

The sound of an electrical vehicle – its contribution to a new urban soundscape

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ABSTRACT

The sound of an electric vehicle will be an agent in modern cities that underlie the concept of new urbanism and smart growth with regard to soundscapes. Soundscape analysis and application is a proven method of providing an improved acoustical environment for urban dwellers, thus addressing a significant portion of the smart growth agenda. Moreover, it covers the collaboration between stakeholders and communities concerning further development in the choice of varied transportation. Most relevant will be here the intervention through electrical vehicles and the choice of its acoustical fingerprint. Results from a study investigating the assessment processes in electric vehicles with respect to acceptance of synthetic sounds will be presented and discussed with respect to the key feature of livability in an acoustical environment.

Keywords: Electrical vehicles, Sound, Environment

I-INCE Classification of Subject Number: 61, 66

OVERVIEW

The respective study provided data about customer reactions to different sound design concepts while driving a series-production electric vehicle. Interviews – collecting data with regard to peoples' expertise in the respective context – and as well physical measurements clearly showed evidence that customer can act as new experts. Evidently, acceptance and disaffirmation of sound concepts are based on the respective background and strongly related to quality of life.

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In order to collect data with respect to the acceptance of synthetic driving noises in electric vehicles, three sound concepts were generated based on a developed sound synthesis tool

The different sound concepts exemplarily cover conceivable sound design approaches. The created sound concepts were (1) a sound resembling a combustion engine, (2) a modern, rather unconventional sound, and (3) an inconspicuous, modest sound. In order to compare the reactions to these sound concepts with the reactions evoked by the original sound the fourth sound under investigation was the original vehicle sound of the electric vehicle.

Based on a context-sensitive, explorative method the acceptance of different sound concepts in an electric vehicle was studied. It turned out that offering synthetic driving noises in the interior of the test vehicle led to more comments and did not necessarily foster positive evaluations or perceptions of the car and its acoustics. The high number of negative comments in the synthesis sound scenarios shows the high sensitivity of customers regarding perceived (sound) quality. Adding synthetic sound, which does not match the customer preferences well, lead to a reduction of the perceived sound quality.

Moreover, the study has shown that target conflicts occur. Test subjects expressed their general preference for a quiet electric vehicle, but demand an adequate acoustic load feedback. It appears that a well implemented adaption of loudness in case of load changes is of utmost relevance and can improve perceived quality. Moreover, test subjects were inclined to favor inconspicuous, discreet sounds, which in turn lead to an increase of felt acoustic transparency of the vehicle, which was negatively connoted in the study. Moreover, although even few subjects were not aware of the presence of a synthetic sound at all, this sound concept achieved a slightly better assessment than the original sound only condition. It illustrates that a discreet sound character can lead to positive comments. But this sound does still not fully mask disturbing noises within the original vehicle sound. Moreover, the sound characteristics and the way a sound is presented will not fully explain why and how a person judge in a specific way.

Following a qualitative analysis of related comments, factors such as emotion, speed impression, frame of reference and general sound character appeared, which have a major influence on the acceptance of the vehicle with its specific interior noises.

The interaction between all acoustic contributions from the car itself and any generated synthetic sound had influence of the perceived quality of the test vehicle. In addition, the contribution of disturbing noises and felt openness of the vehicle was important, which underline the acoustic needs with regard to the development of a harmonized interior and exterior acoustic environment by means of a discreet synthetic car sound. The questions arising are about the contribution of the sound of electrical vehicles to the urban soundscape.

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