

Forum Acousticum 2020, Lyon, Dec. 7-11, 2020.

“Interior sonification of Zero emission vehicles : strategy proposal and impact on driver’s perception”

Sebastien Denjean¹, Richard Kronland-Martinet², Vincent Roussarie¹, Sølvi Ystad²

¹ Groupe PSA, Paris, France

{sebastien.denjean,vincent.roussarie}@mpsa.com

² Aix Marseille Univ, CNRS, PRISM, Marseille, France

{kronland,ystad}@prism.cnrs.fr

Abstract:

Automotive industry is facing a major development of electric vehicles to respect ever-greater limitations of greenhouse gases emissions. If electric motorizations allows reducing in-use emissions, they are also much quieter than Internal Combustion Engines (ICE), leading to a radical change in the acoustic feedback the driver perceives in the passenger compartment. This ”silence” is a strong selling argument for such vehicles, but with the loss of ICE noise, the driver also loses the information brought by this noise. ICE noise is indeed an important source on vehicle dynamics information and its loss leads drivers to face more difficulties in speed and acceleration management. We developed a sonification strategy for electric vehicles aiming to synthetize a new engine sound to enhance the driver’s dynamic perception of his vehicle. We chose to mimic the ICE noise by informing the driver through pitch variations. However, ICE noise pitch variations are correlated to the engine’s rotations per minute (RPM) and its dynamics is covered within a limited vehicle speed range. In order to inform the driver with a significant pitch variation throughout the full vehicle speed range, we based our sonification strategy on the Shepard-Risset glissando. These illusory infinite ascending/descending sounds enable to represent accelerations with significant pitch variations for an unlimited range of speeds. We tested this sonification strategy in a perceptual test and showed that the information carried by this engine sound can be beneficial for drivers.