

## Project Group for Hearing, Speech and Audio Technology of the Fraunhofer IDMT

The Project Group for Hearing, Speech and Audio Technology was founded in Oldenburg in August 2008 and combines the globally recognized Oldenburg hearing research with the competencies and technologies in the area of digital media developed at the Fraunhofer IDMT. As a partner in the cluster of excellence "Hearing4all", it is the goal of the project group to implement the scientific findings from university fundamental research in new technologies. With their research specialities, the scientists address the needs of customers in the fields of telecommunications, multimedia, health, transport and security technology.

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## Hearing and speech acoustics in vehicles





## Reliable prediction of sound quality

The sound in the interior of vehicles is becoming increasingly important as a factor for comfort and customer satisfaction. The desired or undesired perception of functional and operating noises plays a crucial part in this context. The Project Group for Hearing, Speech and Audio Technology of the Fraunhofer IDMT develops measuring methods and models in order to already reliably predict hearing impressions at the stage of product development. For this purpose, research is conducted into the factors that influence subjectively perceived sound quality. On the basis of current findings on binaural hearing, psychoacoustic aspects and the characteristics of impaired hearing, the scientists offer application-specific evaluation models and software solutions which produce more meaningful results than those provided by conventional metrics.



## Optimized speech reproduction

A decisive factor for hearing comfort in vehicles is also the quality with which media systems reproduce speech and music. Improved intelligibility of speech does not just contribute to comfort, but also increases safety. The project group offers software solutions for real-time monitoring of the speech intelligibility of media and navigation systems. Adaptive signal processing algorithms automatically improve intelligibility against the background of interference noise – and even take into account individual hearing loss. In addition to integration of signal processing technology in existing systems, the scientists also develop user interfaces for adaptation of audio signals to individual hearing needs.

## Robust speech recognition

Convenient voice control of functions can now also be found in vehicles. Using models for human auditory perception, the project group develops speech recognition algorithms that function robustly even under conditions with interference noise. The recognition technologies are therefore not just suitable for use in the vehicle interior, but can be used equally well for control functions outside. Apart from developing its own speech recognition systems, the project group also performs evaluation studies with existing systems for defined applications.

## Acoustic recognition of safety-relevant events

It is not just speech that can be recognized with computer assistance. The same is also possible for defined sounds. By extending the sensors already in use in vehicles with microphones and vibration sensors installed inside and outside the vehicle, it is possible to open up a host of completely new safety applications. Acoustic events – such as an approaching ambulance siren or faults and abnormal operating noises – can be automatically detected. By connecting the recognition systems to the audio reproduction system in the vehicle, it is possible to ensure that drivers are made aware of safety-relevant events in good time in spite of acoustic shielding by the passenger compartment and the use of media systems.

## Contract research

Within the framework of contract research and research cooperations, companies can benefit from the scientific expertise and technical equipment of the Project Group for Hearing, Speech and Audio Technology. The services in the automotive field include:

- Methods for sound quality evaluation for product development
- Algorithms for evaluation and enhancement of speech intelligibility – also taking into account individual hearing loss
- Development and evaluation of user interfaces for sound personalization
- Development and evaluation of speech recognition systems
- Technologies for acoustic event recognition
- Technical and hearing-oriented measurements
- Hearing studies with test persons with normal and impaired hearing as well as expert listeners



**3 , 4 Greater safety:** Thanks to acoustic recognition technologies, drivers can hear safety-relevant events in good time in spite of acoustic shielding by the passenger compartment and the use of media systems.  
Photo: 3 Thinkstock, 4 Johanniter Unfallhilfe

**1 Better speech intelligibility in vehicles:** Adaptive signal processing algorithms can significantly improve speech intelligibility under conditions with interference noise.  
Photo: Thinkstock

**2 In close cooperation with the fundamental research taking place at the University of Oldenburg and in the cluster of excellence »Hearing4all«, the scientists in the group are working on methods that take into account current findings on binaural hearing, psychoacoustic aspects and the characteristics of impaired hearing in order to reliably and reproducibly predict hearing impressions. Numerous laboratories and special rooms as well as a database with over 2,000 test persons are available for technical measurements and hearing tests.  
Photo: Hörzentrum Oldenburg GmbH**