
Preface

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Biographical notes: André Liem has been an Associate Professor at the Norwegian University, Department of Product Design, Norwegian University of Science and Technology (NTNU), Norway, since 2005. As a graduate of TU Delft, he previously taught industrial design for 10 years in tertiary education institutions in Singapore. He has widely published in journals and conferences, as well as co-edited several special issues. His research interests include design process and methodology, design education, product planning and goal finding and transportation design. He has undertaken design consultancy projects in The Netherlands, UK, USA and Singapore. He holds an advisory position within Designinsight, an industrial design consultancy in Singapore.

Matthew P. Reed is a Research Associate Professor in the Biosciences Group of the University of Michigan Transportation Research Institute and in the Centre for Ergonomics in Industrial and Operations Engineering, where he directs the Human Motion Simulation Laboratory. He holds a doctorate in Industrial and Operations Engineering from the University of Michigan. He is an author of more than 120 technical papers on anthropometry, digital human modelling, vehicle ergonomics, safety and related design tools. He is a Fellow of SAE International and has received numerous awards from SAE. He is a member of the Society of Automotive Engineers Human Accommodation and Design Devices and Driver Vision Standards committees.

Michael Tovey is the Director for Design and Professor of Industrial Design at Coventry University, UK. He is responsible for developing courses and applied research in design across the university and is Director of the Centre of Excellence in Product and Automotive Design (CEPAD). As a graduate of the

RCA, he was an industrial designer prior to joining the institution in 1973 as a lecturer in industrial design. He was appointed as Head of Industrial Design in 1985 and in 1989 was made Dean of the Coventry School of Art and Design. In 2007, he changed his position to take on the University-wide post of Director for Design.

Automotive design or industrial design within the vehicle industry is mainly concerned with the development of the appearance, emotional value and aspects of the ergonomics of motorised vehicles, particularly road vehicles. Ergonomists concentrate on the understanding of anthropometric, cognitive and workspace issues with an emphasis on the individual-vehicle implications of Human Machine Interface (HMI), particularly the safe interaction with in-vehicle information systems.

The circumstances under which vehicle designers and ergonomists operate are undergoing seismic shifts, driven by factors including broad aspects of sustainability, such as carbon footprint and fossil fuel issues, as well as the credit crunch and the possible worldwide recession. These circumstances will have a tremendous impact on the issues that designers and ergonomists have to address in modern vehicle design.

They also bring new challenges for vehicle design, providing an emphasis on Intelligent Transport Systems (ITSs), safety, comfort and energy consumption. In addition, end-user requirements for vehicles, whether for private or corporate use, are becoming dominated by the elements of 'service' and 'emotion'. New capabilities in vehicle and instrumentation design are emerging, including location-based and navigation services, logistics and fleet management, information and office applications. Multimedia and entertainment services are predicted to be among the highest value applications.

Technical and functional performance needs to be prioritised in the design to keep pace with the evolution of the modern vehicle. In addition, designers need to allow for a high standard of multi-tasking flexibility and enhanced driving experience. Functional ergonomics to address factors such as comfort and safety, and designing for aesthetic and brand identity, are equally important factors in the vehicle design industry. Consideration will need to be given to specific target groups. Older drivers, for example, are an increasing percentage of the user population for both private and commercial vehicles. The physical and cognitive capabilities of these important groups create new challenges for the technological and aesthetic design of both exteriors and interiors. To establish coherence in vehicle design, close collaboration among various disciplines including automotive engineers, automotive/industrial designers and vehicle ergonomists is necessary.

The papers selected for this special issue can be generally categorised into ergonomics, a combination of ergonomics and form, and form-related studies. The ergonomics-related studies address topics concerned with:

- use of Digital Human Models (DHMs) for ergonomic analysis and design of vehicle interiors
- seat design for comfort and safety
- interface design of integrated and customised communication equipment.

The paper 'Towards personalisation of the driver environment: investigating responses to instrument cluster design' outlined the transition between the ergonomics and form aspects in vehicle design. Its line of thought have been complemented by Liem's paper, which discusses interior customisation of fast response vehicles through adaptation.

The form-related papers discuss:

- methods, processes and thinking concepts in form development
- brand and identity development.

DHMs are fast becoming an effective tool for performing proactive ergonomics analysis and design, whereby valid postures and motions are readily available for a designer to make biomechanical and ergonomics predictions. Various types of software, supporting DHM, are available for the designer early in a product development process, when he or she is attempting to improve the physical design of vehicle interiors. In the paper 'A method for simulating the car-entering movement for variably dimensioned vehicles', a four-step method for simulating the car-entering movement for vehicles of variable dimensions have been proposed using a DHM with a head, a trunk, a pelvis and lower limbs.

Comprehensive CAD systems, which incorporate DHM, were influential in facilitating the introduction of common platforms, teamwork and interactions among industrial designers, ergonomists, engineers and other stakeholders. In particular, the improvement of automotive seating systems in conjunction with DHM have been the subject of intense interest for many years. A majority of vehicle seats studies covered vibration, pressure, seating comfort and driver 'fatigue'. The paper 'User-centred design and evaluation of automotive seat adjustment controls' considered the design of seat adjustment controls, looking at the future of HMIs in the premium automotive industry, including such aspects as accessibility of controls, intuitiveness of operation and general usability. On the basis of a case study 'Defining the ergonomic parameters of the driver's seat in a competition single-seater', Sanchez-Alejo et al. proposed a methodology for the ergonomic design cockpit of a Formula SAE single-seater. The results indicated that the characteristics of driving a single-seater were different from those of a conventional car.

In 'Simultaneous consideration of user acceptability and regulatory compliance in vehicle seat design', Parkinson and Garneau's paper showed the importance of understanding and quantifying the many sources of variability in design scenarios, particularly human variability. Rigorous implementation allows an exploration of the design space, facilitates trade-off analyses and guides innovation by revealing fundamental conflicts in candidate designs to be addressed for performance improvement.

In Manjrekar and Parkinson's work, race and gender issues were discussed in determining the distributions of the target user population in the multivariate design of vehicle seating. Base populations specific to the demographic group of interest were used to develop design recommendations for region-specific or worldwide vehicles. A methodology for selecting the relevant design parameters through simultaneous consideration of populations characteristics, along with seat and vehicle design parameters, was explored.

Moving from product to cognitive ergonomics, information and assistive systems are becoming ubiquitous in the automobile sector. However, these systems were subjected to strong constraints even beyond those typical for mobile devices. Designing systems to satisfy these constraints requires an understanding of physical and cognitive demands including, for example, how drivers manage the demands of both driving and operating an in-vehicle information system.

In the paper ‘Driving skills, education and in-vehicle technology’, Barker and Woodcock explored developments in in-vehicle technology and the challenges such systems create for ergonomics and driver training. On the basis of an interview with former rally driver and advanced driving trainer, Rauno Aaltonen, long-life driver education and training in vehicle control should be continuously evaluated and developed in the light of experiences of expert drivers, developments in Driver Assistance and Information Systems, as well as ergonomic research.

Vehicle manufacturers in the developed world are faced with saturated home markets and sophisticated customers. Nevertheless, the markets are so large that they remain attractive to emerging competitors from developing countries, typically entering the market with low price and relatively unsophisticated products. Increasingly automotive manufacturers are aiming for mass customisation, providing product variety for nearly everyone.

In the paper ‘Towards personalisation of the driver environment: investigating responses to instrument cluster design’, the authors based their experiments on recent developments in the automotive and the Information Technology (IT) industries, whereby increased demand for more aesthetic and personalised spaces in the automotive industry are to be supported by powerful and inexpensive forms of IT. Well-balanced designs – in terms of their classic and expressive appearance as well as in terms of their typicality and novelty – are preferred.

In contrast to mass customisation, personalisation from an adaptive viewpoint have been discussed in the paper ‘An ergonomic case study on the interior customisation of Fast-Response Cars (FRCs) based on vehicle adaptation’. The case study compared the interior customisation and ergonomic design of two different FRCs used by the Singapore Police Force. Customisation of the front area addressed the interaction among electronic communication devices, front-passenger and driver, whereas the retrieval and storage of equipment were explored in the customisation of the rear interior.

Creating and maintaining a consistent brand statement is an important aspect of developing a successful product. On the basis of case studies using two transport providers operating in the UK and North America, Mackie aimed to highlight in her paper the design elements and operational requirements that an operator of a transport system needs to consider when translating the brand identity into a livery design. Methods were proposed to improve coherency between brand identity and brand image for a specific livery within a particular service provision.

To extend the concept of brand image on vehicles, designers need to understand their customers’ functional and emotional priorities if they want to improve the user experience and their product’s standing in commercial surveys, which hold so much weight within the industry. In Warell’s and Young’s paper, a Perceptual Product Experience (PPE) framework was introduced to develop an experience-focused design methodology. With reference to an interior design study of the Hulme.F1 supercar,

an experience-focused methodology has proven to be useful for establishing a visual design direction and offering an effective approach for directing creative design work and validating generated design proposals.

In summary, this special issue provides a global forum for presenting authoritative references, academically rigorous research, and case studies in both theoretical development and applied research. It has managed to capture and publish the most recent studies on a variety of topics, addressing future trends and challenges, related to ergonomic and industrial design of road vehicles. Both industry and academia, which are involved in vehicle design and engineering, should embrace the benefits of Ergonomics and Industrial Design to reach, educate and aid as many people as possible.

On a final note, we acknowledge and thank all the authors for choosing this edition of *IJVD* as a platform for presenting their research. We are also deeply indebted to the reviewers for their invaluable contribution in establishing a high standard for this special issue.

According to alphabetical order of last name and affiliation, the external reviewers are listed here:

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