

*Advances in
Cognitive Engineering
and
Neuroergonomics*

Advances in Human Factors and Ergonomics 2014

5th International Conference on Applied Human Factors and Ergonomics *20 Volume Set: Proceedings of the 5th AHFE Conference 19-23 July 2014*

<i>Advances in The Human Side of Service Engineering</i>	<i>Louis Freund and Wojciech Cellary</i>
<i>Advances in Human Factors and Sustainable Infrastructure</i>	<i>Jerzy Charytonowicz</i>
<i>Advances in Human Aspects of Healthcare</i>	<i>Vincent Duffy and Nancy Lightner</i>
<i>Advances in Applied Digital Human Modeling</i>	<i>Vincent Duffy</i>
<i>Advances in Cross-Cultural Decision Making</i>	<i>Sae Schatz, Joseph Cohn and Denise Nicholson</i>
<i>Advances in Human Factors, Software, and Systems Engineering</i>	<i>Ben Amaba and Brian Dalgetty</i>
<i>Advances in Human Aspects of Transportation (Part I, II, III)</i>	<i>Neville Stanton, Steve Landry Giuseppe Di Bucchianico and Andrea Vallicelli</i>
<i>Advances in Safety Management and Human Factors</i>	<i>Pedro Arezes and Paulo Carvalho</i>
<i>Advances in Cognitive Engineering and Neuroergonomics</i>	<i>Kay Stanney and Kelly Hale</i>
<i>Advances in Social and Organizational Factors</i>	<i>Peter Vink</i>
<i>Advances in The Ergonomics in Manufacturing: Managing the Enterprise of the Future</i>	<i>Stefan Trzcielinski and Waldemar Karwowski</i>
<i>Advances in Physical Ergonomics and Human Factors (Part I, II)</i>	<i>Tareq Ahram and Renliu Jang</i>
<i>Advances in Ergonomics In Design, Usability & Special Populations (Part I, II, III)</i>	<i>Marcelo Soares and Francisco Rebelo</i>
<i>Advances in Affective and Pleasurable Design</i>	<i>Yong Gu Ji and Sooshin Choi</i>
<i>Advances in Science, Technology, Higher Education and Society in the Conceptual Age: STHESCA</i>	<i>Tadeusz Marek</i>

*Advances in
Cognitive Engineering
and
Neuroergonomics*

*Edited By
Kay Stanney
and
Kelly S. Hale*

Published by AHFE Conference © 2014

Published by AHFE Conference © 2014

No claim to original U.S. Government works

Printed in the United States of America on acid-free paper

Version Date: 20140710

International Standard Book Number: 978-1-4951-2101-2 (Hardback)

This book contains information obtained from authentic and highly regarded sources. Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access (<http://www.copyright.com/>) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Visit the AHFE Web site at
<http://www.ahfe.org>

Table of Contents

Section 1: Operational Applications of Tactile and Multimodal Research and Displays

Tactile displays for cueing self-motion and looming: What would Gibson think? B. Lawson, USA	3
Tactile displays: From the cockpit to the clinic B. McGrath, Australia, and A. Rupert, USA	14
Tactile displays for soldier systems: Progress and issues L. Elliott, B. Mortimer and A. Skinner, USA	23
Effectiveness of vibrotactile and spatial audio directional cues for USAF pararescue jumpers (PJs) J. Brill and V. Scerra, USA	33
Do you feel... like I do? Individual differences and military cross-modal displays R. Cholewiak, USA	41

Section 2: Trust of Emergent Signal and Task Technologies

Is ignorance bliss? Role of credibility information and system reliability on user trust in emergent technologies P. Madhavan, USA	55
Impact of device reliability and route exposure on navigational performance K. Kennedy and J. Bliss, USA, and L. Nunes, Portugal	63

Section 3: Neuroergonomics of Human Performance

Neuroergonomics of skill acquisition: Genetic and non-invasive brain stimulation studies R. Parasuraman, P. Greenwood, M. Scheldrup, B. Falcone, B. Kidwell and R. Mckendrick, USA	73
Effects of fNIRS on physiological and performance under vibratory stimulus J. Sugimoto and H. Hagiwara, Japan	81
Brain activity during a visual stimulation task performed alone and with an auditory task N. Komiyama and H. Hagiwara, Japan	88

Inattentive deafness in simulated air traffic control tasks: A behavioural and P300 analysis 96
L. Giraudet, M. Berenger, J.-P. Imbert, S. Tremblay and M. Causse, France/Canada

Neurocognitive design methods for plastic model kit 106
M. Takao, M. Matsushima, S. Koretake, H. Shimizu and T. Kamei, Japan

Section 4: Interaction in 3D Environments and Computerized Training Systems

Effects of depth perception cues and display types on presence in the elderly within a 3D virtual store 113
C.-L. Liu and S.-T. Uang, Taiwan

The role of three-dimensional immersive environments in assessment and training of spatial skills 121
M. Kozhevnikov and I. Amihai, Singapore, and M. Kozhevnikov, USA

Features of collaboration in the VirCa immersive 3D environment 131
B. Hamornik, M. Koles, A. Komlodi, K. Hercegi and L. Izso, Hungary/USA

The effect of knowledge of results during computerized system training 140
N. Gavish and H. Krisher, Israel

Using near infrared spectroscopy to detect mental overload in flight simulator 148
M. Causse and N. Matton, France

Section 5: Behavioral and Physiological Indicators of Human Performance

What eye tracking can reveal about dynamic decision-making 157
F. Vachon and S. Tremblay, Canada

Learning and recognition of facial images without awareness 166
T. Ott and S. Schmer-Galunder, USA

Eye tracking study: Overhead menu board and its effect on consumer purchase decision 178
A. Magadia, K. Medel, S. Reyes and L. Grepo, Philippines

Resource allocation strategies in multitasking after switch in task priorities 187
N. Matton, P. Paubel, J. Cegarra and E. Raufaste, France

Effects of inhaling essential oil on decreasing mental fatigue: A physiological indices study
S.-Y. Cheng, Taiwan 194

Ergonomics and teaching: An investigation about Brazilian teacher's stress
I. de Medeiros Costa and R. Carvalho, Brazil 202

Section 6: Cognitive Assessment: Readiness and Workload

Identifying automation opportunities in a life science process through operator task modeling and workload assessment
M. Swangnetr, Germany/Thailand, D. Kaber, USA, E. Vorberg, H. Fleischer and K. Thorow, Germany 215

Initial development of a cognitive load assessment tool
P. Thorvald and J. Lindblom, Sweden 223

Towards a framework for reducing cognitive load in manufacturing personnel
J. Lindblom and P. Thorvald, Sweden 233

Analysis of operator activity in the control room of the production and transfer of oil and natural gas in a Brazilian oil company
A. Reis and R. Carvalho, Brazil 245

Section 7: User-Centered Design

Mental models of eco-driving: Comparison of driving styles in a simulator
S. Pampel, S. Jamson, D. Hibberd and Y. Barnard, UK 249

Context aware interruptions: Existing research and required research
A. Kolbeinsson, P. Thorvald and J. Lindblom, Sweden 260

Preface

This book brings together a wide-ranging set of contributed articles that address emerging practices and future trends in cognitive engineering and neuroergonomics— both aim to harmoniously integrate human operator and computational system, the former through a tighter cognitive fit and the latter a more effective neural fit with the system. The chapters in this book uncover novel discoveries and communicate new understanding and the most recent advances in the areas of workload and stress, activity theory, human error and risk, and neuroergonomic measures, as well as associated applications.

The book is organized into seven main sections:

- Section 1: Operational Applications of Tactile and Multimodal Research and Displays
- Section 2: Trust of Emergent Signal and Task Technologies
- Section 3: Neuroergonomics of Human Performance
- Section 4: Interaction in 3D Environments and Computerized Training Systems
- Section 5: Behavioral and Physiological Indicators of Human Performance
- Section 6: Cognitive Assessment: Readiness and Workload
- Section 7: User-Centered Design

Collectively, the chapters in this book have an overall goal of developing a deeper understanding of the couplings between external behavioral and internal mental actions, which can be used to design harmonious work and play environments that seamlessly integrate human, technical, and social systems.

Each chapter of this book was either reviewed or contributed by members of the Cognitive & Neuroergonomics Board. For this, our sincere thanks and appreciation goes to the Board members listed below:

H. Adeli, USA	T. Marek, Poland
G. Bedny, USA	J. Murray, USA
J. Bliss, USA	C. Nemeth, USA
A. Burov, Ukraine	D. Nicholson, USA
P. Choe, China	A. Ozok, USA
M. Cummings, USA	O. Parlangeli, Italy
M. Fafrowicz, Poland	R. Proctor, USA
C. Fidopiastis, USA	D. Rodrick, USA
C. Forsythe, USA	A. Santamaria, USA
X. Fang, USA	A. Savoy, USA
Q. Gao, China	D. Schmorrow, USA
Y. Guo, USA	N. Stanton, UK
P. Hancock, USA	K. Vu, USA
D. Kaber, USA	T. Waldmann, Ireland
B. Lawson, USA	B. Winslow, USA
S.-Y. Lee, Korea	G. Zacharias, USA
H. Liao, USA	L. Zeng, USA
Y. Liu, USA	

It is our hope that professionals, researchers, and students alike find the book to be an informative and valuable resource; one that helps them to better understand important concepts, theories, and applications in the areas of cognitive engineering and neuroergonomics. Beyond basic understanding, the contributions are meant to inspire critical insights and thought-provoking lines of follow on research that further establish the fledgling field of neuroergonomics and sharpen the more seasoned practice of cognitive engineering. While we don't know where the confluence of these two fields will lead, they are certain to transform the very nature of human-systems interaction, resulting in yet to be envisioned designs that improve form, function, efficiency, and the overall user experience for all.

July 2014

Kay M. Stanney and Kelly S. Hale
Design Interactive, Inc.
Orlando, FL USA

Editors