Preface

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Biographical notes: Dan Högberg is an Associate Professor at the School of Technology and Society at the University of Skövde. His research interests include computer-based methods and support systems for designers and engineers to consider human-related matters in design and development processes, e.g., the development and use of digital human modelling tools. He received his BSc in Product Design Engineering from the University of Skövde in 1998, MSc in Engineering Design from Loughborough University, UK in 1999 and PhD from Loughborough University in 2005. He is a member of the Virtual Systems Research Centre at University of Skövde and Virtual Ergonomics Centre (VEC) in Sweden.

Lars Hanson is an Associate Professor at Chalmers University of Technology and the Project Manager at Scania CV. He received his MSc in Mechanical Engineering from Linköping University in 1997 and PhD in Ergonomics from Lund University in 2004. His research interests include anthropometrics, digital human modelling and physical ergonomic assessment methods. His research is applied and focuses on the human-vehicle interaction, considering drivers' and passengers' comfort, safety and performance, as well as the vehicle assemblers' and dismantlers' health and productivity. He is a member of VEC – Virtual Ergonomics Centre.

Keith Case is with Loughborough University, UK. His PhD was awarded by Nottingham University (in 1975) for his thesis entitled 'An anthropometric and biomechanical model of man'. This work formed the basis for the SAMMIE digital human modelling (DHM) system. For this work, he was the recipient (with colleagues) of the Ergonomics Society Otto Edholm Award to honour an

individual or individuals who have made significant contributions to basic or applied research in ergonomics. Current research includes 'design for all' using DHM in the domestic and transport areas, applications of physical and cognitive ergonomics in manufacturing assembly and consideration of the ageing worker.

The idea for this special issue originated from a user-centred design session of the 2nd International Conference on Digital Human Modelling held at HCI International 2009 in San Diego. Two papers from this session have been enhanced and extended and are presented here together with three papers from other selected authors.

The movement towards virtual product and production development processes leads to a situation where it is both possible and important to represent future product and workplace users as digital human models. These digital human models are at the disposal of design engineers, as one of many design tools that can be employed, and hence, the functionality and method of application of the tools influence the quality of the design work.

This special issue focuses on the application, functionality and usability of digital human modelling (DHM) and other human visualisation and simulation techniques in industrial and other professional development processes. The aim of the special issue is to present the current state of the field in terms of application examples and research and to inspire discussion on the future direction of DHM. This, in turn, should identify the research needed in order to meet the objectives for DHM tools to successfully contribute to user centred design processes and fit within the overall goal of enhanced quality of life and a sustainable development.

Berlin and Kajaks present a literature survey that is concerned with the occurrence of work-related musculoskeletal disorders and their relation with time-related factors such as duration and repetition. The authors propose that to fully utilise the potential of DHM, time-related aspects of physical loading during work should be considered and this paper provides a basis for this in reviews of terminology and methods.

Acar and Mihcin describe a perhaps unusual application of DHM with their pregnant occupant model used to develop design guidelines for vehicle interiors. This 'expecting' model is based on the MADYMO dynamic modeller and in the example described has been used to generate recommendations for steering wheel configuration that minimise foetal death from placental abruption in collisions.

Biomechanical analysis of human motion forms the basis of the method for movement and gesture assessment (MMGA) presented in the paper by Andreoni et al. Experimental work described led to the determination of perceived levels of discomfort related to joint angles which are used as an integral part of the methodology in the 'design for all' of a new refrigerator concept. Eger at al. investigate the use of the Jack DHM tool in the evaluation of lines of sight for large vehicles (an underground mining machine is used as the example). A method for producing box plots (three-dimensional vision maps) for the volume of activity of the vehicle is described. The validation of behavioural aspects built into a DHM tool is the subject of the paper by Summerskill et al. Three experiments were conducted to compare the results of an automatic teller machine ergonomic evaluation by:

1 a skilled ergonomist using a DHM system

2 a user trial with real people

3 the use of the HADRIAN modeller which has the capability to predict simple human behaviours.

We believe that the five papers nicely illustrate the wide applicability of DHM tools for different kinds of design or evaluation purposes. The papers show that the tools can be used to model different kinds of users ('common' people, elderly people, disabled people, people of different sizes, pregnant women…), looking at different aspects (biomechanical load, risks for injuries, safety, comfort, fit, reach, vision…) when interacting with different kinds of systems or products (vehicles, machines, workplaces, refrigerators, wheel chairs…). Our hope as guest editors is that this special edition makes some small contribution to informing and inspiring those researching the area of DHM, and at the same time reaches a wider audience of ergonomists and designers to make them aware of the capabilities of DHM as an aid to their professional activities.