

CHALMERS

Factors Governing Acoustical Comfort In Vehicle Compartments

OLIVER JUNG

Thesis to be defended in public on Thursday, **June 14th**, 2012 at **10:00**,
Lecture Room VK, V-Building, Sven Hultins gata 6,
Chalmers University of Technology
for the Degree of Doctor of Philosophy

The thesis will be conducted in English.

The Faculty opponent is **Prof. Dr. Dr. Birger Kollmeier**,
Medical Physics Section, Carl von Ossietzky University Oldenburg, Germany.

Department of Civil and Environmental Engineering
Division of Applied Acoustics
Chalmers University of Technology
SE-412 96 Göteborg, Sweden
Telephone + 46 (0) 31-772 2200



Factors Governing Acoustical Comfort In Vehicle Compartments

Oliver Jung

Department of Civil and Environmental Engineering
Division of Applied Acoustics,
Communication and Room Acoustics Group (CRAG)
Chalmers University of Technology

Abstract

A pleasant interior sound field is an essential comfort criterion for vehicle occupants. The pleasantness is mainly influenced by a low overall sound pressure level. Further minimization of driving noise, however, is constricted on the lower end by physical limitations. Moreover, driving noise conveys information about the current driving condition, the vehicle state and environmental aspects. Auditory feedback is therefore indispensable for a certain vehicle/driver interaction. The perception of vehicle noise is further dependent on contextual aspects. The experience and the expectation of vehicle occupants regarding the car and its acoustical characteristics in particular driving conditions are determining for an appreciation of these characteristics.

The present thesis deals with various aspects of subjectively perceived acoustical comfort in vehicles. First of all, physical and notably acoustical parameters of in-vehicle driving noise are taken into account, particularly as regards the composition of driving noise based on the main noise contributors powertrain, wind and tires. In addition to the assessment of driving noise, room-acoustical properties of vehicle compartments are included in order to quantify the impact of room acoustics on communication between the vehicle occupants. On the other hand, contextual aspects such as the transfer of information via acoustical events are considered. The outcome of this work may be utilized by researchers and developers of vehicle sound fields for an improvement of customer-relevant acoustical target setting. Additionally, it outlines some basic concepts how to create pleasant in-vehicle sound fields based on sound quality approaches and speech communication aspects.

Keywords: Acoustical Comfort, Driving Noise, Sound Quality, Vehicle Acoustics, Lombard Effect, Speech Quality, Speech Communication, Psychoacoustics, Emotions, Cognition Psychology