQ guide, to provide a reference point for those looking at taking on an apprentice, as well as anyone considering it as a career option.

Available to view at **www.association-of-noise-consultants.co.uk/download/faqs-acoustics-technician-apprenticeship/** the information pulls together general insight and guidance on the Acoustics Technician Apprenticeship for applicants and employers.

It also includes details of the Apprenticeship Levy, recruitment advice and details of the structure and format of the training programme.

The Acoustics Technician Level 4 Apprenticeship has been developed with support from the Association of Noise Consultants (ANC) and the IOA

Engage more as a member in 2021

By Alex Shaida, IOA Head of Marketing

Above: A still from the Acoustics Bulletin video

Last year, the world suddenly turned upside down, as COVID-19 became an everyday part of all our lives.

In the past months, this has brought about many changes to the way our members and the Institute interact, with some likely to be only temporary, whereas others may end up becoming more permanent. This year we hope to spend more time together and make it a better year for us all, despite the ongoing restrictions of the pandemic that are set to continue for most of 2021.

The fundamental value of IOA membership is professional recognition and helping to influence the world in which acousticians work and live. To gain additional membership value, it depends on how much you choose to utilise the various resources on offer. Career progression is often driven by CPD and networking, and membership offers unrivalled opportunities to do both.

As an IOA member, here are some ways to interact more fully in 2021:

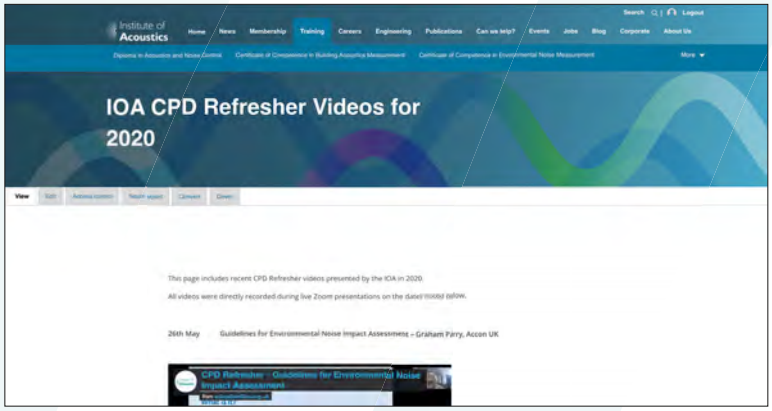
CPD. Are you taking full advantage of CPD? This year we plan to run more CPD sessions. If you have any specific topics in mind, let us know.

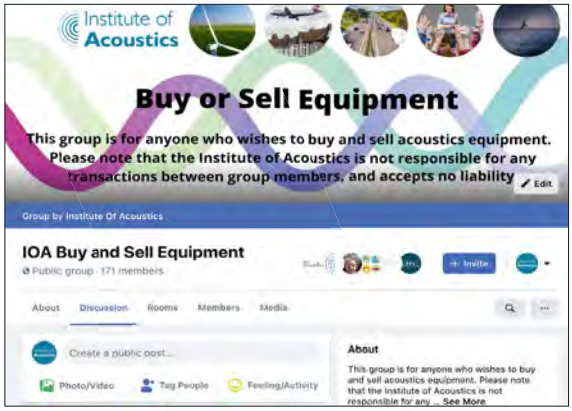
Networking. Networking has been challenging during lockdown, which is why we're planning to run more informal online sessions, along with our regular Monday forums. Also, we've currently scheduled several in-person events including Acoustics 2021 (in Chester), Reproduced Sound (in Bristol) and there will be some more taking place later this year. Given the unpredictable nature of the pandemic, please check the website for updates.

Accreditation. One of the key benefits of IOA membership is accreditation. The IOA offers different tiers of membership, ranging from Student, Affiliate, Technician, AMIOA to MIOA. The membership grades depend on your circumstances and we are always open to discussing these as your needs and circumstances change.

Education. The IOA is traditionally a strong supporter of education in acoustics, and we have been providing a selection of focused short courses via our partner universities, as well as supporting through our partners and providing direct training

Right: Acoustics 2020 was held online





for the Institute of Acoustics Diploma in Acoustics and Noise control. We've recently launched our new blended training programme and we plan to increase the level of content for additional learning resources for our members in 2021.

Talking and influencing politics. The IOA plays an active role in speaking to politicians and influencers about the role that acousticians play in all aspects of society and ensuring that acoustics is being properly addressed when it comes to the shaping of government policy.

Literature and videos. The IOA regularly produces a range of dedicated publications including our bi-monthly Acoustics Bulletin, along with the proceedings that are presented at our diverse selection of acoustics events. You can check out the IOA Library for previous documents, and if you're looking for something in particular, please get in touch and we'll do our utmost to help you find it. In the past couple of years, we've also begun to expand our video library, adding branch and group meetings along with videos that shine the light on so many diverse and fascinating aspects of acoustics.

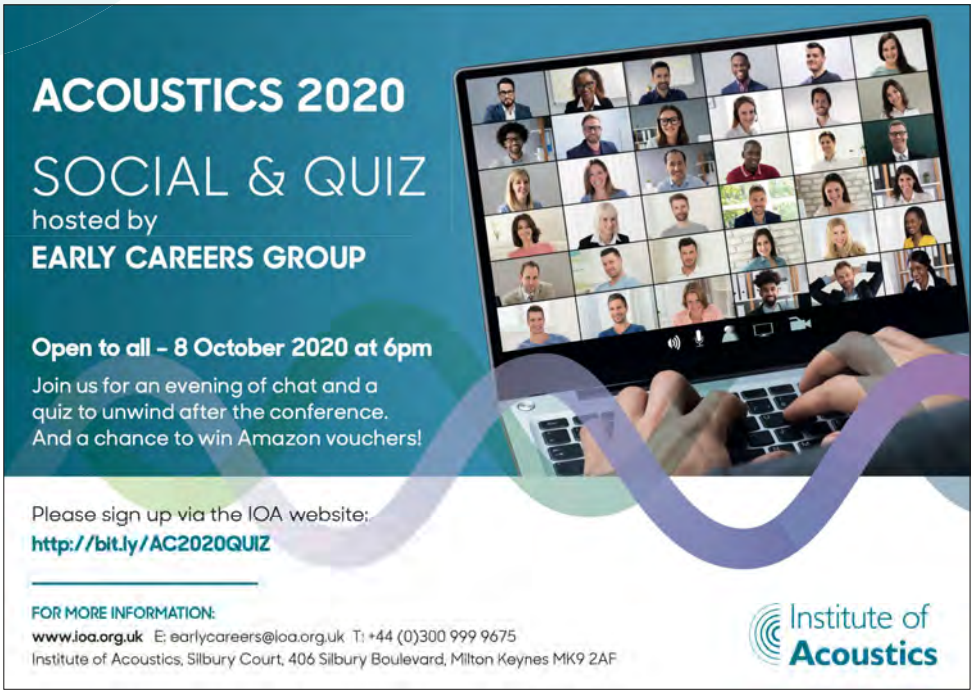
Jobs. The IOA is focused on helping acousticians find and secure their next job, and we regularly advertise job openings in acoustics in our newsletter and on our website. Recently, the IOA has been offering free job postings for acoustics vacancies (currently valid until the end of March 2021).

Above left: We will continue to run more CPD sessions this year

Above right: The IOA buy or sell equipment group is a useful option

Below: The online Rayleigh Lecture

Bottom: Latest social and quiz



Be more social online. In the past few years, the IOA has invested in building up its social media presence. We encourage our members to take full advantage of this and share in discussions, and communicate openly with other community members online. The IOA has a growing presence on Twitter, Facebook, Instagram and LinkedIn and operates several informal discussion groups that facilitate the exchange of ideas and opinions.

Making a difference. As an IOA member, you'll have access to our various groups, branches and committees, as well as the opportunity to also shape the IOA's future by becoming a part of the IOA Council if you want to get more involved. To find out more about how you can be more involved, get in touch.

There's even more

We hold regular meetings each month, the IOA provides industry updates, we publish news announcements, blog postings, distribute a monthly newsletter and partake in all kinds of discussions around acoustics. There's plenty of opportunity to engage with what's going on – even during a lockdown.

We always like to hear directly from our members and welcome your comments on the IOA and what 's being planned. Tell us what you like the most about your IOA membership, and what you like us to improve, as we're always open to receiving your feedback which helps to shape the Institute.

You can call us or email us: **ioa@ioa.org.uk**

Early Careers Group – further education in the time of a pandemic

For many, the pandemic has been an ideal opportunity to bolster their education and learn new skills. For others, furloughs and lockdowns put the brakes on starting a degree or diploma. What options are there for anyone interested in developing their skills and career?

By Tomasz Galikowski

Entry Educational Pathways

The IOA Early Careers Group invited leading educational organisations to attend a webinar on 8 February to find out what courses and financial options are available.

IOA Education and Learning Working Group

Professor Chris Barlow, Chair of the Group, provided a summary of educational pathways into acoustics, career development routes for early career acousticians, ways of keeping current when on furlough or in between jobs, and funding options.

There is a range of webinars and specialist technical training available from manufacturers, educational providers and some universities, The UKAN+ website provides a useful depository and links to relevant webinars. The IOA is developing an enhanced online CPD offer along with new certified and advanced courses on topics including soundscapes.

Transferable and professional skills, such as report writing, project costing and marketing are also important and will form part of the IOA CPD range. Further qualifications such as MSc or PhD could also be considered.

There are currently three undergraduate acoustic degrees, six degrees at masters level and the IOA Diploma (currently offered by six institutions).

There are also several options aimed at technician level, particularly for those moving within the industry, such as: Certificate of Competence (COC) courses offered (i.e. Environmental Noise Measurement and Certificate of Proficiency in Anti-Social Behaviour).

Acoustics apprenticeships are aimed primarily at school leavers but are applicable to anyone thinking about a career change. An apprenticeship allows employees to work while learning, with the training paid for by the government via the apprenticeship levy, up to 100% in some cases. Completing it allows apprentices to apply for AMIOA status. A new HNC Apprenticeship in Acoustics will run from September 2021 at London South Bank University.

Funding options summary

- generally, it is possible to spread the payment over a period of time – subject to each institution;
- advanced learner loan – aimed at those leaving school, however, unsuitable for those with undergraduate degrees;
- student loans are available for masters degrees although paid back in parallel with an undergraduate loan;
- IOA bursary is a great choice for shorter courses, it allows for up to 50% towards course fees – check the IOA website for eligibility and more information;
- research funding options can be found on the UKAN and jobs.ac.uk websites, and through specialist organisations (e.g. Digital Music Research).

Networking helps to keep up-to-date with current information, for example, attending IOA branch meetings or online member forums and conferences. Social media can be helpful and it would be beneficial to get involved with UKAN+.

IOA Diploma

Professor Keith Attenborough presented an overview of the IOA Diploma including recent updates, opportunities for Diploma holders and fee options.

This vocational course is intended to provide sufficient specialised academic training to satisfy the educational requirements for corporate membership of the IOA and is delivered by three centres and three tutored distance learning centres.

IOA Diploma comprises three compulsory modules: principles of acoustics, laboratory, and a project, plus two chosen from:

- building acoustics;
- environmental noise;
- noise and vibration control engineering; and
- regulation and assessment.

Candidates not already working in the field, can use the Diploma to change their careers; it gives access to MSc degree courses and can be used towards chartered engineer registration (you would need three merits to be considered and you would also need an accredited relevant subject at undergraduate level). Graduates can then apply for AMIOA status.

Fees for the Diploma can be made in full or in up to 11 instalments. It is also possible to study individual, specialist modules separately.

The IOA is preparing a new course on report writing aimed at practitioners to include designing and structuring a technical report. This will be based on two days in class and a one-day workshop.

Learn more about the IOA Diploma at **https://www.ioa.org.uk/diploma-acoustics-and-noise-control**

Learn more about chartered engineer registration through the IOA at: **https://www.ioa.org.uk/engineering**

University of Derby

Dr John Pritchard presented the current offer from Derby University, including the courses currently available:

- IOA COC in Workplace Noise Risk Assessment and in Environment Noise Measurements;
- IOA Diploma in Acoustics and Noise Control; and
- MSc Applied Acoustics (top up).

The MSc is a top up course following completion of the IOA Diploma. The degree is designed to allow completion in one year whilst in full-time employment and the project part of the course can be work placed.

Teaching staff include full-time academics and practitioners and because of current COVID restrictions, teaching takes place online and students can complete practical modules in a two-day period on campus.

Learn more at: **https://www.derby.ac.uk/postgraduate/geology-courses/applied-acoustics-msc/**

Institute of Sound and Vibration Research (ISVR), University of Southampton

Dr Nikhil Mistry summarised various courses available at the ISVR, which include:

- BEng/MEng Acoustical Engineering; and
- MSc Sound and Vibration.

The 'advanced course' – a short course taught by experts – is available to those who want to brush up their skills in aeroacoustics or noise control.

There are no fee instalment options at ISVR but individual cases will be considered.

The ISVR will be offering free Jupyter-based notebook tutorials on fundamentals of acoustics. Free seminars are available on various topics and can be accessed by emailing **isvr-spah@soton.ac.uk**

Learn more at **https://www.southampton.ac.uk/engineering/research/centres/isvr.page**

Leeds Beckett University

Leeds Beckett University was represented by Steve Mole, course leader for acoustics. They teach the IOA Diploma and associated MSc top-up option which at this university, is not a stand-alone course. The top-up comprises two modules (research methods and dissertation) which need to be completed on a part-time basis over a year.

Face-to-face research lab classes were available until December 2020 and it is expected to be the same this year. Other classes are taught online. All teaching staff are practitioners.

The fee for the MSc can be paid in instalments and there is a 10% alumni discount.

Learn more at **https://www.leedsbeckett.ac.uk/courses** P20

University of Liverpool

The Acoustic Research Unit (ARU) focuses on research and does not offer taught courses.

Professor Carl Hopkins outlined the benefits for undertaking postgraduate research study including gaining expertise on a specific topic and establishing yourself as an expert.

University of Liverpool offers two postgraduate courses:

- Master of Philosophy – suits employers as it focuses less on 'novelty' and allows upskilling or developing capability; and
- Doctor of Philosophy – focuses on making an original contribution.

Research can be self-funded, paid for by industry, scholarships, or by current employer.

An example of a recent MPhil project is: 'Vibroacoustic modelling of a dowelled-joist timber floor using finite element methods'. A recent PhD project was 'Detection of trapped survivors in collapsed reinforced concrete buildings using structure-borne sound transmission'.

Learn more at **https://www.liverpool.ac.uk/architecture/research/acoustics-research-unit/about/**

London South Bank University (LSBU)

Professor Stephen Dance gave a presentation on teaching acoustics under COVID conditions.

LSBU offers an MSc course in Environmental and Architectural Acoustics. This course is nearly all practical, and cannot be delivered in a lab because of COVID restrictions, so teaching was moved online with lectures either delivered via communications platforms or pre-recorded and supplemented with Q&A sessions.

In order to deliver the practical part of the course, a combination of 12 pre-recorded experiments and a 'lab in a box' was developed, to allow students to carry out a range of live experiments safely at home supervised by the lecturer via remote link.

The software part of the lab in a box included a VPN, environmental and architectural acoustic modelling, a programming platform and a measurement system. The hardware was shipped to the students across the world, comprising an external audio card, an omni-directional microphone, a battery-operated speaker, a Class 2 calibrator, and miscellaneous items such as a tuning fork, a digital metronome and cables. As a back-up, a sound level meter app for a mobile phone was used. The cost of each box was £250. The course received excellent student feedback.

The lab in a box method and recorded sessions can also be used for apprenticeships, future learning and in schools.

Learn more at **https://www.lsbu.ac.uk/study/course-finder/environmental-architectural-acoustics-msc**

University of Salford

Professor Bill Davies introduced topics that can be studied at University of Salford. All of them can be done either as part of taught courses (MSc) or as research (PhD):

- vibro-acoustics;
- structural dynamics;
- psychoacoustics, soundscapes, spatial audio and room acoustics;
- acoustic metamaterials (e.g. acoustics 'black holes');
- drone noise;
- architectural acoustics;
- virtual and augmented reality;
- 'neuro-acoustics' – using brainwaves to control sound;
- computational acoustics – development of simulation algorithms;
- bioacoustics;
- archeo-acoustics; and
- spatial audio.

There are two taught masters (MSc Audio Acoustics and MSc Environmental Acoustics), research masters and PhD, which can be taken as full time/part time and either as distance learning or residential.

Learn more at **https://hub.salford.ac.uk/sirc-acoustics/**

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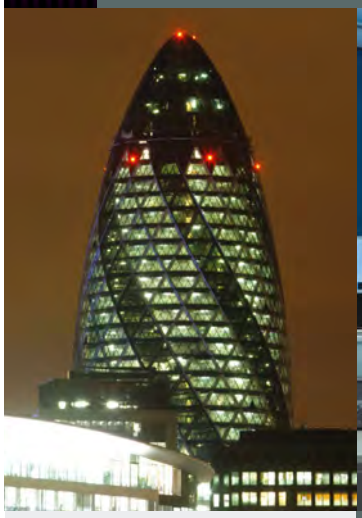

Cellular offices achieve better speech privacy with Sound Masking

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

Similar problems also exist in cellular offices. Apart from noise breakthrough via partitions, flanking over, under and around them, other problem areas include light fixtures, air conditioning systems and services trunking. Sound masking compensates for these problems.

An investment in increasing privacy of speech is certainly cost effective, with Sound Masking one of the easiest ways of achieving this aim. Sound Masking systems along with acoustic panels and acoustic door seals are increasingly used to achieve the desired level of privacy by a number of our major clients including:

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- Procter & Gamble
- Swiss Re
- Mobil Exxon HQ
- Elizabeth Arden
- Barclays Bank
- Freshfields
- KPMG
- PWC
- BP

Sound Masking is now available with a host of extras including:

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

Electro-Acoustics Group taking it up a level at Reproduced Sound 2020

The 36th annual Reproduced Sound conference, organised by the IOA's Electro-Acoustics Group (EAG), took place online from 17-19 November, 2020. The conference represented the cutting edge of modern audio and acoustics in an informal environment that allowed consultants, manufacturers, contractors, end users, academics and students to mingle and share insights and information.

By Adam Hill

Organisation of the conference was led by EAG Chair, Keith Holland (ISVR, University of Southampton), supported by the 11 committee members and IOA's Linda Canty. Complete online audio-visual support was provided by EAG committee members, John Taylor (d&b audiotechnik) and Ludovico Ausiello (Solent University), with support from student members, Sebastian Duran and Panos Tsagkarakis. d&b audiotechnik have generously provided technical support for Reproduced Sound for many years, to the great benefit of the conference.

Due to the ongoing pandemic, the conference was held virtually over three consecutive afternoons. The delegates numbered nearly 100, representing a good balance between industry and academia, with participants joining the conference from across the globe.

Conference – day one

Prior to the official launch of Reproduced Sound 2020, EAG committee member, John Taylor, introduced the technical team for the conference, explaining to all delegates the logistics for the event, including how to ask questions for each presentation (via Mentimeter) and how to access the virtual break room and lobby (via Jitsi). He then turned the virtual floor over to Keith Holland.

Keith welcomed everyone to the first ever virtual Reproduced Sound, hoping that despite everyone being remote, the conference would still achieve the characteristic friendliness that Reproduced Sound is known for, allowing easy access to a wide and diverse community.

Session 1 – Loudspeakers (Chair, Glenn Leembruggen)

Right: EAG committee member, Glenn Leembruggen

Effect of geometry on cone-driven midrange horns and phase plugs

The first paper of the conference was presented by Lewis MacDonald from the University of Salford, detailing research carried out as part of his undergraduate dissertation under the supervision of Jon Hargreaves. Lewis presented a methodical parameterised study on cone-driven midrange horns and phase plugs, where he specifically inspected the effect of phase plug radius, phase plug length, phase plug curvature, and horn geometry. This was done using FEM alongside a lumped parameter electromechanical model. Performance metrics included average intensity over 60 degrees as well as bandwidth and beamwidth achieved. Results pointed towards clear design considerations for constant directivity with minimal sidelobes. Questions from the audience focused primarily on the model's configuration, offering suggestions for further study.

Infinite waveguide termination by hybrid finite element/ series solution

The session continued with a paper from regular Reproduced Sound contributor, Patrick Macey from PACSYS. Patrick provided a thorough treatment of the underlying mathematics and modelling procedure adopted for this study, with several animated demonstrations to help the audience visualise the issues surrounding problematic terminations in models. The most revealing issues were related to cross mode problems due to an improper termination. A number of questions came from the audience, asking about the relationship between the simulation and reality. Patrick was able to clearly explain the relationship, emphasising the modelling method's accuracy.

Advances in acoustic instrument measurements and system design

The final paper of the session was delivered by Ludovico Ausiello from Solent University. This was a follow-on paper from Ludo's P24

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paper at Reproduced Sound 2019, concentrating on furthering the understanding of acoustic instrument design through practical measurement and analysis methods. This work focused on the optimisation of an acoustic guitar's magnitude response, through a parameterised study (performed by carefully and systematically deconstructing an actual guitar). Areas under inspection included string tension, presence of varnish, closing of the body, shaping and position of internal braces, and use of additional braces on the soundboard and back. Through Ludo's analysis, the guitar optimised to exhibit a measurably flatter magnitude response. Many questions came from the audience, indicating considerable interest in the topic. Ludo's enthusiasm on the subject was clear, which made for a very engaging presentation. (See Ludo's technical article on page 30.)

Session 2 – Measurement 1 (Chair, Paul Malpas)

Temporal structure of spectral levels within pre-recorded material

The first conference session on measurement began with a paper from Glenn Leembruggen from Acoustic Directions, Australia, covering a detailed analysis of spectral content for a variety of pre-recorded signals. The data showed material dependent crest factors and spectral content. Unsurprisingly, speech was shown to have the highest crest factor, with metal music exhibiting the lowest. While classical music was relatively consistent across octave bands, jazz music was much less consistent. Ultimately, what this analysis pointed towards was the possibility to save resources on power amplifier requirements if the intended programme material is known. Glenn mentioned, however, that there isn't much published on the audibility of clipping, which should be investigated before committing to a system design process that essentially ignores the peak signal requirements (due to a high crest factor). The presentation prompted numerous questions from the audience. Session Chair, Paul Malpas, was quick to point out that such a system design approach isn't appropriate for hi-fi systems as they require accurate reproduction of peak content. Glenn added that even outside of hi-fi systems, care must be taken before deciding to limit any low frequency content, since this would be audible. This could likely be addressed through use of a multiband compressor.

Energy-Time Curve (ETC) in electro-acoustic measurement and analysis

Next on the agenda was a paper from James Love and David Gilfillan of Gilfillan Soundwork in Australia. James provided a clear overview of energy-time curves (ETC) including how they are mathematically derived from an impulse response measurement. What quickly became clear in this study was that spectral windowing was essential to get right when using ETCs, otherwise a considerable amount of information could be lost (such as with the use of a Blackmann-Harris window). With proper windowing, however, detailed acoustic information can be extracted from measurements such as low frequency reflection arrivals, identification of closely spaced peaks, and a reduction in time domain aliasing. The signal processing was nicely demonstrated using impulse response measurements from real spaces.

Use of artificial intelligence in room acoustics prediction using a photograph

The final paper of the session was presented by Dan Milne from Solent University and was based on his undergraduate research under the supervision of Lee Davison and Ludovico Ausiello. The research looked into whether there was a reliable method of extracting acoustic information of a space from a 2D photograph. This was explored by utilising a convolutional neural network (CNN) with a focus on estimation of RT60. The CNN was trained with data from 38 classrooms, comprising 24 photographs per room. RT60 measurements were taken in each room using a balloon burst with RT60 at 500 Hz used to characterise the room in this instance. After the CNN training was complete, tests were carried out where the photographs were sent to acoustics experts asking them to predict the RT60 of the room, while the same photographs were sent through the CNN to do the same. The CNN outperformed the experts, where the experts tended to overestimate RT60. There was a potentially unfair advantage for the CNN, however, in that it was limited to guesses between 0.4-1.0 seconds, while the experts could guess any number. Dan usefully identified shortcomings such as this within the test and offered suggestions for further work. The audience had many questions for Dan, with some sceptical about how useful this could be for more general spaces (the study was limited to classrooms), but the interest in the topic was nevertheless high.

Session 3 – System design and modelling

Right: EAG Chair, Keith Holland

(Chair, Keith Holland)

Modern advances in the meeting room ecosystem

The first paper in the system design and modelling session was from John Ellis and Andrew Francis of Shure UK. They presented a thorough overview of the history of meeting room audio-visual technology, leading to the current state of the art, with examples provided in the form of current products offered by Shure. They revealed that past surveys have indicated that most meeting room technology frustrations are related to audio, but that current technology such as networked audio and auto mixing can help to prevent many issues. They were able to give an example very close to home – the IOA's new headquarters in Milton Keynes. The IOA's former meeting room AV system was the source of much frustration. In the new facilities, however, care was taken to implement good acoustic and audio-visual design, which EAG Chair, Keith Holland, was quick to confirm has resulted in much more effective meetings. During Q&A it was emphasised that such systems are still reliant on good room acoustics.

Understanding modern amplification systems

The next paper was presented by Alberto Fueyo Gallego from AMS Acoustics. As with

Glenn Leembruggen's paper from the previous session, Alberto's research focused on power amplifier requirements primarily for the purpose of emergency sound systems. As with Glenn, he suggested that systems may not need so much power due to the high crest factor of speech. He emphasised that clipping and compression don't seem to significantly affect STI, hence designing systems to accurately reproduce sound based on peak levels may be overkill. Alberto's presentation prompted supportive comments, suggesting the need for further work in the industry to consider such ideas, including possible work within standards.

An archaeoacoustics investigation of the Beulieu Abbey

The first day of the conference was concluded with a presentation by Sebastian Duran, Martyn Chambers, and Ioannis Kanellopoulos of Solent University, detailing their research which was under the supervision of Chris Barlow. The paper focused on work to achieve an accurate auralization of Beulieu Abbey, which was destroyed nearly 500 years ago. The modelling was carried out in CATT Acoustic, where the sound sources were modelled to be a priest giving a sermon and monks doing chants. In addition, auralizations and data on STI and clarity were presented, where it was found that the acoustics of the Abbey didn't support speech but would be appropriate for the chants. This aligns with the fact that intelligibility was less important before Vatican II, when mass was conducted in Latin. The students were able to field questions from the audience, which focused on aspects of the acoustic model's design.

Conference – day two

Session 4 – Signal processing (Chair, Ludovico Ausiello)

Analysis of neural network architectures for audio signal processing

Day two of Reproduced Sound commenced with a paper from Vlad Paul of ISVR, University of Southampton, with a focus on his research on neural network architectures under the supervision of Philip Nelson. Vlad pointed out that while the research community has seen widespread adoption of neural networks for various purposes over the past few years, most projects utilise these systems as black boxes, where details of specific parameters during the training process are unknown. To illustrate the usefulness of having sight of these parameters, Vlad utilised multilayer perceptron (MLP) to determine the hidden layer variables. Spectral difference detection was used an as example application, whereby the spectra under analysis contained magnitude peaks spaced too closely to accurately resolve with conventional analysis techniques. Through this process, Vlad was able to demonstrate how the neural network can be optimised when the often-hidden variables are revealed. Questions from the audience focused on potential applications for this neural network optimisation approach, while other commented that it was nice to see such a topic presented in an accessible manner to non-experts in the audience.

Automated delay estimation and time alignment in a reflective environment

The next paper in the signal processing session was from Reproduced Sound regular, Ambrose Thompson from Martin Audio and Alexander Holt from the University of Surrey. They presented their work on time-alignment of sound reinforcement systems in reflective environments. They described an optimisation routine that they developed to determine the optimal delay parameters to achieve an ideal magnitude response (characterised by summing all available magnitude responses without phase information). As the system contained a single variable, an exhaustive search was possible. This was shown to be resilient in the face of room modes and strong reflections. Questions focused on the practicality of the approach, given that the optimisation was based on a single measurement location, despite having a wide audience area.

Portable synthesizer on embedded system

The session on signal processing was concluded with a presentation by João Davi de Campos, which described his undergraduate research under the supervision on William D'Andrea Fonseca at the Federal University of Santa Maria in Brazil. After giving the audience an overview on the history of analogue and digital synthesizers, João went on to describe the synthesizer implementation he developed using an MDI keyboard and a Raspberry Pi 3B+, which was running Zynthian software (an open source synthesizer platform). Measurement examples from the device's output were shown along with an impromptu live demo during the Q&A.

Session 5 – Measurement 2 (Chair, Adam Hill)

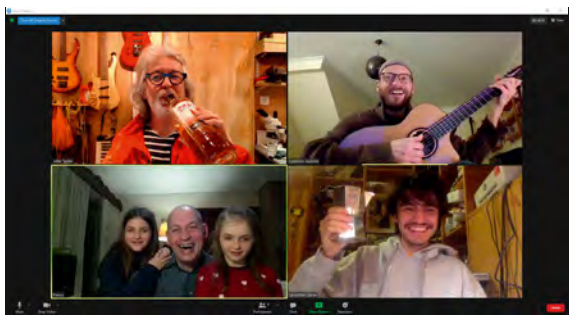
Development and use of a low cost acoustic flow resistance meter

The second measurement session of the conference began with a presentation from Camille Hanrahan-Tan of Acoustic Directions, Australia. Camille detailed her work on developing and testing a low cost acoustic flow resistance meter, which cost approximately one-tenth of a similar commercially available device. She gave ample evidence of the device's performance, with example measurements from a variety of materials. The measurements were in good agreement with predictions and any anomalies were clearly explained. Several questions were received from the audience, focusing on material properties and methods to convert between various metrics. Overall, the impression was a positive one, where it was encouraging to see developments to make specialist equipment more accessible within the industry.

Suitability of hi-fi loudspeakers measuring reverberation time in domestic rooms

The session continued with a paper from Chris Adair of Adair Acoustic Design, which focused on using typical hi-fi loudspeakers to measure reverberation times in domestic environments.

P26



Below: Reproduced Sound technical crew (clockwise from top left: John Taylor, Ludo Ausiello, Sebastian Duran, Panos Tsagkarakis)

Chris emphasised the balance between acoustics and reality, primarily questioning whether we need to measure all spaces with dodecahedral loudspeakers. Considering home theatre systems, why not measure with the in-situ sound system? He noted that there is no requirement within ISO 338-2 for an omnidirectional speaker for surveying and engineering applications. Comparisons of results between conventional and dodecahedral speakers were given, with good agreement at high frequencies and a small amount of variation at low frequencies. Chris's experiment shows that the hi-fi speakers could give sufficient accuracy for RT60 measurements in small rooms, with measurement errors all falling below the just noticeable difference of 10%. The audience responded with many questions about future applications for this, indicating broad support for this concept.

Audio signal statistics revisited: A homomorphic separation approach
Building on an emerging theme of music and speech signal statistical analysis at this year's conference, Jamie Angus-Whiteoak from the University of Salford presented her paper looking into a homomorphic separation approach to audio signal analysis. The issue at hand was that signals that have been combined in a multiplicative manner can't be separated, since original spectral content may not be present as distinct content. To overcome this, Jamie explained how the combined signals can be transformed through an invertible function which converts the signal to an additively combined signal, allowing for straightforward separation. As an example, Jamie applied the process to a speech signal, which in turn confirmed the findings of some previous papers in the conference, showing that speech and music signals aren't gaussian, where these signals spend most time at lower levels – adding weight to the argument for lower power amplification requirements for efficient (non hi-fi) systems. Questions from the audience focused on the signal analysis technique's applications within dynamic processing such as compressors, limiters and even wireless audio systems.

Determining the source of coherence reduction using playback level of M-Noise
The final paper of this session on measurement was from Roger Schwenke of Meyer Sound, USA, where he presented a hands-on look into how sources of audio signal coherence degradation can be determined with M-Noise. Signal coherence is often affected by background noise, distortion, and the acoustics of a venue. With the underlying theory explained, Roger turned to a live demo of M-Noise being used to measure coherence of a simulated system. The results were systematically analysed while adjusting key parameters of the simulated system to show the tell-tale signs of each form of coherence reduction. Overall, this presented a useful toolbox for system engineers to use while on-site tuning sound systems to avoid incorrect analysis of data. Session chair, Adam Hill, noted that the paper session literally stretched around the globe, starting in Australia, stopping off in the UK, and concluding in California.

Electro-Acoustics Group AGM
The AGM of the Electro-Acoustics Group was held prior to the close of day two of the conference. The meeting was chaired by Keith Holland and was attended by 25 delegates, including eight EAG committee members. Keith delivered the chairman's report, describing all activities of the group over the past year, the central focus being the organisation of this conference. It was noted that this year required a very steep learning curve in order to adjust Reproduced Sound to operate effectively in an online space. Notably, Keith highlighted the ongoing efforts of John Taylor and Ludo Ausiello in overcoming the technological challenges this has presented and permitting the delivery a very enjoyable and successful conference. It was agreed that many lessons have been learned over the course of this year and the committee will consider what to roll forward to benefit future Reproduced Sound conferences.

Conference – day three

Session 6 – Virtual audio (Chair, Jamie Angus) WHAM: Webcam head-tracked ambisonics
The final day of this year's Reproduced Sound conference was kicked off by Mark Dring and Bruce Wiggins from the University of Derby who presented their work on WHAM – Webcam head-tracked ambisonics. This research was necessitated by the national lockdown in March, where there was no access to their research group's specialist facilities. To overcome this, a workaround was developed to allow for head-tracked ambisonics to be available to anyone with a webcam and a pair of headphones, where the webcam was used to track head movements alongside presentation of binaural room impulse responses (BRIR), where the software included the necessary support for asymmetrical filtering. In this first instance, only horizontal head rotations were considered (where the head was rotated within the ambisonics system, not the virtual room). Live demos were given via a purpose-built web tool hosted at **brucewiggins.co.uk/WHAM**. Due to the current capabilities of web-based audio, the system was limited to 7th order ambisonics (although Bruce noted that this restriction may be eased soon). The demo gave clear evidence that the webcam-based tracking was effective, giving high-quality ambisonics-based sound reproduction over headphones and (critically) allowing subjective evaluations to continue despite the current restrictions.

Rendering binaural signals for moving sources
The second and final paper of this session on virtual audio was presented by a trio consisting of Lucas Gomes, William D'Andrea Fonseca, Davi Carvalho, all from the Federal University of Santa Maria, Brazil. The work focuses on accurately rendering binaural signals for moving sources. Critically, the Doppler effect had to be considered in these situations, which was implemented within an image source acoustical model. Interpolation was required in this case to account for the variable time of arrival of successive samples from moving sources. P28

Below: Paper from Mark Dring and Bruce Wiggins

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With the moving source model in place, an investigation was carried out looking into the perception of the rendered sound sources in terms of the perception of speed, distance, position, realism, and number of simultaneous sources. It was found that participants were able to correctly identify relative distance and speed, but further work was required to achieve better externalisation over headphones. A key question from the audience revealed that the ground reflection was omitted from the model, where it was agreed that this should be included as part of further work.

Session 7 – Case studies and regulation (Chair, Mark Bailey)
The acoustic design of the Qingdao Oriental Movie Metropolis Grand Theatre
The final session began with a presentation by Shenzhi Su from CSP Acoustics, where she walked the audience through the electroacoustic design of the Qingdao Oriental Movie Metropolis Grand Theatre in China. The 1,970-seat theatre was specifically designed to host a film festival but would have to be flexible to accommodate a range of different events after the festival. Interestingly, it was stated that the theatre is the only one in the world with a Dolby Atmos system as well as an electronic room acoustic enhancement system. During the design stages of the theatre, it was determined that the venue's use would be as follows: movie projection (80% of all events), award ceremonies, and symphonic performances, each requiring a different acoustic. The venue's construction was explained, with a particular focus on the incorporation of the necessary absorption and diffusion. The theatre was initially evaluated by twenty acousticians, sound engineers, and musicians. All groups rated the sound quality as excellent with natural sounding reverberation. Quite a few questions came from the audience, indicating a good deal of interest in the project.

Impact of sound level regulations on sound engineering practice
The second paper of the session was jointly presented by Adam Hill and Jon Burton from the University of Derby. The work focused on a case study looking into the effect of local sound level regulations on live sound engineering practice. A dataset was used encompassing roughly five years of touring and festival dates (130 in total) from a popular UK-based band. For each event, one minute equivalent continuous sound levels were recorded with A and C weighting, allowing for later conversion to any required measurement time window greater than one minute. A number of statistically significant points were drawn from the data. Room acoustics play an important role in terms of overall sound level in the audience. Venues with poor acoustics resulted in louder shows. Additionally, small venues were louder than large venues, since loud stage levels are more significant within the audience area in small venues. Events with an LAeq limit in place were roughly 2 dB quieter overall, but this was only for events with limits at or below 101 dBA (indicating the engineer's natural mixing level to be around 100 dBA). In terms of the time measurement window, it was clear that short times (less than 10 minutes) reduced the dynamic range of the event, due to the engineer having to constantly adjust to maintain compliance with the limit, reducing the possibility for strong dynamics in the reinforced music. In the few cases where an LCeq limit was in place, there were clear issues with the engineer struggling to maintain compliance due to arbitrarily defined limits.

UK and international guidance for the control of noise from outdoor events
Next was an overview of noise regulations in the UK and internationally, presented by Peter Wheeler from Vanguardia. Peter presented a detailed comparison between sound level regulations across the UK, with clear evidence of confusion, either through misinterpretation of the UK's Noise Council Code of Practice on Environmental Noise Control at Concerts or basing limits on best practice and not from guidance documents. While there is clear evidence of the steady ride in low-frequency content within popular music, there are few regulations with low-frequency (LCeq) limits. Of the few areas with such limits, there is little agreement in specific limits and applications, which agrees with the findings from Adam Hill and Jon Burton's paper. Peter explained that this points to a need for updates to the existing guidance documents (work which is currently underway). Many questions came from the audience, primarily focusing on the issue surrounding low-frequency limits. It was clear that the regulations are lagging reality.

The Sound of SoFi – amplifying the experience
The final paper of Reproduced Sound 2020 was presented by Jim Burdette (JBL/Harman), Kevin Day (WJHW), and Demetrius Palavos (Pro Media) on the sound system design for the new SoFi Stadium in Los Angeles, USA. The overarching design criteria for the sound system was to fit most of the sound system elements into the scoreboard, the largest of its type in the world, which was flown centrally above the playing field. This approach went against the current trend of implementing distributed systems in such venues. Kevin Day took the audience through development and testing of the system in EASE, describing key considerations along the way. All presenters made it clear that it was critical to work closely with other departments to make sure nothing interfered with the sound system's operation once it was installed (such as using acoustic mesh to obscure the speakers within the scoreboard to not affect them acoustically). The presentation generated many questions and comments from the audience, unsurprisingly, due to the large and unique nature of the project.

Conference close

EAG chair, Keith Holland, closed the formal proceedings of Reproduced Sound 2020, by thanking all those who were involved with the organisation and running of the event as well as the delegates for attending. Keith specifically thanked John Taylor and Ludo Ausiello, along with assistants Sebastian Duran and Panos Tsagkarakis, for developing and running the technical aspects of the conference, allowing for a smooth and engaging conference experience for all attendees and presenters. He also expressed thanks to the IOA's Linda Canty for her continued support and guidance. With that, Keith formally closed the conference and expressed hope that we'd all be able to see each other in person for Reproduced Sound 2021.

Quantitative measurements to enhance performance of acoustic musical instruments and improve manufacturing

This paper discusses how the sine-sweep measurement method, which has become a standard in room acoustics and loudspeaker testing, can also be used to gather reliable quantitative data representing the response and performance of acoustic musical instruments.

By L. Ausiello (Solent University, Southampton) corresponding author and V. Hockey (collaborator with Martin Guitar)

In the attempt to quantify the accuracy limit of the methodology, a complete instrument has been re-worked and all phases of the process have been measured before and after each modification step.

This provided enough data to perform a sensitivity analysis of the proposed technique, and proved that the method is capable of capturing the influence of the varnish being applied or removed from a soundboard, the presence or absence of structural reinforcing struts (braces), and the impact on the acoustic output of weight reduction and profile optimisation applied to the braces of the soundboard and of the back of the instrument.

The findings suggest this approach is mature and ready to be used in combination with finite element modelling simulations, computer aided machining, and additional manufacturing in order to achieve a desired frequency response for acoustic soundboards or panel loudspeakers.

This technology can potentially disrupt the musical instrument industry and maximise the use of resources that, at the moment, are exploited in an unsustainable way relying on traditional manufacturing.

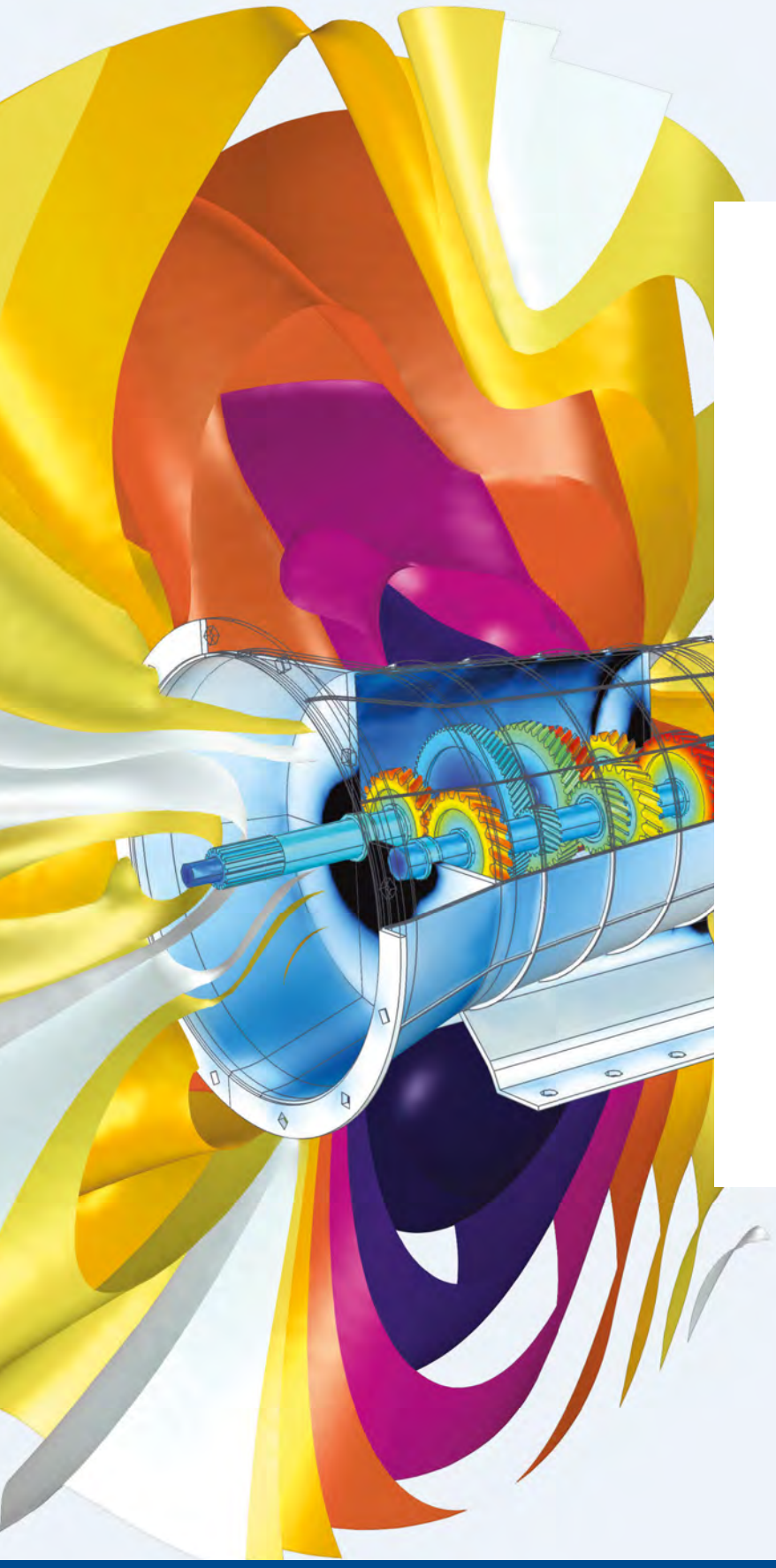
Introduction

Measurements are a key element of audio and acoustic research, architectural design and product development; a plethora of methods have been discovered, perfected or even forgotten in the past decades. In recent years, a specific type of measurements, namely the sine-sweep technique[1], has gained popularity as a quick and accurate strategy to retrieve impulse responses, thus becoming a de-facto standard in fields as diverse as room acoustics or loudspeaker design and manufacturing.

This article aims to illustrate how this method can also be very effective to gather quantitative data representing the acoustic response and performance of musical instruments[2]; such information can be used to implement end-of-line tests to improve manufacturing, or to provide designers with quantitative feedback when studying new bracing patterns or new geometries for soundboards, for example.

In order to show how ready this method is, and how close its implementation is to the practice which has become a standard in loudspeaker design and testing, this paper analyses the frequency responses of an acoustic guitar being re-worked to assess the sensitivity limit of this measurement technique.

In section two the principle of the sine-sweep method applied to musical instruments which was validated in[2] is recapped, in section three the methodology of the experiments performed for this case study are illustrated, and in section four the results are presented and commented. Finally, in section five conclusions and foreseeable future development are discussed. P32



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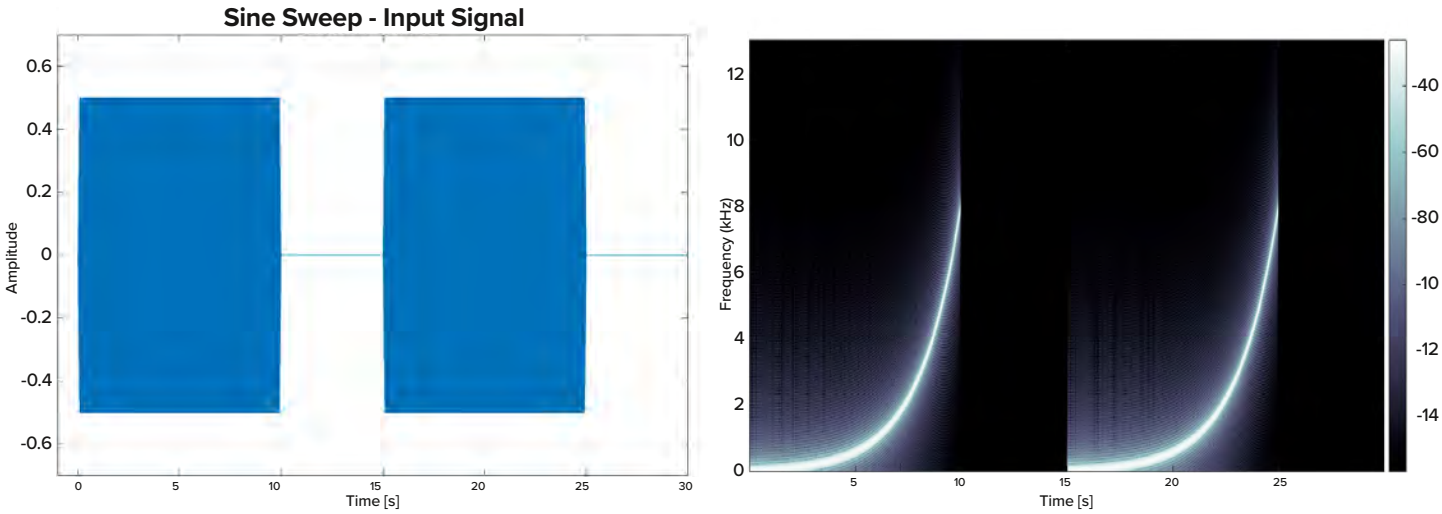
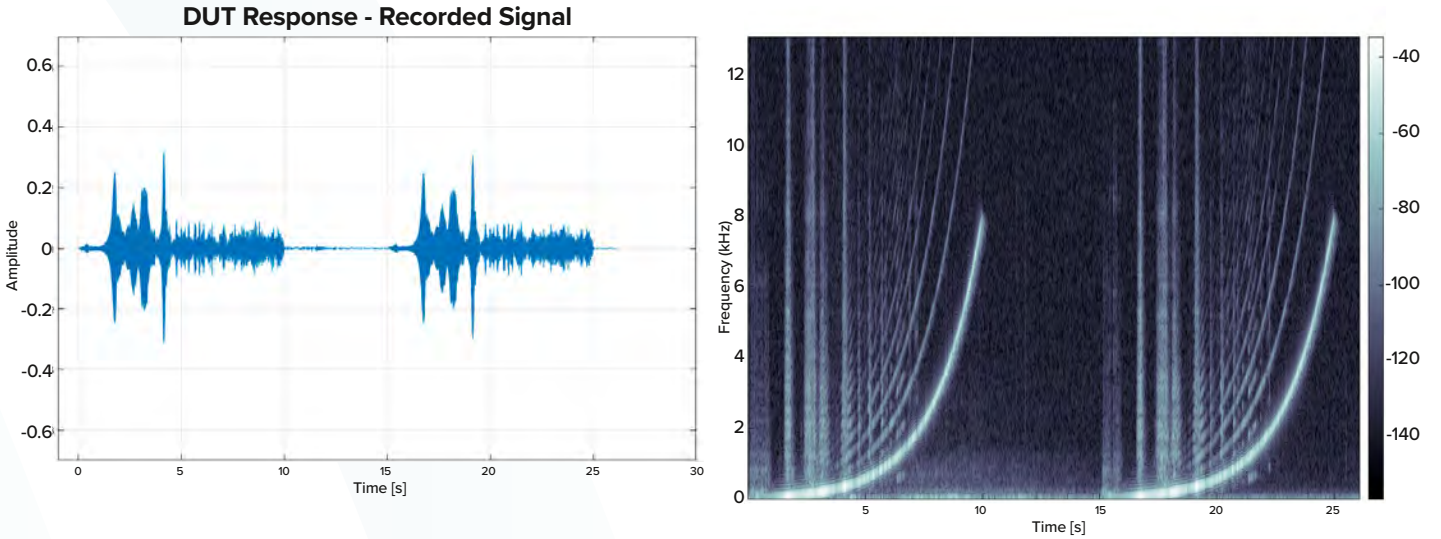
1. Quantitative measurement of acoustic instrument

The sine-sweep method is generally used to retrieve the impulse response (IR) of linear time-invariant systems. To do so, the device under test (DUT) is stimulated with a signal of constant amplitude containing all the frequency relevant to the analysis at hand, starting from the lowest and ending with the highest in an exponential progression. This can be shown with a picture of the time behaviour and the spectrogram of a sine-sweep test signal (Figure 1).



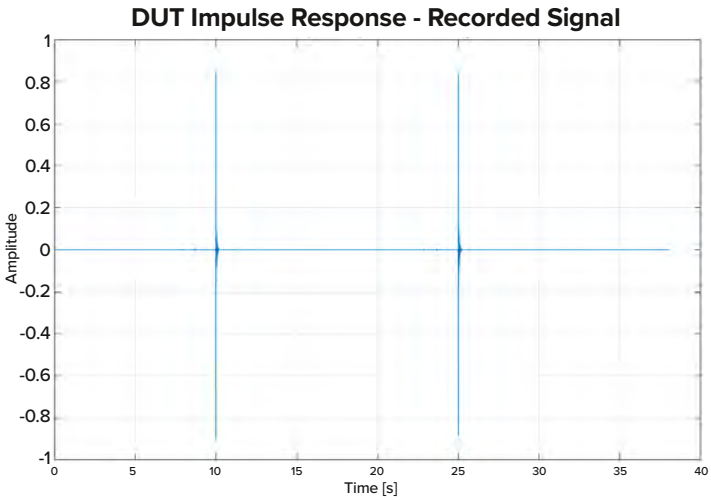
Below:
Figure 1: Sine-sweep test signal; on the left, time domain representation, on the right the corresponding spectrogram

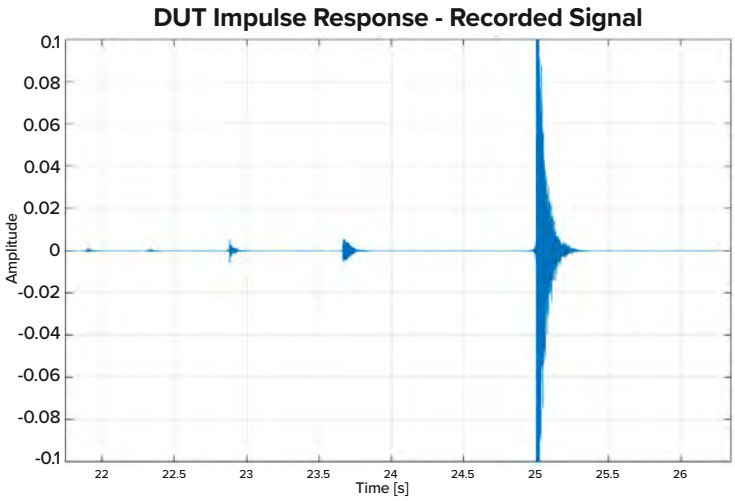
On the left-hand side of Figure 1, time is on the horizontal axis and the signal's amplitude is on the vertical one; on the right-hand side of Figure 1, time is on the horizontal axis, frequency is on the vertical one, and the amplitude of the signal is colour-coded.



Below:
Figure 2: DUT response to the sine-sweep test signal. Note both the resonances of the DUT (vertical lines) and the harmonic distortion components in the spectrogram (exponential lines)

The DUT reacts to the test signal by emitting an altered or filtered version of the sine-sweep, as per Figure 2. What was a constant-amplitude time signal is now clearly varying in amplitude over time, suggesting the presences of resonances in the system which makes its response not flat.





As per[1], we can convolve the recorded output of the DUT with the ideal inverse filter of the original sine-sweep, obtaining its impulse response (Figure 3).

The largest component of the IR resulting from the convolution is the linear component of the response, while the smaller peaks before it, are harmonic distortion products[1]. In our scenario we are interested in the linear component of the IRs. Traditional musical instruments such as pianos, acoustic and classical guitars are passive systems made from wood, metal, and glue (normally an aliphatic or organic one)[3].

We assume these systems are passive in the sense that the only energy they might store is contained in the materials they are made of or coming from permanent deformation imposed by other parts. This is the case of a guitar or a piano whose soundboards are under the tension of the strings, or under the tension of strings, wooden frame, and cast-iron frame respectively[4].

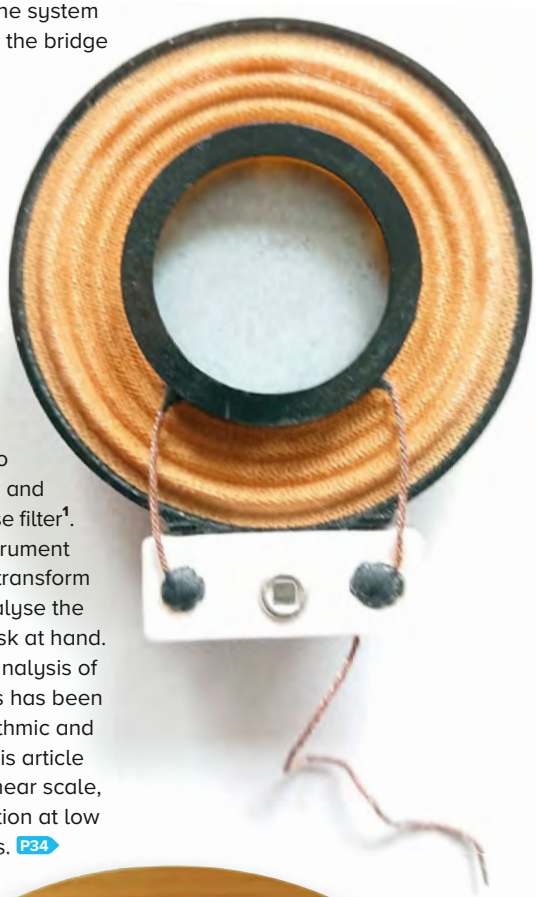
This means that when analysing the output of the DUT we assume that the only contributors to the non-linear distortion products are the power amplifier, the exciter, the microphone internal preamp, or the soundcard input/output circuitry. More details can be found in[2,5,6] or by corresponding with the authors.

It is common practice to use a digital audio workstation (DAW) as a source for the sine-sweep signals, thus connecting a PC to a power amp via a soundcard. The power amplifier is then connected to an 8-ohm exciter, as per Figure 4. The sensitivity analysis of the best position of the exciter has been carried on in[2], and it showed that the most efficient way to inject energy in the system is to place the exciter on the bridge of the instrument.

Above: Figure 3: Output of the convolution between recorded output from DUT an ideal inverse filter. Circled in grey the harmonic distortion products of the convolution process, in light blue the linear component of the IR

In essence, the exciter injects the sine-sweep signal into the soundboard of the guitar, which, being a linear time-invariant system, resonates according to its frequency response. The measurement microphone collects the acoustic output, and this signal is then sent back to DAW where it is recorded and convolved with the inverse filter[1].

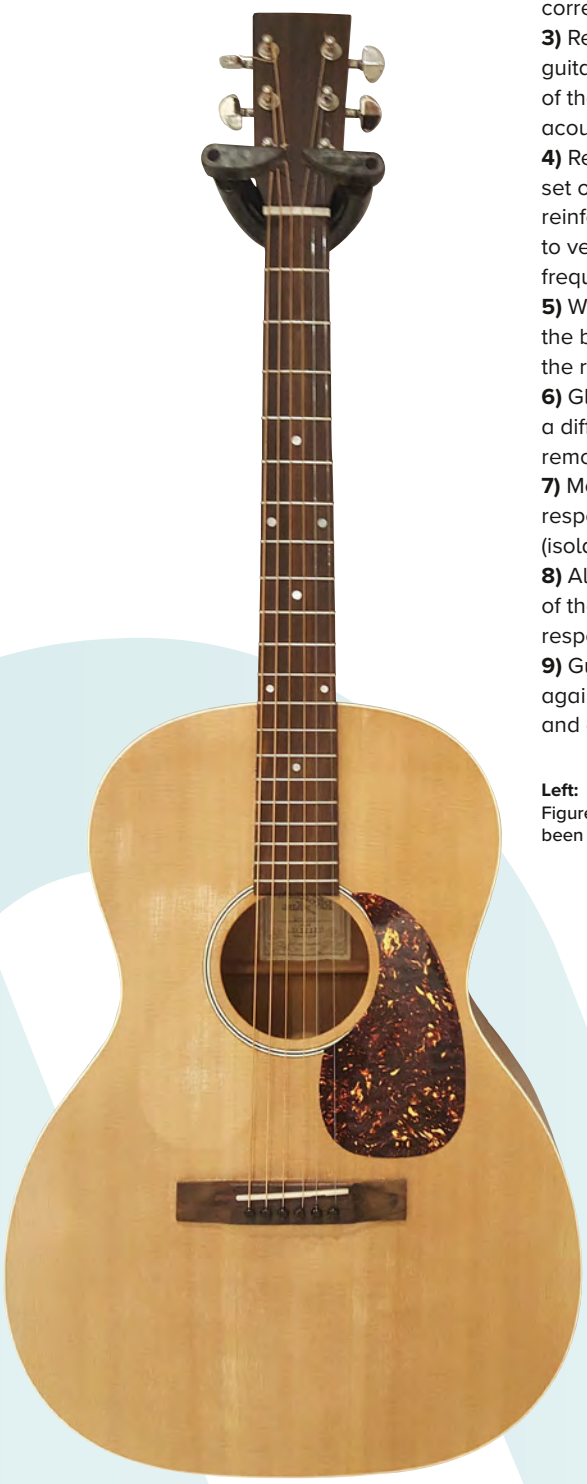
Once the IR of the instrument is collected, fast fourier transform (FFT) can be used to analyse the data according to the task at hand. In literature, frequency analysis of measurements of guitars has been presented in both logarithmic and linear scale[2,6,7], but in this article data will be plotted in linear scale, due to the higher resolution at low frequency that this offers. P34



Right & below: Figure 4: A 25mm voice-coil exciter. The inner black ring is the bottom of the voice coil, which is attached to the soundboard, in yellow the spider and at the bottom the transducer's terminals. On the right, the position of the exciter on the guitar's bridge

2. Methodology

The ideal way to show the accuracy of the presented method and its readiness to be used in manufacturing would be to build a complete instrument (e.g., an acoustic guitar) from scratch, pairing each step of the making with acoustic measurements. Due to practical limitations this was not possible, so an alternative approach was used. A complete instrument was first measured in its original state and then sequentially re-worked to highlight several different steps, although in reverse order with respect to a normal manufacturing process.



Left:
Figure 5: 000 body, 12-fret guitar which has been re-worked and measured step-by-step

Accordingly, the following building steps have been performed and measured:

1) Removal of strings to verify if the measurements can capture the impact of the strings' tension on the soundboard, and corresponding response.
2) Removal of the varnish from the soundboard to measure the impact of polyurethane lacquer on the soundboard, and corresponding response.
3) Removal of the back from the guitar body to verify the absence of the Helmholtz resonator in the acoustic response.
4) Removal of **one** tone-bar from the set of braces forming the structural reinforcements of the soundboard to verify their impact on the frequency response.
5) Weight and profile optimisation of the bracing, and consequences on the response.
6) Gluing of an additional brace in a different position from the one removed on step (4).
7) Measurement of the frequency response of the removed (isolated) back.
8) Alteration on the bracing pattern of the back and new isolated response captured and compared.
9) Guitar body being closed again, and last response captured and compared.

By inspecting the list of modifications above we can see that it contains the last production steps of a guitar manufacturing process in reverse order. Steps from (4) to (9), and especially step (4), (5), and (6) are the ones mainly praised and debated among guitar builders and musicians for being the most relevant ones in determining the instrument 'voice' and quality[7,8,9,10].

Some authors like Gore and Gilet refer to some specific frequency responses as being better than others and more desirable[7], while others stress the fact that a direct correlation between frequency responses and players' preference has not been found yet[8].

In fact, now that a direct measurement method is available, such knowledge is desirable; by collecting sufficient IRs (and corresponding frequency response data), it is hoped that experiments to correlate different guitars' responses and users' preferences will be undertaken soon.

For this research, the instrument being re-worked is a 000 body, 12-fret acoustic guitar with solid Sitka spruce soundboard, and solid mahogany back and sides, as per Figure 5.

The soundcards used were a Motu 896HD and a Focusrite Scarlett 18i20, while all signal processing was done in Adobe Audition 3.0 using Aurora Plugins by Farina[11]. The microphone used was an Earthworks Smaart M30, and the exciter was a 5 W, 8Ohm, ASK driver, with 25mm voice coil. As per [2], Blu Tack was used to attach the voice coil to the bridge of the guitar. The amount used was 2.5 grams, and it was kept clean and reused for all the measurements to minimise differences due to changes in mass during the experiments. P36

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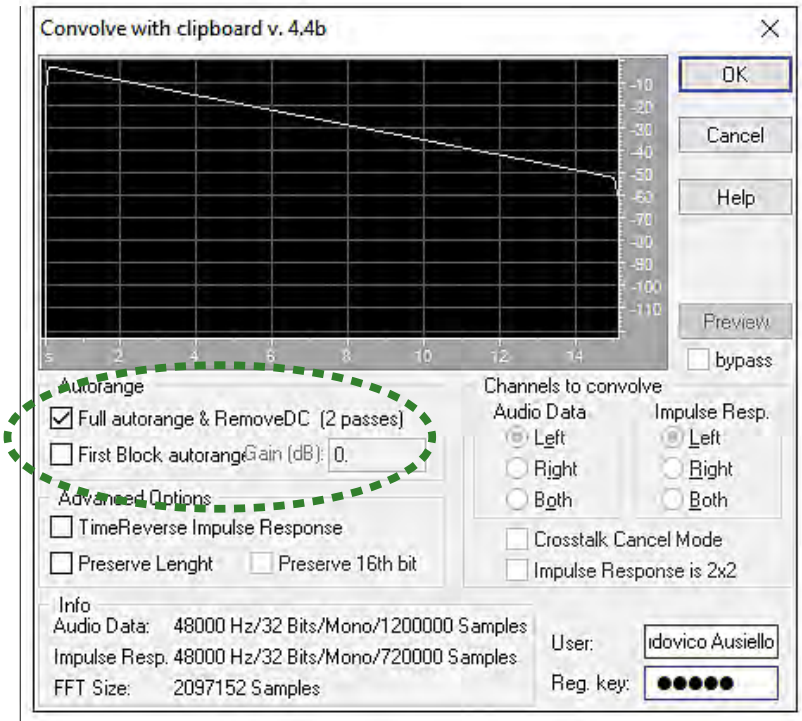
The reproduction chain was calibrated using a -6 dB LUFS 1kHz tone signal, sent to the exciter via a Primare i30 amplifier, which has a digitally controlled volume. The output of the amp was then checked to be 2.83V RMS with a Fluke 177 meter. This way the sine-sweep test signals were always 1 W nominal power for all the measurements.

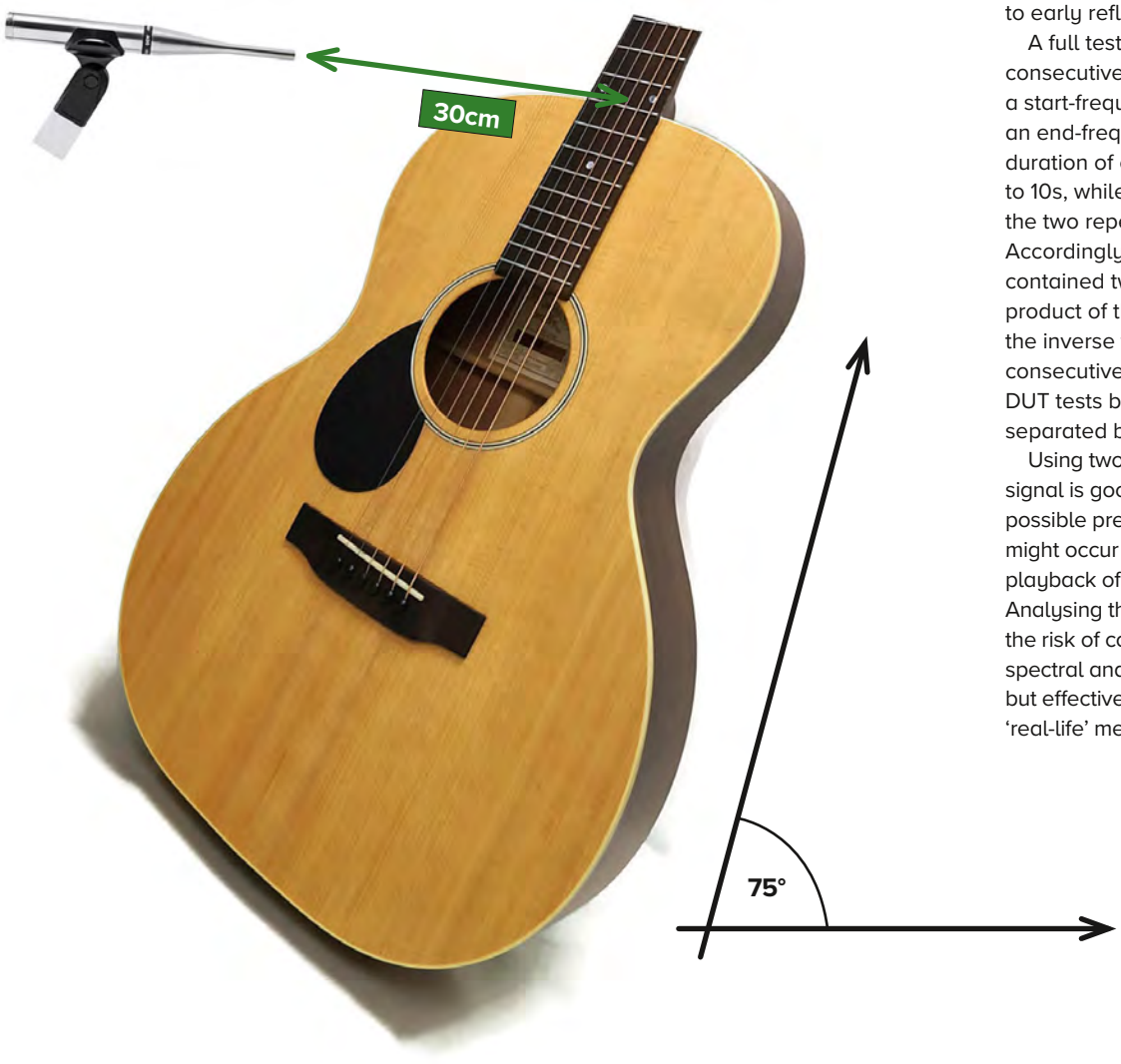
The gain structure of the recording chain was normalised to achieve a -1 dB LUFS on the first recording and corresponding convolution retrieving the first IR; this was done by setting to a fixed value the convolution gain in the Aurora plugins for Audition 3.0, as per Figure 6.

After the first IR was processed, the normalisation gain was kept constant to offer an absolute reference for all the following measurements done before and after all the alterations steps described above. Calibration was also checked using a B&K Type 4231 calibrator with a 1/8" adapter on the M30 microphone.

Right: Figure 6: Normalisation gain setting was used to normalise the first collected IR, and then kept constant to enable absolute reference for all the following measurements



Below: Figure 7: Measurement setup. The guitar is angled at approx. 75 degrees



The M30 microphone was placed 30cm on-axis in front of the 12th fret of the guitar. To reduce the impact of early reflections, the instrument was positioned on the floor and set at an angle of approx. 75 degrees, as per Figure 7. The measurements were performed in a domestic environment, and the IRs were checked to be free from spikes due to early reflections.

A full test signal contained two consecutive sine-sweeps, with a start-frequency of 45Hz and an end-frequency of 8kHz. The duration of each sweep was set to 10s, while the silence between the two repetitions was set to 5s. Accordingly, the recorded output contained two sweeps, and the product of the convolution with the inverse filter consisted in two consecutive IRs per each of the DUT tests being performed, still separated by 5s of silence.

Using two repetitions of the test signal is good practice due to the possible presence of spikes which might occur at the beginning of the playback of the first sine-sweep. Analysing the second IR eliminates the risk of consequent artefacts in the spectral analysis, and it's a simple but effective habit to obtain reliable 'real-life' measurements[12]. P38

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3. Results and sensitivity analysis.

In this section the IRs gathered will be shown as their corresponding FFT, and their capability of being informative to characterise each step of the instrument manufacturing process will be discussed.

Each re-work step will be characterised by a 'before-and-after' measurement, and for clarity the colour **blue** will always represent the response **before** changes were made to the instrument, while the colour **red** will represent the response after a change was made. All plots show the same frequency range, starting from approx. 20Hz and ending at approx. 750Hz.

The first sensitivity test was aimed to see if any difference between the response of the instrument with or without strings' tension was measurable.

The horizontal division in the spectral plot is 3 dB, and it is possible to appreciate a difference in the region between 220Hz and 300Hz, where the blue curve represents the guitar with the strings in standard tuning, and the red curve is the guitar without strings. It is worth considering that the overall dynamic range of the spectra is more than 50 dB, thus making this difference quite subtle, nonetheless this result is accordance with the literature; the peak in the frequency response corresponds to the (0,0) mode of the soundboard[3,7,8,10] for this type of guitar.

The second test wanted to quantify the impact of the varnish on the response of the instrument. Now in blue there is the response of the guitar without strings, and in red the response of the guitar without strings and without varnish on the soundboard.

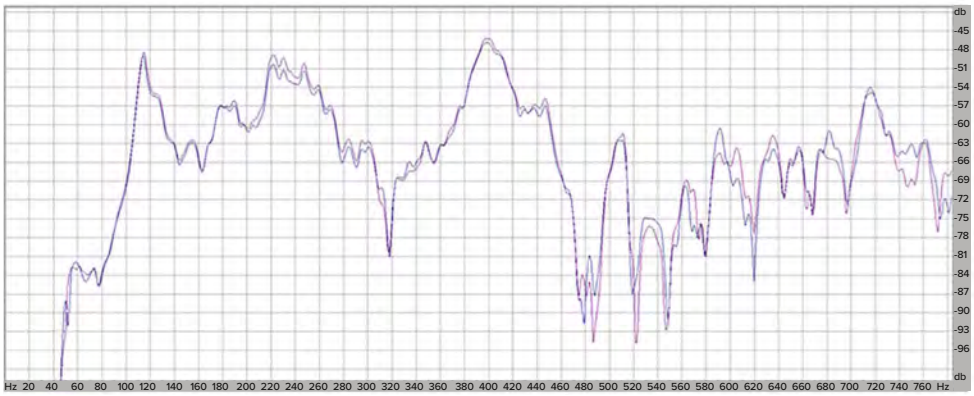
A large change is visible; the frequency of the Helmholtz resonance changed from 114Hz to 108Hz (more than a semitone) because of a shift in frequency of the (0,0) mode due to changes in mass and stiffness of the soundboard[3,7] . Also, a higher modal resonance at 400Hz has moved down to 380Hz, which is the equivalent of more than a semitone too.

The third test wanted to check the effects of opening the guitar body removing the back.

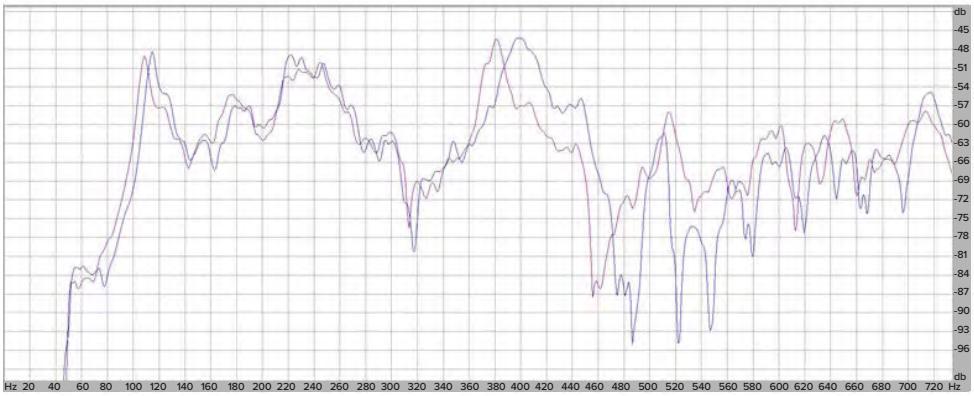
This re-work step was aimed at cancelling the Helmholtz resonance which is the lowest resonance shown by the instrument. Another consequence is the downward shift in frequency of the (0,0) mode of the soundboard. The Helmholtz resonance and the (0,0) mode repel each other[7], and the absence of the former lets the latter shift down in frequency[3,7] .

The absence of the Helmholtz resonator at 108Hz is clear, as well as the frequency down-shift of the (0,0) mode, which went from 220Hz to 202Hz, which is almost a full tone. Further to this, other peaks of the response are also greatly attenuated.

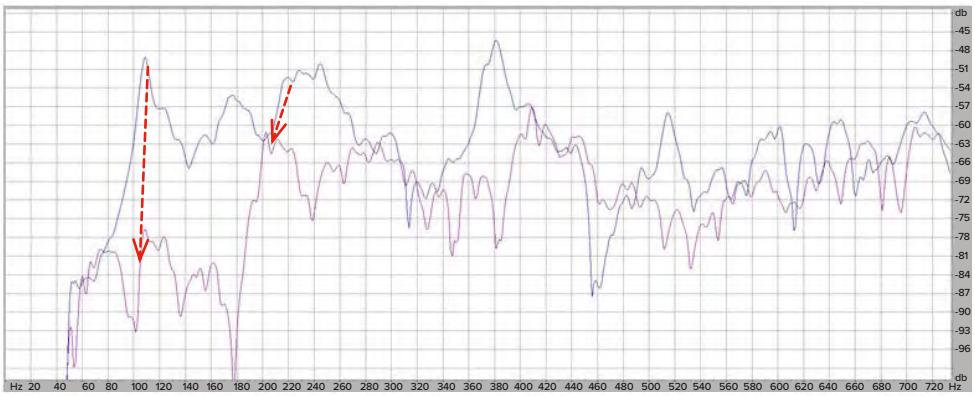
After removing the back of the guitar there was the opportunity to verify the sensitivity of the measurement technique while 'tuning' the soundboard braces. At this point an accurate finite element model (FEM) of the soundboard and corresponding correlation between changes in the bracing pattern and alteration of the frequency response would have made possible to target an ideal acoustic response as investigated by Boven[10]. Unfortunately, such model was not available for this specific guitar model. P40



Above: Figure 8: FFT plot (linear frequency axis) of the guitar in its original state (blue) and after removing the strings (red). Horizontal division is 3dB



Above: Figure 9: FFT plot (linear frequency axis) of the guitar with original varnish (blue) and without the varnish (red)



Above: Figure 10: FFT plot (linear frequency axis) of the guitar without varnish on the soundboard (blue) and the guitar with a removed back (red). Red arrows show the absence of the Helmholtz resonator at 108Hz and the shift in frequency of the (0,0) mode from 220Hz to 202Hz.

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Figure 11: Soundboard bracing nomenclature (left), X-brace (green), tone bars (red), secondary tone bars (light blue and yellow). Bracing in its original state (centre) and with one tone bar removed (right). Note the large rectangular profile of all the braces

Accordingly, a traditional approach of 'scalloping', 'shaving' and altering the profile of the braces from rectangular to triangular was attempted and measured after each step.

The results were not always going in the direction which some authors praise[7], but they were nonetheless clearly visible. The first modification was to completely remove one tone-bar, as per Figure 11.

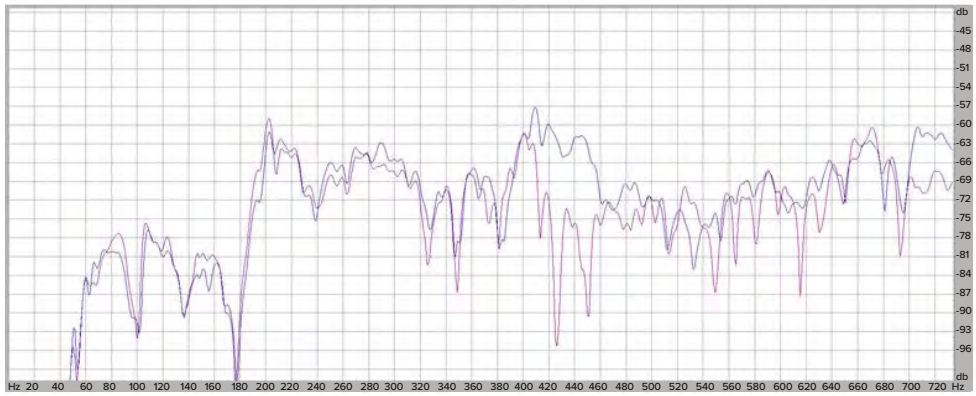
Removing one tone bar had a remarkable effect on the frequency response of the instrument, as it's clearly visible in Figure 12.

The effect of this manufacturing step is very large and visible in the measurements, with a reduction of almost 15 dB in the amplitude of the resonances located between 410Hz and 450Hz.

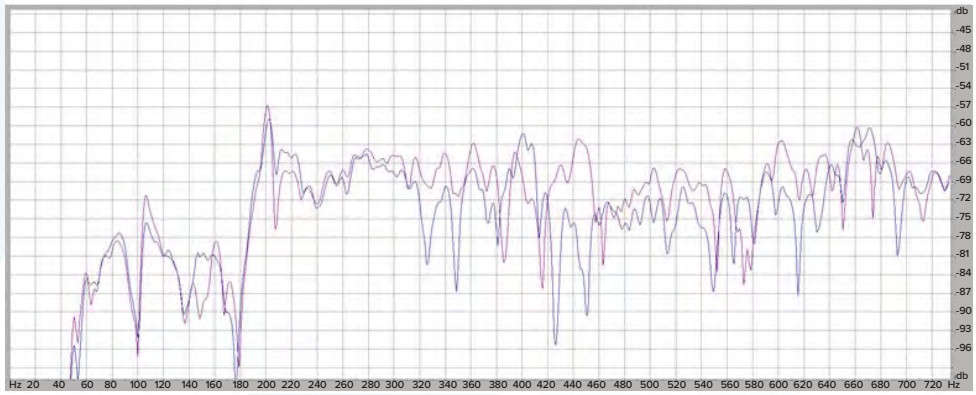
After this, several other steps were performed:

- Shaving the X-brace on the treble side (left side looking at the soundboard from the inside of the body) and one secondary tone bar (light blue in Figure 11).
- Shaving the X-brace on the bass side (right side looking at the soundboard from the inside of the body) and one secondary tone bar (yellow in Figure 11).
- Final weight reduction of all the braces and reduction of the weight of the bridge

The results are plotted in sequence in Figures 13, 14 and 15. P42



Above: Figure 12: FFT plot (linear frequency axis) of the guitar with removed back (blue) and the guitar with one tone bar removed from the soundboard (red). The removal of one tone bar has a dramatic effect on the response, reducing of almost 15dB the amplitude of the resonances between 410Hz and 450Hz



Above: Figure 13: FFT plot (linear frequency axis) of the guitar without the tone bar (blue) and the guitar with some additional weight reduction applied to the treble side of the X-brace.

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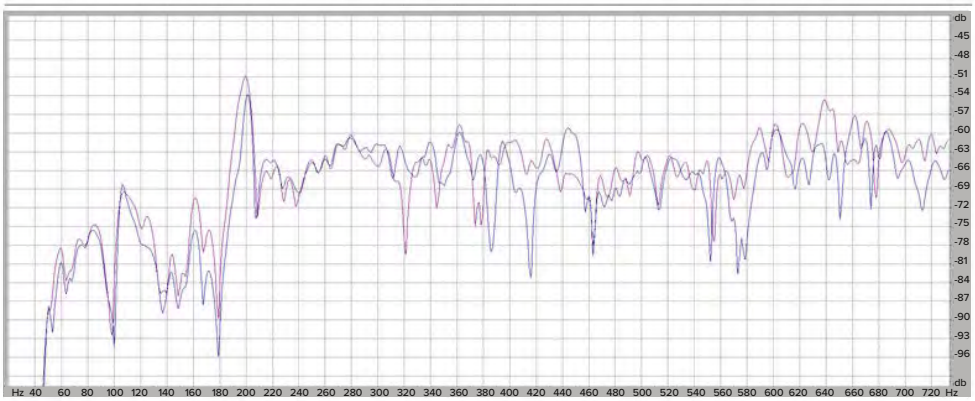
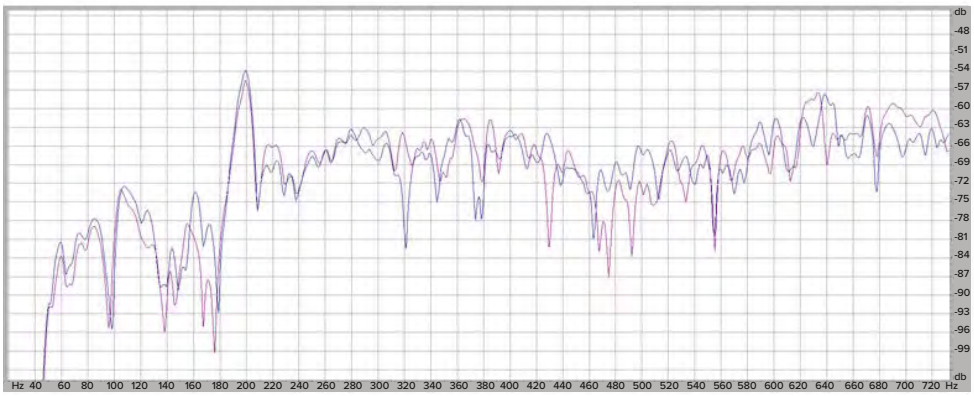


Above: Figure: 14: FFT plot (linear frequency axis) of the guitar with weight reduction applied to the treble side of the X-brace (blue), and of the guitar with weight reduction applied to both the treble and the bass side of the X-bar (red)



Above: Figure 15: FFT plot (linear frequency axis) of the guitar with weight reduction applied to both treble and bass side of the X-brace (blue), and of the guitar with weight reduction and profile optimisation applied to all braces and bridge

From this sequence of measurements, substantial information can be gleaned, and such data is sufficient to guide a maker with trained ear or an optimisation algorithm to obtain a desired final response, as demonstrated by Boven in his research[10].

A last set of results will be included here to demonstrate how tuning the back of the guitar with the aid of this measurement technique is substantially identical and can lead to an enhanced bass response of the instrument. Another reflection is that this process is also essentially the same used to tune a resonant panel loudspeaker.

A guitar back is normally braced in a simpler way compared to the soundboard, with four braces laid parallel to each other. Some authors call this pattern 'ladder' bracing[7,8], as visible in Figure 17.

Gore and Gilet demonstrate that ladder bracing provides the instrument with loudness, but they suggest different patterns to make the back of the guitar contribute to the final response with additional resonances[7], so to say, to enhance its tone and response. P44

Above: Figure 16: Back with standard ladder bracing pattern (above left) and back re-worked with alternative bracing pattern similar to the one used by Gore and Gilet in[7]. In red the excitation point and in green the suspension point

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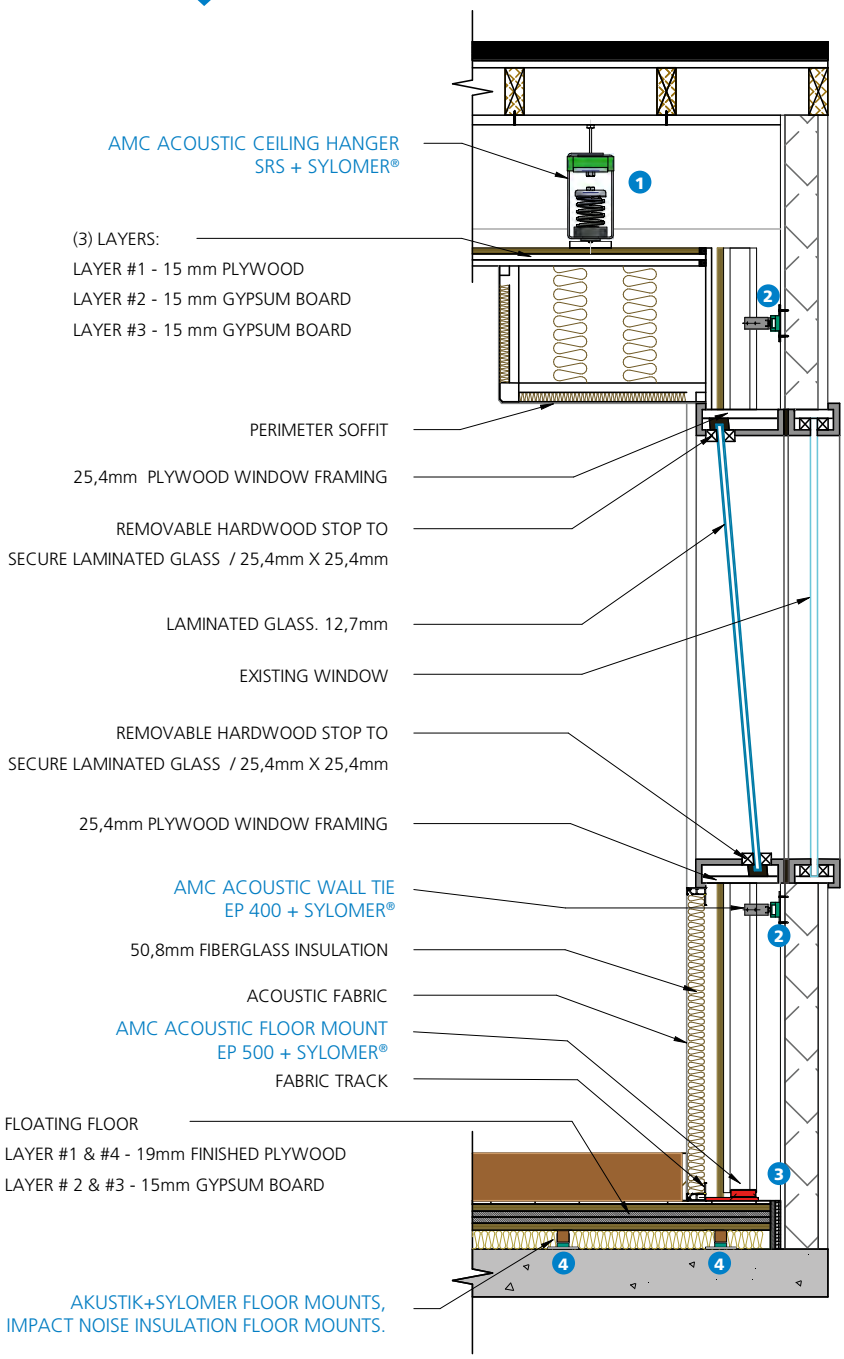

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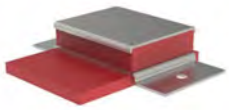

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Before discussing the results, some considerations must be shared. The excitation point influences the modal response of a resonating plate, as highlighted in[2] when discussing the best location for the exciter to inject energy in the soundboard. When measuring the back, it is then possible to accidentally place the exciter on a nodal line, and to impair the response of the panel at one or more resonant modes.

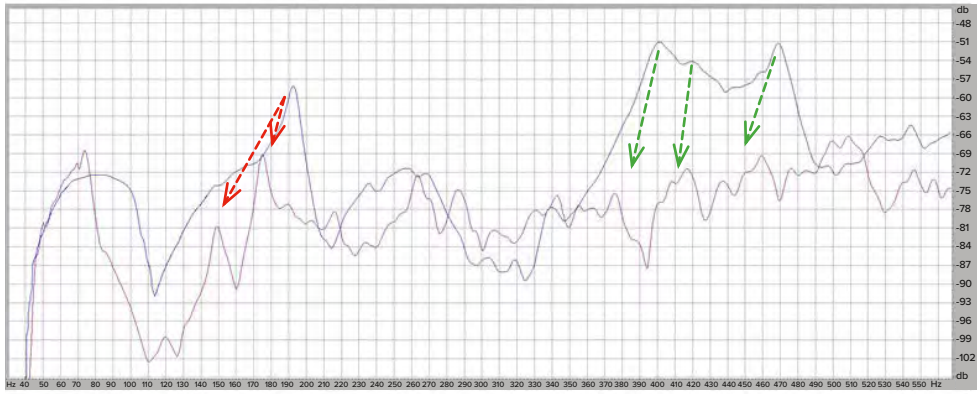
Furthermore, also the point used to suspend the back during its measurement has an impact on the response; it was decided to place the exciter on a side of the lower bout, while the panel was suspended from a point near the edge of the plate in proximity of the end of the second brace (see Figure 16). The effects of a different bracing pattern are visible in Figure 17.

The large resonance at 191Hz was replaced by two separate ones, the first at 174Hz and second at 148Hz. A substantial amount of energy was lost between 380Hz and 480Hz, in line with the literature indicating that the traditional bracing patter is 'loud'.

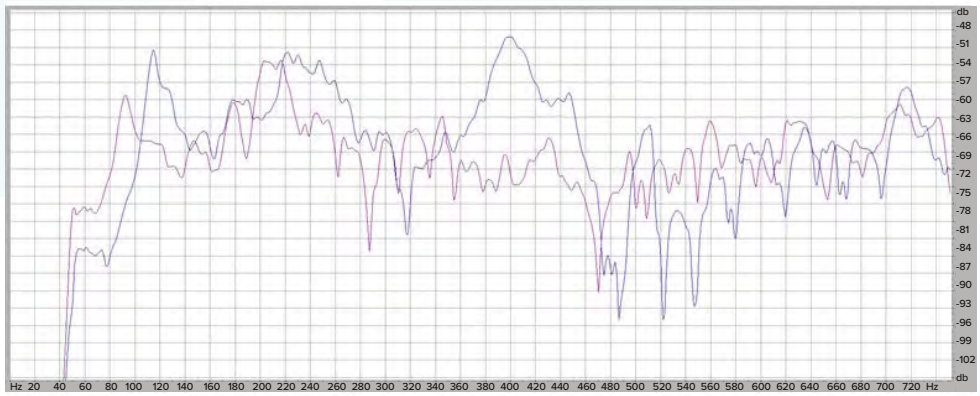
From the perspective of a loudspeaker system designer this modification would be considered an improvement, due to the flatter frequency response shown by the modified bracing pattern. Similar reflections could be made when comparing the initial spectrum of the soundboard shown in Figure 9 with the final one presented in Figure 15.

Eventually, the back was re-glued and the new complete guitar, without varnish on the soundboard, was measured again. Comparing the original response (without strings) and the final one (without strings) gives the cumulative difference of a manufacturing process guided by acoustic measurements compared to a traditional 'blind' one.

The Helmholtz resonance of the body has moved from 114Hz to 92.3Hz, which is approximately two tones below and closer to the lowest note in the range of the instrument, which is an E2 at 82.4Hz. The (0,0) mode of the soundboard has moved from 220Hz to 202Hz, which is about a whole tone below. The two modal resonances of the back are visible at 148Hz and 178Hz, almost exactly where they were on the free back. This new arrangement of peaks is more balanced and suggests an enhanced bass response, which is normally praised by players and listeners[3,7]. The loss of energy in the region between 360Hz and 460Hz also contributes to a flatter response in the low-midrange and midrange.



Above: Fig 17: FFT plot (linear frequency axis) of the back with standard ladder bracing pattern (blue), and the back with alternative bracing pattern (red)



Above: Figure 18: FFT plot (linear frequency axis) of the complete guitar without varnish before the re-work process (blue), and of the complete guitar without varnish after the bracing pattern, weight, and profile optimisation (red)

4. Final conclusions and future work

The data collected and analysed so far indicates that the method discussed in this paper is mature and ready to be included in the manufacturing process of musical instruments. With accurate and repeatable measurements, we can quantify changes as small as the effect of the tension of the strings on the soundboard, as well as the effects of the varnish on the final tone of the instrument. It would be remarkable if this technique could also be used to quantify the consequences of materials ageing, and this is a direction of investigation which the authors recommend.

From the manufacturing point of view, further research must be done to estimate how short the sine-sweep test signal could be to minimise measurement time and maximise efficiency in processes where time is key, namely to mass produce instruments. Also, now that an analogy between loudspeaker tuning and soundboard tuning has been drawn, it would be profitable to implement other types of analysis of the responses of musical instruments.

The authors envision that it would be possible to monitor the impact on the acoustic response of the instrument due to the bracing patter or due to the distribution of masses in real time. This would require different type of stimuli, e.g. white or pink noise, and real time spectrum analysis, but it would make the design and prototyping of new instruments a much more predictable task to implement.

Also, now that this method to retrieve the acoustic response of a musical instrument has been understood, investigation about measuring the impedance curve of the guitar-and-exciter system could be undertaken to refine the lumped element models used in the literature today, and to explore the relationship between such impedance curve and the acoustic impedance of the instrument in the hope to enhance the radiation efficiency of the resulting instruments.

This reflection also brings forward the opportunity, or the necessity, to correlate the frequency responses of guitar soundboards with accurate FEM analysis and correct material characterisation. Once this will be done, the use of artificial intelligence

to guide wood machining robots to achieve a desired target performance from a soundboard will be desirable and achievable too. For the time being we can surely use the IRs gathered with this method to create useful auralisation of all the manufacturing steps, which can be used to guide makers with trained ears towards their desirable acoustic performance.

Another interesting question raises from the analysis of the responses of the different bracing patterns of the guitar back being presented in this paper (Figure 17); the original frequency response is very 'peaky', while the re-worked one is flatter. In literature, loudspeakers which show a flat frequency response are generally praised[1,13], so why shouldn't we prefer a similar feature from a musical instrument? Is it possible that, being the response of traditional instruments everything but flat, the general audience got used to its characteristics and limitations?

This advocates that further research about musicians' preference and its correlation with frequency responses of guitars (or other acoustic instruments) is now possible and desirable. The authors have played and built guitars for many years, and still reckons that the tones they normally prefer are those we heard in the recordings we are most familiar with. But shouldn't we challenge our habits when new knowledge is available?

Acknowledgements

This research would not have been possible without the incredible experience and knowledge of Vince Hockey, who worked all his life building and repairing guitars and showed the most genuine and useful curiosity about the chances to use measurements together with our hearing to perfect an instrument. Special thanks go to Professor Angelo Farina, to Dr Giacomo Squicciarini from Univerisity of Southampton and Dr Domenico Balsamo from University of Newcastle, who supported the authors in what, seemingly, was just a crazy idea.

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Institute response to ICCAN's Future of Aviation Noise Management

In October 2020, the Independent Commission on Civil Aviation Noise (ICCAN) published a consultation document entitled: 'The Future of Aviation Noise Management: ICCAN's emerging view'. With the assistance of the Institute's Environmental Noise Group, led by Steve Mitchell, the following response was prepared and submitted to ICCAN.

Introduction: This response has been prepared by members of the Institute of Acoustics (IOA) and approved by its Governing Council.

For ease of reference, the survey questions included in the consultation document are set out below, followed by the IOA response.

The ICCAN draft goals and associated activities are listed at the end.

1. Future of aviation noise management

Our emerging view is that in the short term ICCAN should have statutory status, with power to set standards, be a statutory consultee on planning applications and airspace change proposals, and give advice to government and others that must be considered. It is our view that existing regulators (CAA, government, local planning authorities) should retain an enforcement role.

Do you agree with our emerging view on the future of aviation noise management, and the role ICCAN should play?

Yes – in full/Yes – in part/No

IOA response

Yes – in part

Please could you provide a brief explanation for your response?

The IOA support the principle of independent bodies contributing to noise management.

We feel ICCAN could have a useful role as a statutory consultee. This is in line with the recommendations of the Airports Commission in 2015, where it states:

An independent aviation noise authority should be established with a statutory right to be consulted on flight paths and other operating procedures. The authority should be given statutory consultee status and a formal role in monitoring and quality assuring all processes and functions which have an impact on aircraft noise, and in advising central and local Government and the CAA on such issues.

With regard the proposal that ICCAN should have powers to set standards, there is a lack of clarity regarding what type of standard is being considered.

We believe that ICCAN should participate actively in the discussion leading to any standards and should, where necessary, produce good practice guides. However, the setting of any standards should not be the sole responsibility of ICCAN.

ICCAN should be able to advise the government, if asked by the Government to do so, but not to be the sole adviser. In this sense, we note that the Airports Commission recommendation did not refer to a commission which set standards.

With regards to aviation, there are several different types of standard that could apply. They might cover the noise emitted by aircraft, the noise impinging on properties and the sound insulation provided by the building envelope for dwellings, schools or other sensitive receptors affected by aircraft noise.

But some of those standards already exist. We have international standards for aircraft noise emission, and through the British Standards Institute, standards already exist which assist in determining the appropriate level of building envelope sound insulation for buildings. Setting standards for the amount of noise impinging on properties is fraught with difficulties and that is why few such standards can be found in noise management.

Furthermore, we feel that any noise standards must flow from the over-arching noise policy and that they should always be set taking into account the full current context, and not just considering only the noise aspects. The Noise Policy Statement for England (NPSE) expresses this as 'in the context of government policy on sustainable development'. Government, is better placed to set policy and any associated relevant noise standards.

With regards to enforcement, we agree that the authorities listed (CAA, government and local planning authorities) may not have always adequately enforced airport noise management. However, it is important to understand exactly why any failure of enforcement has occurred. For example, it may be due to a lack of powers or it could be due to lack of resources.

With the expertise that ICCAN is developing in understanding how noise is managed in all manner of situations around the UK, ICCAN could play a role in identifying the cause of any shortcomings in enforcement and provide advice regarding appropriate noise management actions to take in particular situations. P48

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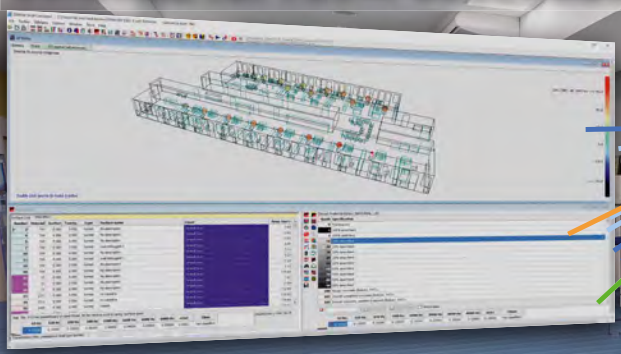

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2. ICCAN's future vision and goals

Do you agree with our draft vision to make the UK the world leader in managing aviation noise?
Yes/No

IOA response
Yes

Please could you provide a brief explanation for your response?

Given the way the question has been asked, it will be surprising if any respondent says 'no'. Clearly the IOA supports trying to make the management of aircraft noise in the UK as good as it can be.

We would, however, question the wisdom of seeking to be the 'world leader'. Firstly, does it really matter if we are the world leader? What is important is that we manage noise effectively. Secondly, elsewhere, there have recently been ambitions for the UK to become a 'world leader' and the outcome has not been achieved leading to some ridicule. It is arguably incautious, therefore, to express such an ambition in this way.

Do you agree with the draft goals which will help us achieve our vision?
Yes/No
If you answered no, please could you provide a suggestion for how should they be framed

Goal – 'Setting standards'
Increase the consistency and transparency in the management of aviation noise by setting enforceable standards and providing guidance to regulators.

IOA response
Setting enforceable standards – No

Providing guidance to regulators – Yes

See comments with regards setting standards in our response to Question 1. P50

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Goal – 'Putting people's health and wellbeing at the heart of aviation noise policy'
Lead research into the health and wellbeing impacts of aviation noise.

IOA response
Yes – but remembering good health and wellbeing can also come from a vibrant economy through business, from individuals being able to travel for holidays and people being employed, all of which the aviation industry can offer.

Goal – 'Focus on the future'
Ensure future policy and regulatory systems for managing noise are fit-for-purpose, and that future technological advances have noise management at the heart of their development.

IOA response
Yes – but the systems must not only be fit for purpose but also effectively implemented.

Are the key activities we identify to help us achieve our goals the right ones? Do you have any views on which activities should take priority over others?

IOA response
The consultation lists 12 activities, some of which we agree with and some we do not, as follows.

We feel ICCAN should review and then potentially set best practice guidance for reporting noise exposure, health effects and defining airport reporting requirements. Whilst airport reporting should be consistent in principle, what is appropriate for an airport affecting a very small population may not be appropriate for one affecting many thousands of people.

The setting of standards for noise insulation, compensation and mitigation (e.g., decibel or some other quantified levels above which an airport must offer noise insulation, or pay compensation etc in given circumstances) flows from policy that the Government produces. Whilst ICCAN should research the effects of noise and the preferred targets to address these effects, and thus advise the government accordingly, it is for policy makers to decide how much of the burden of noise is acceptable to society, in the overall national context, weighed against the social and economic benefits aviation brings.

One challenge in managing noise around airports is to make sure that all those affected by noise are considered. In many cases stakeholders who most strongly represent their views are not those who suffer the greatest effects of noise. We would like ICCAN to address this in their work plan so that noise management addresses the health effects of noise proportionately across populations affected.

We support the proposed role in research, and would ask what budgets ICCAN expects to have available to support these activities. We would also like to see a research roadmap with clear objectives and strategy, which is based on feedback from all stakeholders.

Effective communication is also key moving forward - it's not just about the information presented but also how it is presented and communicated.

We would also like ICCAN to consider key aspects to the effective development and implementation of noise envelopes in building sustainable aviation going forward.

ICCAN should also be mindful of the role of non-acoustic factors in managing noise effectively as these can account for up to a third of the variance in noise annoyance. As aviation grows back there is an opportunity not only to reduce noise, but also build trust, leading to a more sustainable future for aviation. P52

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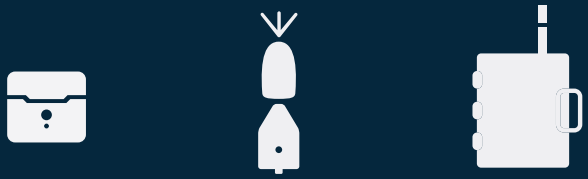

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3. ICCAN's performance to date
What are your reflections on ICCAN's establishment, and its work so far?

ICCAN has spent much time consulting those affected by noise, and its role in representing this large group of stakeholders has been productive. At the moment, and possibly not surprisingly, the reports produced on the metrics and the effects of noise have usually restated and/or consolidated what is already known, rather than provided any clear or new ways of addressing the problem of noise.

Are you confident that ICCAN plays a truly objective independent role in aviation noise management?
Yes/No/Not sure

IOA response
Not sure

Please could you provide a brief explanation for your response?
Our response reflects the fact that we feel it is too early to tell. We support ICCAN's objective to be independent, and as ICCAN begins to make recommendations, it will be increasingly important that scrupulous independence is maintained. Perhaps this can be achieved through internal checks and balances on the independence of ICCAN's outputs.

Do you think ICCAN's work has materially helped the way in which decisions about aviation noise are taken?
Yes/No/Not sure

IOA response
No

Please could you provide a brief explanation for your response? *
It is too early to say, but we are optimistic ICCAN can help in future.

Has ICCAN's existence and role given you more or less confidence that aviation noise will be managed better in the future?
More/Less/Not sure

IOA response
Not sure

Please could you provide a brief explanation for your response?
It is too early to say, but much will depend on ICCAN having resources and expertise available to study in detail, and consult widely on the difficult questions that remain. ICCAN will also need to be sure it carries with it the support of all the stakeholders, which will be essential for any successful implementation of its work or recommended approaches.

We are pleased that IOA members have been assisting ICCAN with technical advice, and the IOA would like to continue to offer our members' expertise in the future where we can help.

ICCAN draft goals

1. 'Setting standards'
Increase the consistency and transparency in the management of aviation noise by setting enforceable standards and providing guidance to regulators.

Key activities:
- Setting enforceable standards, issuing best practice guidance and advice on all matters relating to aviation noise (e.g., insulation, compensation, mitigation, metrics, modernisation).
- Advising regulators/decision-makers on the setting of clear and enforceable targets (and, where necessary, restrictions) for aviation noise management.
- When applicable, advising on planning applications.
- Providing advice on noise restrictions, noise envelopes, and noise mitigation activities in airspace change proposals.
- Setting consistent standards for industry and community engagement and collaboration.

'Putting people's health and wellbeing at the heart of aviation noise policy' Lead research into the health and wellbeing impacts of aviation noise.

Key activities:
- Build partnerships with academia and health research establishments to deliver research priorities.
- Design and run the next series of Aviation Noise Attitude Surveys in order to inform government policy on annoyance.
- Equip decision-makers in Government and industry with a clearer view of impact of aviation noise on public health.

'Focus on the future' Ensure future policy and regulatory systems for managing noise are fit-for-purpose, and that future technological advances have noise management at the heart of their development.

Key activities:
- Play critical role in advising on airspace modernisation and future aviation strategy.
- Engage fully in development of regulations around new technologies, including drones, urban air mobility (UAM), supersonic, alternative fuel aeroplanes.
- Encourage and facilitate innovation in the measurement and communication of aviation noise impacts, including geospatial advancements.
- Ensure noise reduction sits alongside carbon reduction as the fuel for advancement in technological improvements.

The ICCAN consultation document can be found at:
https://iccan.gov.uk/wpcontent/uploads/2020_10_23_Future_of_aviation_noise_management_ICCAN_emerging_view-1.pdf

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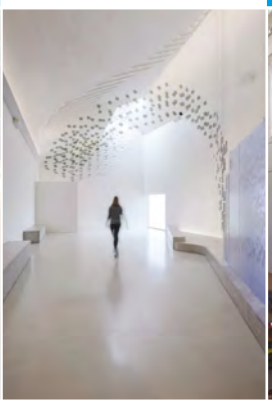



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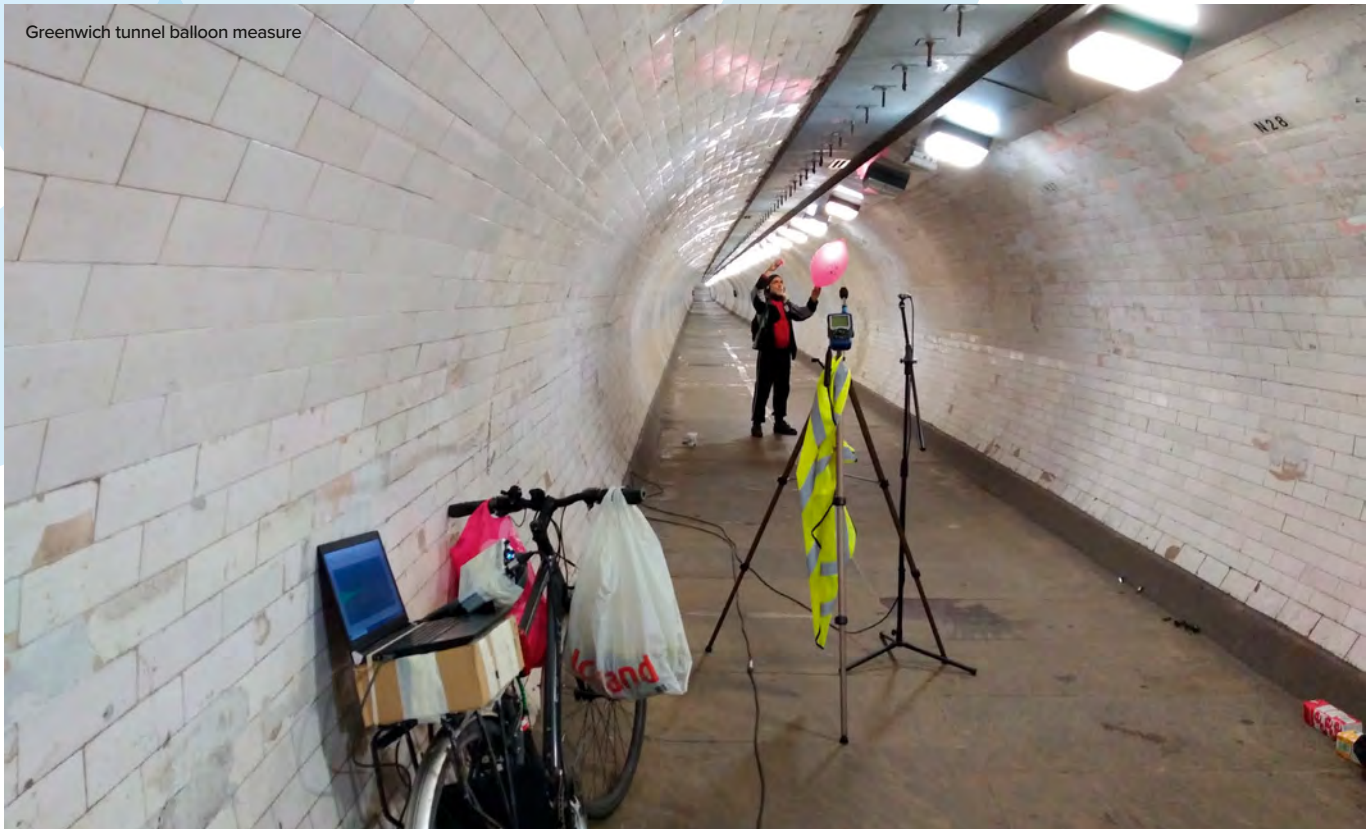

Greenwich tunnel balloon measure

London Greenwich foot tunnel acoustics characterisation

Dr Luis Gomez-Agustina and his colleagues at London South Bank University (LSBU) have surveyed the acoustic characteristics of the Greenwich foot tunnel in London, UK. Full details and results will be published in Acoustics Bulletin in the near future.

By Dr Luis Gomez-Agustina

The Greenwich foot tunnel in London runs 15m below the Thames riverbed, connecting the Cutty Sark Gardens in the Royal Borough of Greenwich on the south bank with the Island Gardens in the Borough of Tower Hamlets on the north bank. The tunnel was inaugurated in 1902 and, since then, has served pedestrians as an all-weather and reliable means to get from one side of the Thames to the other.

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The subterranean link is used by 1.2million people a year and the listed building[1] has become an interesting London landmark because of its unusual and interesting acoustic characteristics.

Survey technique

In December 2020 (and for the first time ever) a comprehensive survey to characterise the acoustics of the tunnel was undertaken. It was conducted by LSBU senior lecturer and researcher, Dr Luis Gomez-Agustina, and former LSBU masters course in acoustics student, Pedro Vazquez-Barrera, with the assistance of PhD candidate, Doug Shearer.

The survey took place during early morning hours when the frequency of passage, background noise and activity is minimal. Measuring equipment was all portable and battery operated due to the lack of main power supply in the tunnel. Part of the measurement equipment was installed on Luis' bicycle to serve as a mobile measuring station.

Two researchers took measurements in the tunnel at times of minimal background noise, when there was no activity and no pedestrians using any part of the tunnel. Typical background noise during measurements was 36 dBA.

Bursts of party balloons filled with air were used to excite the sound field at two source positions and to obtain the impulse response at 14 receiver positions. Acoustics parameters derived from impulse responses measurements were based on BS ISO 3382-1[2]. These included reverberation time (RT30, RT20), early decay time (EDT) and definition (D50). Audio recordings of the impulse balloon bursts at each receiver position were also audio recorded for subjective demonstration purposes.

Sound pressure level (SPL) decay with distance was measured in turns from the two different source positions at the 14 receiver positions.

Predicted speech intelligibility was determined by taking STIPA measurements at all receiver positions. Audio recordings of standardised speech reproduced by loudspeaker were also captured at each receiver position for speech intelligibility subjective quality assessment.

Below:
This plaque was installed at street level outside the tunnel by Greenwich Brough Council

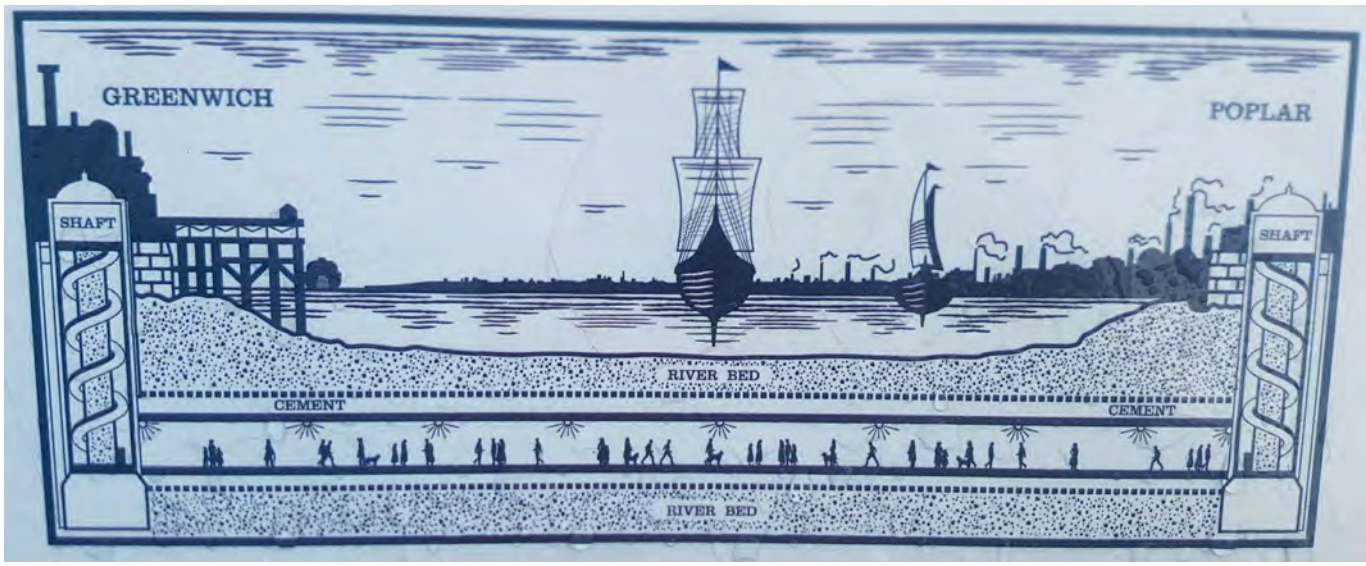
Results

Examples of early analysis of the results shows that the tunnel has a typical RT30 and EDT of 6.8sec and 3.1sec respectively at 125Hz and 5.4sec and 3sec at 1kHz.

Sound pressure level decayed by 8 dBZ between two receiver positions situated at 10m and 160m from one of the source positions.

STIPA values dropped at receiver positions from 0.65 (good) at 10m to 0.53 (fair) at 40m from one of the source positions.

Subjective assessments of speech found that audibility of the signal was largely unattenuated with distance. Speech remained understandable for surprisingly long distances from the source. However, at greater distance ranges, the clarity of the message diminished increasingly with distance to incomprehensible perception.



References

[1] Royal Borough of Greenwich. (Undated) *Foot Tunnels*. Available at: **https://www.royalgreenwich.gov.uk/info/200259/transport_and_travel/693/foot_tunnels** (Accessed on 19 Dec 2020)

[2] British Standards Institution (2009). *BS EN ISO 3382-1: Acoustics. Measurement of room acoustic parameters. Performance spaces*

ISO 717 Parts 1 & 2 and ISO 10140 series update

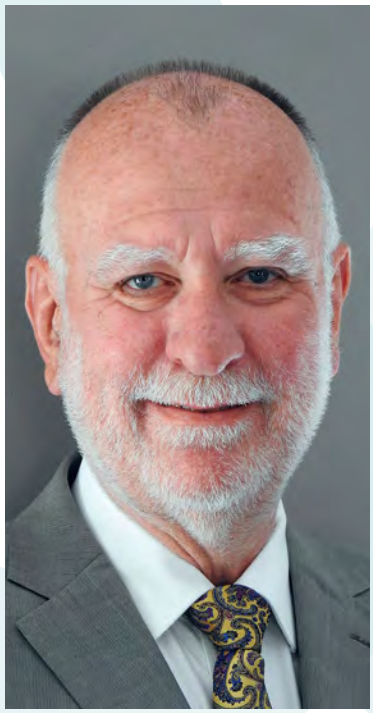
When the ISO 140 series was converted into the ISO 10140 series for laboratory testing, and both parts of ISO 717 were revised, they were revised and published at very different times. Unfortunately, this lack of joined up thinking left some parts of ISO 140 in the ISO 10140 series, which should have been in the ISO 717 series.

At the plenary meeting of ISO TC43 SC2 held in Milan in September 2015, resolution 217 was approved to correct these problems. This has meant revising both parts of ISO 717 and all relevant parts of ISO 10140 simultaneously.

There have been no fundamental technical changes to the standards and the following are the key changes:

ISO 717 Part 1

- move the definition and calculation procedures for SNQs for ΔR from ISO 10140-1 to the revised ISO 717-1; and
- move the smoothed reference curves for ΔR from ISO 10140-5 to the revised ISO 717- 1.



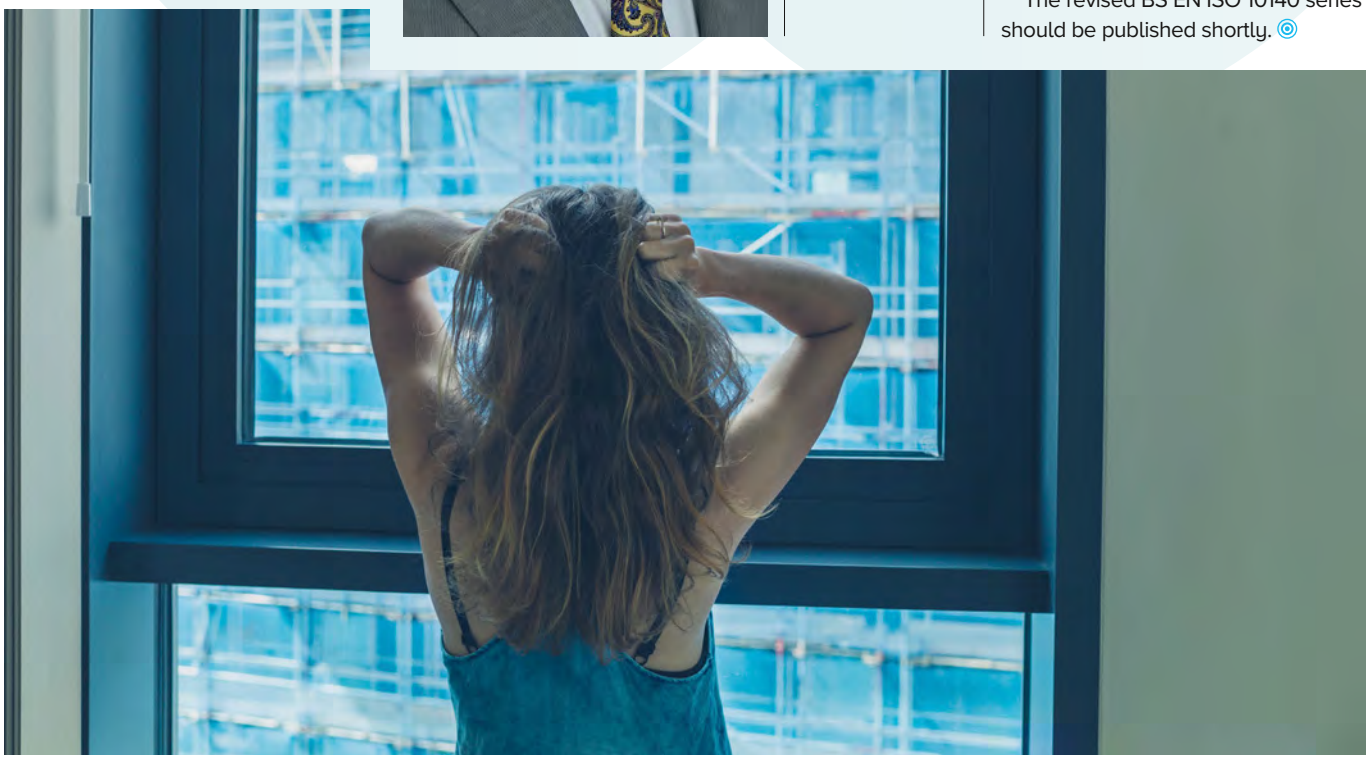
Left:
Phil Dunbavin, Chairman of the BSI EH/1 Committee

ISO 717 Part 2

- remove the smoothed reference curves for Ln from ISO 10140-5 because they already exist in ISO 717-2;
- add an annex to ISO 10140-1 for measuring ΔL for ceiling linings; and
- add the option to calculate ΔLw,direct and ΔLlin,direct in ISO 717-2.

BS EN ISO 717-1:2020 Acoustics – Rating of sound insulation in buildings and of building elements, Part 1: Airborne sound insulation and BS EN ISO 717-2:2020 and Acoustics – Rating of sound insulation in buildings and of building elements, Part 2: Impact sound insulation were published by the BSI at the end of December 2020.

The revised BS EN ISO 10140 series should be published shortly.



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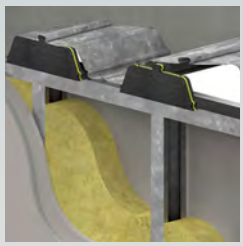

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NEWS

IOA Diploma congratulations

Badruddin Abdul Khadar is to be congratulated on persisting to complete the IOA Diploma as part of the 19/20 cohort despite difficult circumstances associated with the pandemic.

Welsh Government Clean Air Bill

The Welsh Government has published a White Paper for public consultation ahead of a Clean Air Bill for Wales that includes proposals for stricter penalties and statutory guidance for authorities in relation to vehicle idling. This is intended to address noise concerns linked to idling as well as air pollution, and the Welsh Government welcomes any consultation responses from a noise perspective.

The draft proposals for enhanced vehicle idling measures/powers (increased fixed penalties, statutory guidance for local authorities, etc.) on pages 26-29 of the consultation document, linked to consultation questions 11-14, are areas where the Government is looking to take air quality and noise/soundscape policy forward in an integrated fashion. The Welsh Government is just as interested in receiving consultation responses relating to idling noise – such as where legislation/guidance can most usefully be improved to reduce noise annoyance linked to idling – as they are to have views on the air pollution angles.

The consultation document is at **https://gov.wales/white-paper-clean-air-wales-bill** Responses should be submitted by 7 April 2021.

Update to Government Guidance on Risk Assessment for Your Environmental Permit

www.gov.uk/guidance/risk-assessments-for-your-environmental-permit

The most important updates relate to the measuring background sound level:

"The noise impact assessment for human residential receptors must be done in line with the BS 4142:2014 standard and by a suitably qualified person.

When applying for a variation, do not include the noise from the existing site (before changes) as part of the background, known as the 'residual level' in BS 4142:2014. Your noise impact assessment must consider all the noise resulting from the proposed variation - the existing site and the variation together. Show both components clearly and then add them together to give a new total for the site noise at the receptors. The impact assessment will be based on this new value, known as the 'specific level' in BS 4142:2014."

Exam dates

Due to Covid-19 restrictions the CCWNRA certificate course examination will now be taking place on Friday 14 May 2021 rather than Friday 5 March 2021.

INTER-NOISE 2021

The 50th International Congress and Exposition on Noise Control Engineering will be held online from 1-4 August 2021.

The theme of INTER-NOISE 2021 is 'Next 50Years of Noise Control' and the programme will cover all aspects of noise control engineering, acoustics and vibration. Keynote speakers and interactive workshops (including a panel discussion on the effect of COVID-19 on noise control) should provide some thoughts on successes and continuing challenges, and some suggestions on how advances in technology, as well as health, societal and environmental issues will affect global noise control in the future. **https://internoise2021.org/**

IOA video 'blooper' competition winner

A couple of months ago we launched our first video version of Acoustics Bulletin, and to get us a little more into the seasonal mood at the time (as Christmas was nearly upon us), we also created a version of it that included some of the funnier mistakes before these were skilfully edited out.

John Hammond, winner of the IOA video 'blooper' competition

We then asked members to send us a list of obvious and not too obvious bloopers by finding at least three apparent errors. Qualified competition entries were entered into a draw to win a bottle of fine champagne in order to celebrate in the New Year along with a Bluetooth enabled pair of earphones.

We're pleased to announce that the winner of the competition was John Hammond who has already received his prizes. We did have one entrant who gave us the most detailed response of bloopers in the video; and, although he didn't win this time, we'd like to give him a special mention as well. That was Jonathan Neale, well done for spotting so many of the bloopers. A special thanks also goes to Linda Canty for organising the winner's prizes and making sure that it was safely received in good time during a national lockdown. The Acoustics Bulletin video is at: **https://vimeo.com/465306481/175859bc0e** The Blooper version is at: **https://vimeo.com/480772914/6327323535**

For those who haven't yet checked it out, there are a number of great interviews in the video Bulletin, and it's well worth taking a look.

Another video Acoustics Bulletin is currently being planned for later this year. If you'd like to recommend an interview or feature to be covered in the next video, do email us at **ioa@ioa.org.uk** and add the subject *'Video Bulletin'*.

Dr Geoffrey Jackson

Dr Geoffrey Jackson, who used to work at Atkins, died in December. Adam Lawrence remembers him here, using information taken from the funeral order of service.

Geoffrey was born on 21 July 1946 in the country village of Hook-a-Gate, near Shrewsbury. He and his three siblings enjoyed a childhood of climbing trees, long country walks, catching minnows in jam jars from the local brook and bird spotting.

He attended the village primary school next door and went on to pass the 13+. He studied engineering at Shrewsbury Technical College, where he excelled at sport, particularly the western roll high jump, and he was head boy for two years.

Later he had a Lambretta scooter and went off with his sister visiting churches studying the architecture and stained glass.

Between 1965 and 1972 he studied physics at London University's Chelsea College and was awarded a PhD in applied acoustics writing a thesis on the noise of domestic appliances.

He stayed on at Chelsea for a while publishing papers and lecturing undergraduates on electroacoustics, before joining Atkins Research and Development in 1974.

Career

Initially working on transportation noise, he appeared as expert witness for noise on many public inquiries into new motorway and major road schemes.

Between 1995 and 1999 he worked on the longest ever public inquiry – the Heathrow Terminal 5 Inquiry which sat for 525 days. Part of Geoff's attire for those Public Inquiries was his IOA tie, which you can see him wearing in this photo. His calm demeanour and total command of his topic area won him a reputation as a formidable expert witness. One Atkins colleague recalls attending a training course run by barristers who had worked with Geoff years earlier – they reminisced to the young colleague "...your written work is clear, if only you could also present evidence like Dr Jackson...".

Geoff was also an important figure at the IOA; he was Honorary Treasurer between 1985 and 1990.

As part of his voluntary work in Ashtead, he sat on on the committee of the Ashtead Resident's Association and was editor of 'The Ashtead Resident' magazine for 10 years. Later, he was technical secretary of The Art Society of Ashtead, where he advised on their sound systems.

Later in his career, Geoff's work involved him visiting UK theme parks as the country's leading expert on noise from theme park rides. It wasn't all straightforward – whilst working out of the back of his car in an adjacent field to Chessington one day, a thief, escaping from the World of Adventures, ran to his car, got in and drove off towards Kingston, dropping all Geoff's equipment, papers and briefcase along the Kingston road as he sped off with the tailgate still open.

An inspirational colleague

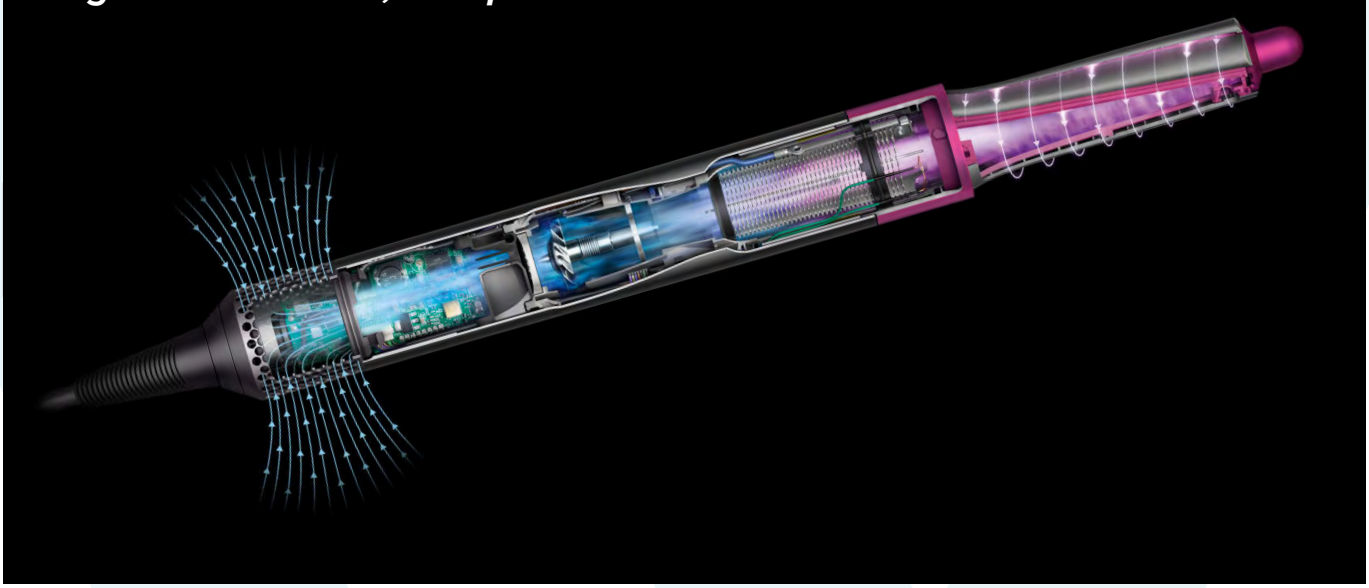
Geoff is remembered by everyone as a fantastic colleague and an excellent acoustician at Atkins over the nearly four decades that he worked there.

Thanks to his customary friendly and approachable way and his experience, he was the go-to gentleman for practical solutions or words of wisdom.

Many acousticians, long gone from Atkins, remember him for the way he inspired his colleagues and for his positive influence which continues to shape their careers today.

IOA Noise and Vibration Engineering Group

By Malcolm Smith, Group Chair



The NVEG committee is embracing the move to online seminars. We have long-term plans for a series of talks that will hopefully raise our profile, and be of interest to both the general IOA membership and the wider community of noise and vibration engineers around the world.

The first seminar was held on 9 February 2021, on 'Acoustics of the Dyson Airwrap™,' presented by Nathan Thomas, the engineering manager with responsibility for this hair drying and styling product.

Nathan took us through the fascinating acoustic, vibration and aerodynamic challenges encountered during the development of the product. From an aeroacoustics point of view there appeared to be many similarities with a small aero-engine: intake noise, exhaust noise, compressor noise, thermodynamic effects, duct acoustics, etc.

Above: The Dyson Airwrap™

Given the complexity of the physics and multiplicity of noise sources, it was great to see how the development team sifted through the problem of interpreting the noise data as a mathematical scaling model, derived from a series of carefully controlled experiments. The understanding that this provided enabled them to carry out development work at standard temperatures and scale the results to the normal operating temperature of the hair styler.

Beyond the physics, however, lay the mysteries of how different cultures around the world have varying expectations of such consumer products, and it was intriguing to consider how the modes of vibration of the fan shaft could directly affect sound quality and hence desirability of the Airwrap.

The diverse topics covered by the talk inevitably provoked a wide range of questions from the audience. Some of these were about use of computational prediction methods (CFD and CAA) to evaluate the flow, aeroacoustic and duct acoustic characteristics of the device. Other questions covered the subjective acoustic and cultural aspects of this commercial product, such as the importance of tones compared with broadband noise, and the effect of differences in preferred heat and power settings on consumer opinions and feedback.

A recording of the talk has been put on the IOA website, and this is recommended viewing for people who missed the live event.

The next seminar will be held on 11 May, 13:00-14:00 by Zoom. This will also have an aeroacoustic theme, but with a very different focus; a review of flow noise mechanisms on airframes, high speed trains and whistling buildings. The date of the third seminar is provisionally 10 August 2021, and will cover a topic from automotive acoustics.

IOA Early Careers Group

By Tom Galikowski, Group Chair and Josie Nixon

Early Careers Group began 2021 on a strong foot with a webinar on careers in academia and industry on 11th January, which, I think, was the first CPD event of the year! Josie Nixon MIOA (HA Environmental) has kindly written this report.

This event was our second in a series of webinars prepared in response to COVID-19. We are working on more events including 'University Fair', which was held on 8 February (see full report on page 18) and 'Ask Anything' on 8 March. We are always on the lookout for CPD ideas – please get in touch if there is a technical, career or education-related topic you would like to be discussed.

If you are a fan of 'The Art of Being a Consultant' you will be pleased to know that the in-person event is currently being planned for the autumn. In the meantime, we are working on a virtual session building on the usual themes and topics.

We are starting our preparations for Acoustics 2021 and Internoise 2022.

Early Careers Webinar: Career Routes between Academia and Industry

This webinar built on the early careers session organised by the IOA, ECG and UKAN Young Members Group for the Acoustics 2020 conference. We asked what academia needs from industry, and vice versa, and how to transition from one career to the other. To answer these questions, we asked four people; Joe Allen, Nikhil Banda, Ashley Leiper and Andrew Mathieson, who have all recently made these career switches, to share their experience.

Joe Allen, RBA Acoustics, London – academia into industry.

After studying theoretical physics in Leeds, Joe undertook his PhD at the University of Surrey, with no links to acoustics. The university ran research degree programme classes that highlighted other degrees and provided an employability and skills co-ordinator. As a result, Joe went to IBM research centre in New York for a three-month internship in 2016; an experience that spurred him on to look at a career outside of academia.

The University of Surrey is part of the South East Physics Network, which offered a residential summer skills programme and good links to employers. One of the workshops was from RBA about acoustics and construction, Joe subsequently got in touch with the company and started to work for them that year. Supported by RBA he then went on to complete the IOA Diploma.

Joe stressed the importance of building a network of contacts in the industry you are considering moving into. Events such as summer career fairs or meet-ups with employers, can be useful in introducing you to companies you may never have heard of.

Dr Nikhil Banda, Seiche – career in underwater acoustics

Nikhil began his career working in vibration research in the automotive industry in India. He then moved to research in the UK before moving back into industry with Seiche. During his talk, Nikhil described various ways of moving from academia to industry which included knowledge transfer partnerships (KTPs), networking, developing your own ideas (e.g. via Royal Society's Industry Fellowship), networking and directly applying for a job.

Nikhil outlined similarities and differences of underwater acoustics with other types of acoustics. There are numerous factors that can affect underwater acoustics: for example, sound frequencies used by marine animals overlap with sonar, the speed of sound in water is strongly dependent on the density of water and the depth of the source. These differences were illustrated with the vocalisation of a sperm whale.

Nikhil provided examples of commercial and academia research projects. Typical work, he said, could be an environmental noise impact assessment of how marine animals or humans can be affected by introducing noise sources (e.g. wind turbines) in the ocean, and another example, carried out with the University of Bath, involved an oil rig noise assessment to determine and measure non-disruptive sound waves from the oil/gas construction industry at a particular site. The automated pod in this assessment was required to get the near field as well as the far field measurements and report the source level.

Ashley Leiper, EnviroCentre – What the consultancy industry needs from academia

In his talk, Ashley focused on soundscapes and what research projects potential employers might be interested in directly (i.e. relevant to projects) or indirectly (i.e. by advancing industry knowledge).

Ashley explained that soundscapes are well established in academia; however, they are considered a 'hard sell' with developers and there is a lack of guidance on integration with the industry and planning system, although, the recently published ISO 12913 series provides guidance on data collection and analysis. Soundscapes are mentioned in the Welsh and City of London noise policies, but there is nothing on how to consider the aspects and/or to protect them. There is a long reported lack of connection between practice and academia. This discourages developers from

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implementing soundscapes into their projects and, in turn, does not provide a sufficient number of 'real life' projects to support research.

More guidance and standardisation is needed on what soundscapes need protecting and preserving, how to design and evaluate them and how to integrate them into the planning system. There are concerns about the costs of stakeholder engagement although automated tools such as automated neural networks and auralisation can help to reduce it.

There are some examples of soundscape projects within built projects but not many. Ashley described one example, St Asaph Care Home, which is the only widely publicised UK project to consider soundscapes. This included a positive soundscape map as well as a noise impact map. Sonic art soundscapes are slowly becoming popular, which could encourage soundscape intervention.

Dr Andrew Mathieston, Maritime Systems UK Thales Group – Working across academia and industry: a case study

Andrew began his career as a researcher at University of Glasgow's School of Engineering, where he worked with a number of companies, which allows him to draw parallels and dependencies between academia and industry.

Andrew explained that in academia the aim is to meet publication demands and to teach and obtain research funding, whereas in industry, you are profit driven and need to maintain advantage while having recruitment opportunities. Both academia and industry aim for knowledge transfer to gain what they require.

When collaborating with industry one needs to consider factors such as company size, legal challenges, resource management, classification, or budget cycles. Things need to be planned well in advance to be executed because of the number of parties involved.

Andrew drew on his own experiences to describe choices when arriving at a career crossroads. Options are moving into industry within similar technology field, moving into industry within a different technology field, or applying for research funding (continuing in a similar position).

Andrew said that the skills built upon work in academia are transferable into consultancy work – skills such as problem solving, succinctness, resilience, robustness or communication (networking again!),

I would like to thank my colleagues – Daniela Filipe MIOA from Hoare Lea, Dr Niklhil Mistry MIOA from ISVR and Josie Nixon MIOA from HA Environmental as well as Linda Canty and Alex Shaida from the IOA for their time and dedication in organising the event.

Early careers – underwater acoustics

Above: Adam Woolley, ECG Secretary

In this column, we continue to highlight a wide range of skills, sectors and regions where early career professionals work. Adam Woolley, our new ECG Secretary, provides an insight into his career in underwater acoustics.

Underwater acoustics has its place in many industries. The defence sector is perhaps the largest area of activity but sonar is also used to map the oceans, conduct archaeological searches for shipwrecks, survey potential construction sites for off-shore energy farms and assess the impact of man-made noise on marine life. Because underwater sound is not something we as humans experience on the same level as airborne acoustics, it can often be overlooked when the everyday person considers the occupation of an acoustic engineer. Nevertheless, it is a thriving and exciting field of science with a world of opportunities for those who are interested.

My acoustics journey began when I enrolled on the University of Salford's audio acoustics undergraduate degree. My dissertation was on the acoustic effects of bubble-bubble interaction in microbubble clouds, such as those used in medical ultrasound contrast agents and drug delivery via high intensity focused ultrasound. While studying at Salford I worked part time at WSP as an acoustics technician. Those who know Salford will know that underwater acoustics is not part of the curriculum but airborne and underwater acoustics are not too different from one another (besides some conventions, e.g. Pref = 1 µPa instead of 20 µPa). It is the same science, just a different medium. What drew me to underwater acoustics was sonar. I was fascinated by the concept of revealing an unseeable environment with sound waves. The marine creatures that use biosonar – such as whales and dolphins – were definitely a point of interest for me too. Another interesting fact about underwater acoustics is that sound waves are the best waves when it comes to propagating underwater. Electromagnetic waves can travel about 100m or so at best, whereas sound waves can travel for miles (hence the military's interest in sonar for their seafaring platforms).

After graduating from Salford in 2018, I started working at Thales and I am now a member of their acoustics group. My team is responsible for the research, design, modelling, development, testing and production support for sonar transducers that are used on surface ships, unmanned platforms, submarines and mine-hunting sonar systems. We work in close collaboration with a long list of engineering disciplines including other acoustic engineers and the wider academic community. Together, we produce some of the world's most advanced and capable underwater systems used by over 50 navies around the globe. On top of this, Thales graduate employees are encouraged to get involved in outreach activities as STEM ambassadors. In my first year at Thales, I constructed an acoustic levitator for the Big Bang Fair at the Birmingham NEC. I also presented a seminar at the University of Salford on underwater acoustics.

Unlike the many fields of airborne acoustics that have multiple specialist IOA groups, all of the

IOA's underwater acoustics interests are overseen by a single committee: the Underwater Acoustics Group (UAG). The UAG committee has members representing many areas of underwater acoustics from both industry and academia. Last year on 9 September, we hosted the IOA's first ever virtual conference: the International Conference on Underwater Acoustics 2020 (ICUA2020), in which I co-chaired a session on signal processing. The conference was a great success and attended by 280 delegates from 26 countries.

Coming from a purely airborne acoustics background, I have always been keen to spread awareness of underwater acoustics across the wider acoustics community, particularly to early career acousticians. The skills you have learnt relating to airborne sound are largely transferrable to the underwater domain. When applying for underwater acoustics jobs where you will be competing against applicants whose backgrounds are in more general physics and engineering, you may stand a better chance of success than you first expected.

The ECG is open to all members of the IOA (both corporate and non-corporate) who shall normally be under 35 years of age or within first five years of their career. The group is always keen to hear from members and non-members alike. To join the Early Careers Group, to find out more information or to voice your concerns, visit **https://www.ioa.org.uk/early-careers-group**

IOA Senior Members' Group

This 26 January Zoom meeting: UKAN – its structure, research aspirations and relationship with the IOA, attracted 31 participants and produced some lively discussion following an interesting and informative presentation by Professor Kirill Horoshenkov.

Right: Professor Kirill Horoshenkov

From some initial suggestions made back in early 2016 work started to gauge opinions on forming a community resource among the disparate cross-section of researchers and academics working in the field of acoustics. With support from the Engineering and Physical Science Research Council the UK Acoustics Network, UKAN, was launched in November 2017. It had initial funding for three years and was open to any researcher, practitioner or end-user in acoustics giving access to the entire pool of acoustic expertise across the UK.

It is a research network with the aim of promoting the existing activities and to generate new research and collaborations in acoustics across the home nations. This is being achieved by enhancing the communications between groups, and maximising the future impact of acoustics-based research in the UK.

UKAN had initial funding through to March 2021. The definition of acoustics was cast very wide

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and, to date, the network has 15 special interest groups and approaching 1,200 members. Just over 50% of the membership are academic/research orientated with some 30% engaged in practical applications as engineers and consultants. An interesting side statistic on the membership is that some 40% of these acoustic practitioners are not yet members of the IOA.

To date the UKAN has, in addition to the networking facility, supported some 150 network events as well as forming an early career sub-group with over 300 members. The main publication of this first phase has been the 'Value of UK Acoustics Report'. This has been reported on separately in Acoustics Bulletin and shows that acoustics contributes £4.6 billion to the UK economy, employs 160,000 people in 750 companies.

In these closing months of the initial phase on the network, funding has been obtained from the EPSRC for UKAN+. This new phase of the project will start on 1 April 2021 and run through to the end of March 2025. This will include a budget of £1.4 million, to be matched by a similar level of industry funding, to promote ongoing research and development in the field of acoustics. These activities are all designed to be complementary to the Government's 'Grand Challenges' for future research. With this in mind the objectives of UKAN+ are:

1. To develop a new roadmap for acoustics research in the UK related to these grand challenges of clean growth, healthy ageing, future mobility and AI and data (see table below).

2. To facilitate explorative (pilot) cross-disciplinary research projects between industry, government, third-sector organisations and academia following on from the agreed roadmap.

3. To use the results from the explorative projects to develop full-scale, high-quality responsive mode applications to the UKRI, and other funders, aligned with the grand challenges.

4. To set up a National Centre for the Coordination of Acoustics Research (including coordination activities in relation to EDI (equality, diversity, and inclusion) as well as obtaining full sustainability for UKAN+.

A new UKAN+ structure has been devised to realise these objectives and named investigators have been assigned roles to guide and control the programmes, these are summarised below.
Full details are on the UKAN website **www.acoustics.ac.uk**

Grand Challenges	Clean Growth	Healthy Ageing	Future of Mobility	Artificial Intelligence and data
Industrial Strategy Challenge Fund areas	Energy revolution Transforming construction Transforming food production Manufacturing and future materials	Medicines manufacturing Data to early diagnosis and precision medicine Healthy ageing Leading-edge healthcare	Faraday Battery Challenge Extreme robotics National Space Test Facility Stephenson Challenge Driverless cars	Audience of the Future Next-generation services Quantum technology
Enabling fields of acoustics	Non-destructive sonic testing Acoustic metamaterials Sound insulation Acoustics building design	Ultrasound Psychoacoustics Soundscapes Sound and music reproduction Communication acoustics	Environmental management Noise compensation and suppression Electro-acoustics Noise measurement Underwater acoustics / sonar Smart warning signatures	Voice control Active noise suppression Artificial speech Artificial intelligence Sound and music reproduction
Theme Champions	Paul Lepper (lead) Olga Umnova (deputy)	Stephen Dance (lead) Christian Sumner (deputy)	Abigail Bristow (lead) Antonio Filippone (deputy)	Mark Plumbley (lead) Alan Hunter (deputy)

BRANCH NEWS

Irish Branch

We are happy to provide a summary of the following webinars hosted and attended by the Irish Branch in 2020.

By Siobhan Maher

Assessing the noise impact of dog kennelling developments
Paul McCullough, Environmental Health Manager with Armagh City, Banbridge and Craigavon Borough Council, gave a well-attended lunchtime presentation last June on proposed draft EHO guidance for Northern Ireland on *'Assessing the noise impact of dog kennelling developments'*. The draft guidance has been developed in Northern Ireland to ensure that noise is adequately considered in the planning stages for proposed dog kennelling operations as these types of businesses are increasing as dog ownership and related noise complaints rise.

Paul outlined that EHOs in Northern Ireland recognise the difficulty in assessing the noise impact associated with dogs barking. Various methods have been deployed which can be confusing for planners and can lead to appeals in the planning process. The draft guidance identifies a combination of potential measures to minimise impact; including adequate set-back distance from sensitive receptors, sound insulation against noise breakout from kennels and good management practices. The guidance deliberately seeks to ensure that no barking is audible during the night-time period and to remove unworkable planning conditions. The draft guidance proposes the use of the L_{AFmax} parameter as a proxy for the sound power level of barking with a lower limit on the acceptable source noise level of no less than 95 dB to be used in assessments. The draft guidance is currently being reviewed for effectiveness in practice.

European Green Leaf webinar – looking for a quiet life?
Irish Branch members were treated to a webinar last October by Dr Simon Jennings of Limerick City and County Council and Dr Antonella Radicchi of the Technical University of Berlin, inventor and principal investigator of Hush City. The Hush City project seeks to identify, assess and then protect quiet areas. The idea of soundscape as a resource was presented. A qualitative approach to designating areas was outlined using Limerick City as an example and attendees were introduced to the Hush City App that allows ordinary citizens to map tranquil spaces which have a positive impact on health and quality of life.

Presentation on the 'AVO' Residential Design Guide
Last October, Jack Harvie-Clarke of Apex Acoustics gave an overview presentation on the Acoustics Ventilation and Overheating Residential Design Guide, jointly prepared and published by the IOA and ANC in January 2020. Forty-eight Irish Branch members attended online. The presentation gave an overview of the design guide and focused on highlighting the need for an integrated approach to assessing these often conflicting requirements in modern residential development and the role played by acousticians. The hierarchy of assessment in Stages 1-3 was neatly explained and awareness of these issues has no doubt been raised as a result of the presentation. The related Professional Practice Guidance (Pro-Pg) on Planning and Noise for new Residential Development has been referenced in a number of Noise Action Plans in the Republic of Ireland. The 'AVO' Guide may also follow suit.

The Irish Branch would like to thank Paul McCullough, Dr Simon Jennings, Dr Antonella Radicchi and Jack Harvie Clarke for their time and contributions.

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London Branch

By Dr Luis Gomez-Agustina (FIOA), course director of IOA courses at LSBU

As is customary now at the January London Branch meetings, some of the best IOA Diploma student final projects undertaken at the London South Bank University (LSBU), were presented by their authors.

In addition, the NTI-Audio LSBU IOA Diploma Student Final Project award competition takes place also during the January London Branch meeting. This award was set up in 2019 by LSBU Diploma course director, Dr Luis Gomez-Agustina, in collaboration with the sponsor of the award, acoustics instrumentation manufacturer NTI-Audio.

Due to the COVID-19 restrictions and current lockdown, the 20 January 2021 London Branch meeting was held online. The three nominated finalists for the award presented their work undertaken at LSBU in the 2019-20 academic year.

Rory Hendrick

Rory Hendrick presented his work entitled: 'An Investigation into the vibration characteristics of fibre reinforced concrete composite'. The project aimed at determining how the vibrational response of fibre reinforced concrete is affected by fibre type and volume. The pandemic halted initial plans for physical impulse response testing, so finite element analysis software was employed with an aim to simulate these experiments remotely.

Simulation validations were conducted, which would compare the modal analysis results of the model to those of a real impulse response test on a concrete sample. These simulations were proven to show linearity with the real data, and so further simulations were conducted to find both the natural frequencies of each concrete type and the expected levels of acceleration. Regarding the finding, Rory explained that for all the fibre types, there was an optimal volume for which maximum natural frequency and minimal acceleration are reached, after which these values begin to decrease. Both of these parameters were shown to be related to the strength and stiffness properties of the material. Steel and polypropylene fibres demonstrated this volume to be 1.5%, whereas basalt was 0.5%. Rory added that basalt fibre reinforced concrete proved to be the most sensitive to fibre volume changes and so, along with the lower volume requirement, it was shown to be an ideal candidate for future research.

The execution of this particular project was an excellent example of contingency adaptability to the significant restrictions caused by the COVID-19 pandemic.

Courtney Hawkins

Courtney Hawkins presented her project entitled: 'Why undesirable weather conditions should be considered when designing high-rise residential buildings in the UK'. Her research identified the lack of suitable guidance relating to effects that meteorological conditions can have on internal noise levels. The study investigated whether undesirable weather conditions should be considered during the design stages of a building and for internal ambient noise level measurements, to ensure that occupants can enjoy an acoustically comfortable and safe environment within the home. Courtney noted that current UK acoustic guidance favours dry weather conditions with low wind speeds, however, the UK only experiences these conditions for just under half the year, meaning that some residential buildings are failing to provide suitable internal noise levels during a large portion of the year.

Charles Greene presenting the NTI Award to Rory Hendrick

Measurements taken from within a newly built 182m tall residential building in London, revealed up to a 15.6 dB increase in internal LAeq,8hour during a period where winds reached up to 42 mph, resulting in noise levels being compliant with BS 8233:2014 during low wind-speeds, but non-complaint during higher wind speeds. She pointed out that implementing a precise methodology could prove difficult as changes in wind direction, wind speed, topography, precipitation and external background noise sources make replicating the exact conditions incredibly difficult.

The last presentation was delivered by James Allen and was entitled: "An investigation into the level differences between over-ear and in-ear communications signals for aircrew". James started by noting that military aircrew are exposed to high levels of noise during their working days/weeks and that currently, it is not possible to measure the at-ear sound directly with a microphone when using a dual hearing protection system.

The project aimed to determine a transfer function between the over-ear and in-ear communications systems for use in occupational noise risk assessments. Measurements were made with a head and torso simulator and Knowles microphones in order to determine the difference between the communications sound level under the earcup of the helmet and on the occluded side of the in-ear communication devices (IECDs). The transfer function required validation in a real-life scenario on board an aircraft to assess the impact of ambient noise on the results. James discussed the results that showed that, as with similar studies in the relevant literature, the use of the transfer function when predicting the level at-ear when wearing vented aviation moulded protection (VAMP31) earplug resulted in a lower level than that measured in the earcup. Consequently, he noted, the use of this transfer function results in the allowance of working hours for aircrew being increased significantly.

After the three presentations, Rory, Courtney and James took questions from the online audience.

Charles Greene, General Manager of NTI-Audio UK, and Luis, 'presented' the award to the winner of the competition, Rory Hendrick.

The IOA President Stephen Turner, the London Branch Chair, Louise Beamish and attendees commented on the high quality of the presentations and their contents.

Congratulations Rory, Courtney and James for these commendations!

Members can access all three presentations here:

1. Vibration in fibre reinforced concrete composite
https://vimeo.com/507452776/b9e733247c
2. Why undesirable weather conditions should be considered when designing high-rise buildings in the UK
https://vimeo.com/507453422/95419a458d
3. An investigation into output level differences between over-ear and in-ear communications systems
https://vimeo.com/507456773/58cab6a8e0

Southern Branch

On Wednesday 27 January 2021, the Southern Branch hosted the latest in its series of virtual events.

By David Yates (Syntegra Consulting)

Dave Clarke of SRL Technical Services Ltd presented on Building Information Modelling (BIM) and ran through the many acronyms and standards that are used. He explained what it is and why it is useful, and that the introduction of 3D modelling allows designers to quickly see the building as a whole. This assists in the construction of higher quality buildings and infrastructure and allows them to be built more quickly and cheaply, avoiding mistakes and reducing material costs.

He explained where we are currently; at (BIM Level 2), with a common data environment and all outputs in open format types that can be read with free software and filed with a designated numbering system. Finally, Dave speculated as to what BIM Level 3 may look like in the future, with potentially all designers contributing to the same computer model. He also speculated as to what the model may be able to do in terms of basic acoustic calculations, predicting reverberation times, internal noise levels and internal sound insulation – hopefully not putting us acoustic consultants out of a job!

There were 97 people in attendance, which is a new record for the Southern Branch, obviously helped by the fact that members from other branches across the country are free to attend, as well those Southern Branch members who normally cannot get to meetings due to the wide geographical area we cover.

The Southern Branch subsequently held its AGM during which the Chair, Daniel Saunders (Clarke Saunders Associates), provided an update of the last year's business and meetings that we hosted. One committee member was re-elected to the committee, Sebastian Woodhams (Sustainable Acoustics), with no other committee members due for re-election this year and no new nominations to committee. We always welcome offers of help on the committee so if you would like to assist us or have a good idea for a presentation then please get in touch.

Yorkshire and North East Branch

By Dr Julija Smyrnowa

The Yorkshire and North East IOA Branch conducted an online survey of their members recently. The aim of the survey was to gather the branch members' opinion on what could be improved and how our members could engage better in the work of the branch. The survey consisted of nine questions, some of which had predefined answers, while others were open-ended.

Overall, we gathered 33 responses, which enabled us to get an insight as to what was good and what could be improved.

The questions posed, and summary of the responses, were as follows:

Q1: What do you find to be three most attractive factor(s) for a Branch meeting?

The results indicated that t**opic** is the most attractive factor for the participants (97% of the responses) followed by **ease of accessing an online meeting electronically** (51.5%). Third was **speaker experience and competence** (48.5%). Statistics of the answers are shown in Figure 1. P68

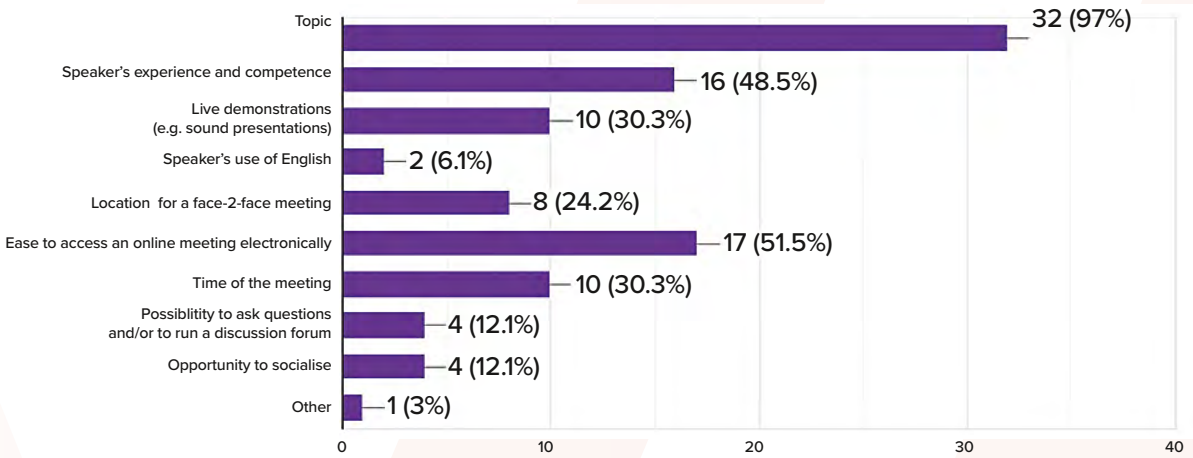
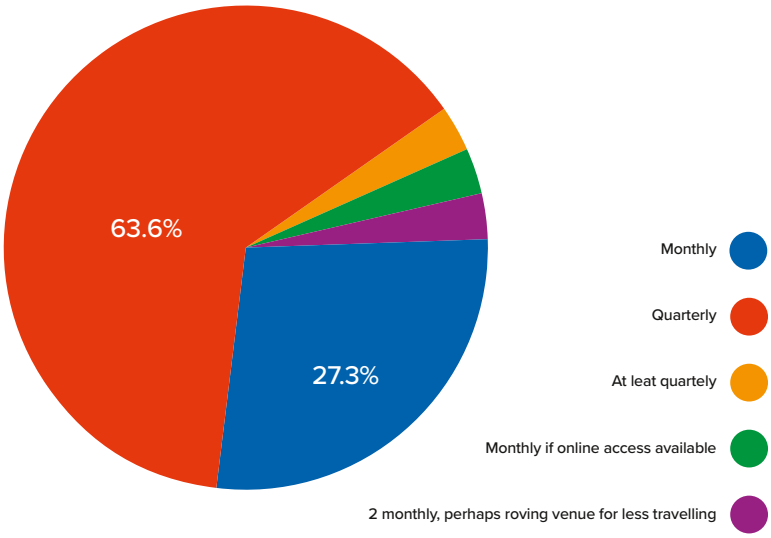


Figure 1: Q1: What do you find to be three most attractive factor(s) for a branch meeting?

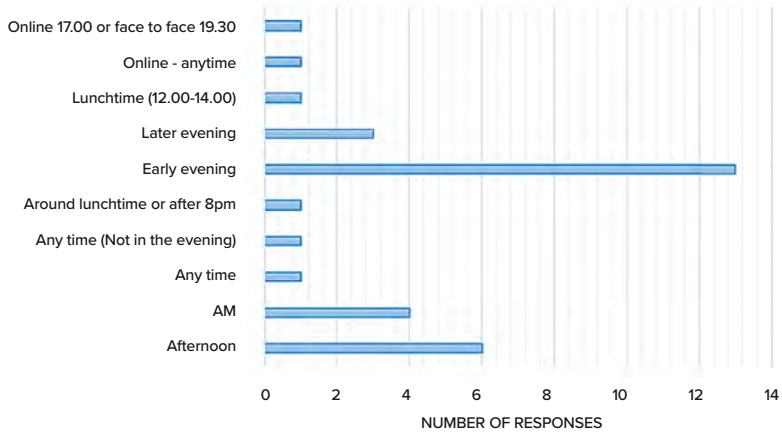
Q2: How often do you think the branch meetings should be organised?
63.3% of the respondents prefer the **quarterly** branch meetings, while 27.3% suggested **once a month.**
See Figure 2 for details.

Figure 2: Q2: How often do you think the branch meetings should be organised?



Q3: What would be the best time for online meetings to take place? Results are shown in Figure 3, which indicates the majority preference is for early evening.

Figure 3: Q3: What would be the best time for online meetings to take place?



Q4: Is there anything can be improved in our branch meetings in terms of presentation quality or organisation?
Only 21% of the respondents provided suggestions for improvements. These include:

- avoiding rush-hour (18:00-18:30) as the start time for live meetings;
- suggestion to have both virtual and in-person meetings in the future;
- better guidance for virtual meetings (e.g. muting microphones);
- improved access to CPD certificates;
- more technical detail; and
- making notes available before and printable copy/ recording of presentation after, which will be useful for SEN participants.

From the other side, only three people said they would be interested to help to run the branch **(Q5)**.

With regards to **Q6: Please suggest topics and/or speakers that would be of interest to you and may also attract the others**, almost everyone suggested a topic. The most common are related to:

- industrial noise, including BS4124, LFN, NARN45 and property development near to industrial premises;
- standards, guidance and regulations;
- ventilation and overheating (AVO); and
- product details such as glazing and ventilation and noise control experience from engineers.

However, there were also unique topics and suggestions including on new developments in acoustics, medical acoustics, trends in sound measurement equipment, clay pigeon shoot, public enquires from big Development Consent Order (DCO) projects, Local Authority/planning consultants` views on noise assessment requirements, and presenting on case studies: not only good/successful. One of the respondents recommended inviting speakers who 'may offer a more tangential view on what we do, or who do different things that may be interesting but not directly relevant.'

Only five respondents mentioned they would be interested in presenting for the branch **(Q7)**. However nearly everyone would like to have online branch meetings recorded and saved to a depository managed by the IOA for the members to access at their convenience **(Q8)**.

Final suggestion and comments **(Q9)** were related to:

1. Difficulties in accessing live meetings due to distance. The Y&NE committee comments on this are that traditionally, the live branch meetings had been organised in Sheffield as committee members were based in this area and had access to Sheffield University facilities. We have a very large geographical area to cover and over recent years, efforts have been made to hold meetings in other places, and several meetings were organised in Leeds and Newcastle in 2019-2020. We intend to carry on with this practice in the future and encourage any members with access to suitable facilities for meetings in different venues to get in touch.

2. An advantage to not recording meetings and making it 'live only', would encourage people to actually turn up.

3. Advice on completing the CPD tracker; employability advice, guidance on upcoming sectors and community engagement opportunities.

4. Advantages of the online meetings are they are much more accessible than face-to-face meetings in terms of time, travel and cost.

5. One hour online meetings are the most effective as the time commitment is much easier to make.

6. Collaboration with associated professions/trades: architects, councils, builders, building services, interior designers and similar.

The Y&NE Branch committee is grateful to all members for completing the survey and for providing valuable comments and suggestions that we will try to implement where possible. We also suggest the other branches could run similar surveys, therefore obtaining a wider response from the membership, which we believe would help shape the future of the IOA as a whole.

If you wish to get in touch, please do so via email: **ioa-yorkshire-north-east@outlook.com**

Sto brings acoustic balance to London landmark

A new landmark on the London skyline now benefits from a balanced acoustic environment thanks to the use of the StoSilent Distance system from Sto. The main lobby and Mezzanine Club area of The Stratford (formerly Manhattan Loft Gardens) have been fitted with StoSilent Distance, to create interiors which combine comfortable acoustic surroundings with a clean and contemporary appearance.

Sto's Acoustic Technical Consultant, James Gosling, explains: "There are acoustically challenging areas in most buildings as they usually involve a considerable volume of noise being generated in large open spaces, by foot traffic and speech. Attenuating that noise to a level where conversations are possible at normal volumes is an essential requirement if those spaces are to operate smoothly and efficiently."

The StoSilent Distance system allows architects and interior designers to create efficient, sound-absorbent walls and ceilings in situations where they must be suspended to reduce room height, accommodate services or to achieve a certain visual appearance. It can be used to create seamless surfaces of up to 200m^2, including inclined planes or curved vaults, along with sharp joints and creases wherever they are required. The system has a very high degree of resistance to cracking, and includes options which allow it to accommodate both air movement requirements, plus humid and damp conditions.

For this project, the StoSilent Distance system was finished with a grey-tinted StoSilent Decor M sound-permeable coating, which complements the overall appearance of the treated areas. This solvent and plasticizer-free finish is spray-applied to create an attractive fine-stipple surface, and can be tinted to match a wide range of shades from the StoColor system. It is easy to refurbish, environmentally friendly, inert and natureplus® approved.

Brush up your environmental knowledge with HBK's webinars

HBK's free, online training sessions, run by its technical experts, cover a variety of topics – from general acoustic, environmental and occupational noise to more specialised product training.

For acousticians seeking guidance on sound and impact insulation measurements that meet current standards, HBK will run two building acoustics webinars, to cover this topic in March.

HBK's full webinar calendar is available at **https://hbkworld.com/public-online-courses/**

New venture for Phil Evans

Phil Evans, formerly Senior Director and Acoustics Team Leader at RPS, has moved on to form Evans Acoustics. Phil joined RPS in 2001 following the acquisition of Ashdown Environmental Limited where he was a board director. Following 20 years with RPS, and 13 years before this with Ashdown and Travers Morgan and Partners, Phil is now pursuing specialist areas of acoustics (construction, minerals and general planning) and expert witness work whilst continuing with two RPS projects.

This new venture will give him time to focus on technical work and client delivery.

Philip@evansacoustics.com

Introducing Fade Acoustic Plaster

Pacy & Wheatley now offers Fade Acoustic Plaster, a plastering system that absorbs unwanted noise. Providing a flexible alternative to traditional solutions, it can be applied onto virtually any surface making it perfect for curved walls, dramatic angles and arches.

The solution comes in two different variations, the Plus+ and the Albus.

The Plus+ has an ultra-smooth, fine grain finish whereas the Albus gives a smooth, medium grain finish. Both solutions have a choice of finishes from fine texture, trowelled and smooth. They are available in a vast range of colours, so can be tailored to design requirements and can be installed at either 25mm class B or 40mm class A.

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Committee meetings 2021

DAY	DATE	TIME	MEETING
Wednesday	**17 March**	**10.30**	**Council**
Tuesday	23 March	11.00	CPD Committee
Thursday	25 March	10.30	Meetings
Thursday	22 April	10.30	Membership
Thursday	6 May	11.00	Publications
Thursday	13 May	10.30	CCMOEHAV Examiners
Thursday	13 May	13.30	CCMOEHAV Committee
Wednesday	19 May	10.30	Executive
Tuesday	25 May	10.30	Research Co-ordination (London)
Wednesday	**9 June**	**10.30**	**Council**
Tuesday	15 June	10.30	Engineering
Wednesday	16 June	10.30	Engineering
Tuesday	22 June	10.30	ASBA (Edinburgh)
Wednesday	7 July	10.30	CCWNRA Examiners
Wednesday	7 July	13.30	CCWNRA Committee
Tuesday	13 July	10.30	Diploma Tutors and Examiners
Tuesday	13 July	13.30	Education
Wednesday	14 July	09.30	CCBAM
Wednesday	14 July	10.30	CCENM Examiners
Wednesday	14 July	13.30	CCENM Committee
Thursday	15 July	10.30	Meetings
Thursday	5 August	10.30	Diploma Moderators Meeting
Thursday	12 August	10.30	Membership
Thursday	26 August	11:00	Publications
Wednesday	8 September	10.30	Executive
Wednesday	**22 September**	**10.30**	**Council**

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