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# How electric vehicles have been finding their voice

Engineers are developing signature sounds to counter a lack of engine noise. **Chris Dearden** investigates

In the distance, you hear the rumble of a high-performance engine approaching. Your experienced ear identifies it as a flat-six Porsche. Sure enough, a few seconds later a Boxster grows past, and you smile to yourself that once again your finely honed, petrol-head senses haven't let you down.

Or have they? This is no ordinary Porsche, it's a Boxster E. The flat-six has been replaced with a liquid-cooled lithium-ion battery, driving an electric motor in the rear axle. That might sound like heresy to a brand purist, but it's not surprising in a market where almost every manufacturer is developing or preparing to launch an electric model.

The surprise here is that, despite its electric motor, it sounds exactly like its petrol-driven brothers.

Instead of being emitted by twin exhausts, the notes are played from a loudspeaker, rising and falling in pitch and volume with the engine speed. The driver, incidentally, has another speaker inside the car so he or she can share in the illusion. Is this the result of a Porsche engineer with a sense of humour and too much time on his hands? Not a bit of it. The Boxster E may only be a development model, but it represents

Porsche's solution to a problem that the motor industry, countless pressure groups, and legislators worldwide are currently grappling with.

Engineers have been working for decades towards the holy grail of zero emission motoring. Counting the lack of engine noise as a welcome bonus, no one gave much thought to the fact that it warned other road users, particularly pedestrians, of an approaching vehicle. Pedestrians rely as much on their ears as their eyes when deciding whether it's safe to cross the road. Pressure groups in the US representing a variety of road users, including the blind, successfully campaigned for a solution to the problem, resulting in the well-intentioned Pedestrian Safety Enhancement Act. Similar legislation will surely follow in Britain and the rest of the EU, with sources for the latter confirming: "We are closely and actively following developments at an international level on this issue." Existing legislation states, in effect, that motorised vehicles must emit a noise to warn other road users of their presence. What it does not dictate, however, is what that noise can or cannot be, nor how loud it should be. Those details are, at the moment, being left to the marketplace.

The history of legislation is littered with examples of where legislators got it wrong, but they pale beside the number of catastrophic decisions made by an unfettered marketplace. Left to their own devices, what noises are the manufacturers planning to impose upon electric car buyers?

Porsche's fellow German manufacturers are approaching the issue with

customary thoroughness. Both Audi and Mercedes are keen to formulate a sound that will have some form of identity, but they appear to be treading a different route from Porsche. Mercedes talks of "a naturally produced sound that does not mimic an internal combustion engine". Dr Ralf Kunkel, head of acoustics at Audi, says: "One obvious approach for an electric car sound would be to work on the basis of the familiar sound of a combustion engine. But we're studying several other approaches at present. Some sounds, such as the rustling of leaves or the twittering of birds, are not viable options for Audi. However, the sounds used for spaceships in films are reminiscent of car sounds, yet also very different, making this a rather interesting approach."

Nissan is far more explicit with its Leaf model, whose turbine-like hum has



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frequencies ranging from 600Hz to 2.5kHz depending on the speed of the car. The seven-person development team, headed by Tsuyoshi Kanuma, consulted extensively with classical music composers before arriving at the final sounds. The noise needed to carry well without being excessively loud, and a breakthrough came after examining how opera singers make themselves heard above the sound of the orchestra. Before his current role, Kanuma had spent 30 years as a vibration and noise engineer, trying to make conventionally powered Nissan cars as quiet as possible. The irony in this change of

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focus certainly doesn't escape him. In Britain, Lotus Engineering has developed the Halosonic sound system, which offers a choice between V8 and V12 engines or, like Audi, a spaceship.

These and similar firms represent the more responsible end of the market. Bran-Rae, which produces and distributes electric vehicle sounds, is a somewhat less established firm. Its EV-tones website offers a seemingly unlimited range of noises for electric vehicles, which are simply downloaded onto MP3 players in the same manner as mobile phone ringtones, then played through the vehicle's external sound generator. An indication of their seriousness of purpose can perhaps be judged from the suggestion that you "pull up next to that Harley, switch to chopper sound, and have fun as they listen in disbelief". It also claims that every sound has a tone embedded in it of a frequency that only dogs can hear, in order to "to pre-alert seeing-eye dogs". Before we dismiss this as "only in California", reflect for a moment that the same 18-year-old who currently fits an exhaust the diameter of a baked-bean

can to his Vauxhall Corsa will be able to download a custom tone and be playing it on Fulham Broadway moments later. Beauty is in the ear of the beholder.

Hope of establishing some sensible boundaries can be found at [Warwick](#)

University, where Professor Paul Jennings is leading highly regarded research into alternative vehicle noises, based on the premise that sticking with the sound of conventional internal combustion would be a wasted opportunity, since high levels of traffic create a din that is intrusive and annoying for many people. Jennings's team are seeking sounds that are much more pleasing while being as safe as possible and which people will still associate with approaching traffic. As part of the project, the team has been driving an electric vehicle around the university campus, demonstrating and testing a range of specially created sounds. Current favourites include a deep buzzing, a high-pitched hum and one that sounds like a piece of cardboard stuck in the spokes of a spinning bicycle wheel. Groups of blind and partially sighted people have been invited to the university to give their verdict. These demonstrations also involve synthesising how a whole town of electric cars would sound. Only by doing so can you hope to make any meaningful comparisons between what we have now and what we might have in 10 years' time.

It's easy to smile wryly at the lack of clear, coherent thinking demonstrated

by legislators and some car makers, and pass on to more important world news. But CE Delft, the independent environmental research and consultancy organisation, estimates that the social costs of road traffic noise in the EU exceed €40bn a year; and that traffic noise is harming the health of almost one in three people in Europe.

In the UK, a 2011 local transport white paper suggested that the annual cost of transport noise is £3bn to £5bn, and recent research has estimated that more than 100 deaths from heart attacks each year in London can be attributed to traffic noise. Age is a significant factor, with older and younger people seemingly most affected.

For example, living near a busy road may stop a child doing well at school. A child's academic performance, behaviour, attention span, and even cognitive development could all be affected by the noise of traffic, concludes Dr Peter Lercher, who leads research into the problem at Innsbruck Medical University in Austria.

It's rare for us to have the chance to

make a fresh start and eradicate problems that have built up over generations. This is one of those rare opportunities. Perhaps we should recognise it as such, finding the time and the political motivation to reach the right solution – not the one that happens to suit the marketing departments of big companies, which, too often, are still wedded to the mantra that loud is good.

