Psychophysics of Windnoise and Sound Quality Engineering

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At relatively high speeds, windnoise becomes a dominant component in the interior of most automobiles and is often determined to be objectionable in customer evaluations. While subjective ratings improve when the loudness of the windnoise is reduced, it is not always possible to achieve such level reduction. The present paper addresses whether it is possible to improve the sound quality of the windnoise without altering its loudness, e.g., whether some shapes of windnoise spectra are preferred over others.

To determine whether spectral shape affects the sound quality of windnoise, active sensory tuning (AST) was used [Sterian, Runkle, and Wakefield, Intl. Conf. Acoust. Speech and Sig. Proc., 1995]. This methodology, in general, allows listeners to efficiently and selectively adjust the parameters governing an acoustic signal to optimize along some subjective dimension. In the particular case, we chose spectral shape as the key attribute of our windnoise investigation, parameterized shape using an equalizer model, and asked listeners to judge candidate signals according to a preference criterion. A genetic-algorithm version of the AST procedure was implemented based on psychophysical studies of shape sensitivity. Results from these studies, the slope and shape quantization model, and preferred shapes will be presented and discussed in light of the controllable surfaces in windnoise generation. [Work supported by grants from the Ford Motor Company and the Office of Naval Research.]