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**Titel/Title:**

**Warnsignale für leise Fahrzeuge – Im Spannungsfeld zwischen Lärm (Emission) und Sicherheit**

**Warning signals for quiet vehicles – The conflict between noise and safety**

**Abstract**

Different surveys have shown the increased risk of accidents for pedestrians and cyclists with respect to collisions with quiet vehicles, which caused a lively discussion about acoustical warning systems for the prevention of crashes. The NHTSA report [1], which is often quoted in this context to emphasise the importance of warning signals for quiet vehicles, concluded that HEVs have a higher incidence rate of pedestrian and bicyclist crashes than do ICE (internal combustion engine) vehicles in certain vehicle manoeuvres.

First reactions to the debate were the prompt development and sale of commercial systems, which should considerably enhance the pedestrian safety using synthetic sounds emitted by specific loudspeakers. However, Sandberg et al. [2] have shown that the NHTSA study lacks a few methodological and interpretational accuracies. They derived that further research is required to reliably determine the crashes risk between pedestrian/bicyclists and (H)EVs.

All in all, two general conflicts emerge. Firstly, the developed systems appear to be a hasty action not considering sustainability and ecology aspects adequately. In fact, several concepts and technical solutions are conceivable to overcome several recent difficulties of the actual warning systems.

Secondly, the chosen warning signals do not extensively regard general perception theories and attention models. Sounds must be selected reflecting localization, distance estimation, identification of the source, recognition of source condition, pleasantness aspects.

Consequently, on the one hand sustainable concepts must be developed for the successful avoidance of accidents and on the other hand the general traffic noise must be minimized.

The paper about warning and information signals respectively will show different approaches for minimizing the risk of accidents caused by quiet vehicles. For it, recent and future-oriented concepts will be introduced and critically scrutinized as well as own experimental results will be shown.

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