Signals to noise in acoustic vehicles alerting systems

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If you've ever wished for a quieter commute, you may be in luck: The low-emission electric vehicles of tomorrow are expected to lower noise pollution as well as air pollution. In Europe, and across the world, the prospect of a future powered by environmentally friendly electric vehicles is leading experts to consider the benefits—and the risks—of quieter traffic.

Already, acoustics specialists are examining how best to address potential harms posed by quiet cars. For pedestrians who have limited vision or who are blind, quiet vehicles could be particularly dangerous, and the European Union will require any future electric or hybrid vehicles to include acoustic vehicle alerting systems, or AVAS.

Two acoustics experts, Klaus Genuit and Rene Weinandy, are studying the implications of future use of AVAS. Genuit, founder of HEAD acoustics GmbH, a company that provides sound and vibration analysis, is studying how best to design vehicle alert signals, while Rene Weinandy, head of Noise Abatement in Transport for the German Environment Agency, is evaluating whether AVAS should be used at all. They will present their work at the 177th Meeting of the Acoustical Society of America, which takes place May 13-17 at the Galt House in Louisville, Kentucky.

Though AVAS could improve vehicle safety, they are also likely to replace the traffic noise that electric cars are designed, in part, to help eliminate. Requirements for AVAS to contain different tones and

frequencies could quickly lead to a cacophonous soundscape, like New York City at rush hour. It may also defeat the purpose of AVAS: the collective noise could drown out any meaning of the signals to the people they are meant to protect.

Genuit, a psycho-acoustical expert, hopes to help solve this problem by reviewing different acoustic signal designs and evaluating their detectability, localization, and sound quality.

"An alert signal is only effective if it happens in very specific situations," said Genuit. "All published results are showing only examples of one car with a warning signal. It was not considered what happens if several cars are producing warning signals." Genuit added that this cacophony could also be distracting to drivers.

Meanwhile, Weinandy wondered if electric vehicles should have acoustic alerting systems in the first place. The EU has legislated certain required aspects of AVAS, which include sound continuously emitting from speakers on the cars.

Noise can be annoying and distracting, but, Weinandy points out, can also be an environment poison considering its ill effects on health.

"It is a synthetic, increasing sound that is supposed to be similar to an internal combustion engine vehicle startup," said Weinandy of AVAS. "The question is, what are the downsides this noise poses? Is it really a wise decision to increase the noticeability of electric vehicles in traffic by making them spray poison? Now regulations on the so-called AVAS for electric cars have been cast into laws both in the U.S. and Europe without scientific proof of their effectiveness and adequate consideration of their negative side effects. Neither have less harmful alternatives been systematically sought for and investigated."

The German Environment Agency is currently working to reduce existing roadway noise and is now evaluating alternatives to AVAS. Experts like Genuit will help improve the sound quality of any AVAS that are introduced, as well as the sound quality of the environmental noise.

"If we really use warning signals instead of more intelligent systems like car-to-pedestrian communication using smartphones, then we have to consider the following aspects: detectability, is it localizable, elimination of strong tones to avoid disharmony and roughness, and elimination of pitch shifting," said Genuit. "A suitable signal should be developed based on a modulated broadband noise whereas the slope of the envelope gives the information about acceleration and speed."

More information: Genuit's presentation #1pNS4, "How to design Vehicle Alert signals?," will be at 2:35 p.m., Monday, May 13, in the Segell room of the Galt House in Louisville, Kentucky.

Weinandy's presentation #1pNS5, "Should Hybrid and Electric Vehicles Have Acoustic Alerting Systems?," will be at 2:55 p.m., Monday, May 13, in the Segell room of the Galt House in Louisville, Kentucky.

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