



SOUND ARGUMENTS: THE WONDER OF ACOUSTICS

Acoustics is one of the most diverse and varied areas in engineering, yet it's a subject many of us take for granted in our day-to-day lives. To mark The International Year of Sound 2020, acoustics expert **Cameron Salisbury** explains why it's time to bring sound to the forefront of the conversation.

How loud is the sun?" A seven-year-old can put any expert on the spot with this perfectly simple question (the answer is both wonderful and technical in equal measure). That's why The International Year of Sound¹ is a fantastic opportunity for acousticians around the world to engage the public (including inquisitive seven-year-olds) in the science behind sound and the new technologies that help us all appreciate its impact on our daily lives.

The history of sound is an audio adventure through time. Humanity has utilised sound for communication and music through the ages. Carbon dating takes us back more than 40,000 years to the first recorded musical instrument — a primitive flute carved from bone. The fact that you can now get Siri to read this article out loud is just one example of how far we have come.

Fast forward from woolly mammoths and there is a myriad of ingenious and useful ways to employ sound, ranging from cinema and concert hall design through to new

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cancer treatment and advanced technology to improve the efficiency and sustainability of our cities. Acoustics is also considered when designing roads, rail, aviation, buildings, phones and vacuum cleaners — the list is endless. ➡

When does sound become noise?

Despite its ubiquity, sound is a topic many take for granted. Acousticians like to joke: "If we've done our job, you won't recognise we've done it". Well, forget that!



Close your eyes for 30 seconds and try some active listening. Listen to everything. Focus on the sounds you would usually, inadvertently, ignore. It's surprising how hard our ears work day-to-day and yet how few sounds grab our attention. It only takes a couple of minutes of active listening in an anechoic chamber² (an echoless, sound-absorbing room) before you can hear your own heartbeat or, if you really listen, blood flowing through the capillaries in your ears.

Not all acousticians reside in anechoic chambers. Most are hard at work designing more comfortable, sustainable solutions to improve our everyday lives. Acousticians are even working towards quantifying the cost of poor acoustics on community health and wellbeing. A sleepless night caused by unwelcome noise can lower productivity at work, reducing economic growth. High levels of noise can increase the risk of cardiovascular issues — an increase of just 10 decibels is believed to increase this risk by 12 per cent³.

However, not all sound is noise, and loudness is not always a representative measure of the impact of sound. For example, 60 decibels of running water and 60 decibels of construction drilling are

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What does acoustic change mean to me?

Consultations are a useful interface between acousticians and the public, especially when employing AECOM's Immersive Sound Studio⁴ (ISS), an emerging technology that helps to contextualise a sound climate. For example, to help the local community understand the impact of a major road scheme at Stonehenge in the UK, locals were encouraged to use the ISS to experience predicted changes in the sound climate at specific locations around the scheme.

AECOM's innovative ISS approach makes acoustics more accessible for communities. Avoiding complex maths and technical jargon, ISS allows people to understand acoustic change by enabling them to listen to the existing soundscape and then compare it to the predicted soundscape with the scheme in place. This approach is critical for credibly quantifying, and providing context to, acoustic change for a non-technical audience.

Lockdown impact on community sound levels

As experienced around the world, lockdowns resulting from the coronavirus outbreak significantly reduced various forms of pollution. While the lockdowns remained in place, fewer trains, planes and automobiles — together with reduced manufacturing activity — meant a vast reduction in sound levels. As a result, the world was the quietest it had been for a long time.

In the UK, changes in community sound levels are being recorded by the Institute of Acoustics and Association of Noise Consultants as part of 'The Quiet Project'. This is a community effort to crowdsource a publicly-accessible database of environmental sound levels during the UK's coronavirus lockdown and subsequent recovery period. It will document the rise and fall of sound levels over this period of uncertainty and help to indicate the impact of human activity on local sound levels.

An entire year dedicated to sound. Why?

Raising the profile of acoustics as a science and encouraging collaboration between industries, researchers and the public requires a substantial commitment of time and resource. The International Year of Sound 2020 — now extended into 2021 due to the coronavirus outbreak — aims to be an important step towards improving the public's understanding of sound (and its applications) in the future.

Acoustics provides value to national economies. For example, a recent report⁵ calculated it contributes £4.6 billion (\$6 billion) to the UK's economy annually and employs more than 16,000 people nationwide with each of them contributing an annual average value of £65,000.

Acoustics is one of the most versatile and diverse subject areas in engineering with jobs spread over a multitude of different disciplines⁶. Knowledge of sound and acoustics can be applied to many areas of research, including major issues facing countries around the world. ➔

In the UK, the Government has posed four 'Grand Challenges': clean growth; ageing society; future of mobility; and artificial intelligence and data. Impressively, aspects of acoustics can be linked to each of these challenges many times over. Electric vehicles are an obvious example when thinking about future mobility. But what should an electric car sound like? How safe is silent?

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Clean growth includes reducing and managing noise pollution in urban areas. This has significant implications for developing Smart Cities where we can expect to see advances in active noise cancellation, soundscape design and artificial intelligence.

Imagine a city where artificial intelligence is trained to identify sound sources — to the point where an emergency response could be automatically issued on the identification of a particular sound. For example, a gunshot could be triangulated by its audio signature, CCTV engaged on the correct street, facial recognition used to track the suspect, and an emergency response sent within seconds of the shot being fired.

Sound is incredibly powerful, especially when paired with advances and innovations made by engineers in other fields. It can be used in so many different ways, including locating defects in pipelines buried deep underground, focusing medicine delivery to precise areas of the body, reading to the blind, touchless buttons⁷ for smart devices, sonar and underwater communication as well as passive biodiversity measurements.

How can 2020 make a difference?

The International Year of Sound's goal is to make acoustics approachable, understandable and applicable — challenging people to look beyond current knowledge boundaries, close the knowledge gap and bring sound to the forefront of the conversation. So, let's talk about it during 2020 (and 2021)... and learn to listen.

What about the answer to that seven-year-old's question: how loud is the sun? If you replaced space with air and stood 92,957,130 miles away from the sun on Earth, it would measure about 125 decibels — roughly the same as a train horn from just a few steps away, but constant. Ouch! **WL**