

Waldemar Karwowski  
Tareq Ahram *Editors*

# Intelligent Human Systems Integration

Proceedings of the 1st International  
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# **Advances in Intelligent Systems and Computing**

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Waldemar Karwowski · Tareq Ahram  
Editors

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# Preface

This volume, entitled *Intelligent Human Systems Integration*, aims to provide a global forum for introducing and discussing novel approaches, design tools, methodologies, techniques, and solutions for integrating people with intelligent technologies, automation, and artificial cognitive systems in all areas of human endeavor in industry, economy, government, and education. Some of the notable areas of application include, but are not limited to, energy, transportation, urbanization and infrastructure development, digital manufacturing, social development, human health, sustainability, new generation of service systems, as well as developments in safety, risk assurance, and cybersecurity in both civilian and military contexts. Indeed, rapid progress in developments in the ambient intelligence, including cognitive computing, modeling, and simulation, as well as smart sensor technology, weaves together the human and artificial intelligence and will have a profound effect on the nature of their collaboration at both the individual and societal levels in the near future.

As applications of artificial intelligence and cognitive computing become more prevalent in our daily lives, they also bring new social and economic challenges and opportunities that must be addressed at all levels of the contemporary society. Many of the traditional human jobs that require high levels of physical or cognitive abilities, including human motor skills, reasoning, and decision-making abilities, as well as training capacity, are now being automated. While such trends might boost the economic efficiency, they can also negatively impact the user experience and bring about many unintended social consequences and ethical concerns.

The intelligent human systems integration is to a large extent affected by the forces shaping the nature of future computing and artificial system development. This book discusses the needs and requirements for the symbiotic collaboration between humans and artificially intelligent systems, with due consideration of the software and hardware characteristics allowing for such cooperation from the societal and human-centered design perspectives, with the focus on the design of intelligent products, systems, and services that will revolutionize human–technology interactions.

This book also presents many innovative studies of ambient artificial technology and its applications, including the consideration of human–machine interfaces with a particular emphasis on infusing intelligence into development of technology throughout the lifecycle development process, with due consideration of user experience and the design of interfaces for virtual, augmented, and mixed reality applications of artificial intelligence.

Reflecting on the above-outlined perspective, the papers contained in this volume are organized into five main sections, including:

- I. Intelligence, Technology, and Automation
- II. Humans and Artificial Cognitive Systems
- III. Computational Modeling, Simulation, and Design
- IV. Ambient Intelligence and User Experience
- V. Society, Governance and Smart Systems

We would like to extend our sincere thanks to Dr. Stefania Camplone, University of Chieti-Pescara, Italy, for leading a part of the technical program that focuses on Smart Materials and Inclusive Human Systems. Our appreciation also goes to the members of Scientific Program Advisory Board who have reviewed the accepted papers that are presented in this volume, including the following individuals:

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We hope that this book, which presents the current state of the art in *Intelligent Human Systems Integration*, will be a valuable source of both theoretical and applied knowledge enabling the design and applications of a variety of intelligent products, services, and systems for their safe, effective, and pleasurable collaboration with people.

January 2018

Waldemar Karwowski  
Tareq Z. Ahram

# Contents

## **Intelligence, Technology and Automation**

<b>A Design and Description Method for Human-Autonomy Teaming Systems</b> . . . . .	3
Axel Schulte and Diana Donath	
<b>Current Insights in Human Factors of Automated Driving and Future Outlook Towards Tele-Operated Remote Driving Services</b> . . . . .	10
Christopher D. D. Cabrall, Alexander Eriksson, Zhenji Lu, and Sebastiaan M. Petermeijer	
<b>External HMIs and Their Effect on the Interaction Between Pedestrians and Automated Vehicles</b> . . . . .	13
Ye Eun Song, Christian Lehsing, Tanja Fuest, and Klaus Bengler	
<b>Attuning the ‘Pedestrian-Vehicle’ and ‘Driver-Vehicle’ - Why Attributing a Mind to a Vehicle Matters</b> . . . . .	19
Peter Bengtsson	
<b>Designing a Proactive Risk Mitigation Environment for Integrated Autonomous Vehicle and Human Infrastructure</b> . . . . .	23
Caitlin Anne Surakitbanharn	
<b>The 4D LINT Model of Function Allocation: Spatial-Temporal Arrangement and Levels of Automation</b> . . . . .	29
Christopher D. D. Cabrall, Thomas B. Sheridan, Thomas Prevot, Joost C. F. de Winter, and Riender Happee	
<b>Study on Estimation of Driver’s State During Automatic Driving Using Seat Pressure</b> . . . . .	35
Kenta Okabe, Keiichi Watanuki, Kazunori Kaede, and Keiichi Muramatsu	



<b>Automated Text Detection and Character Recognition in Natural Scenes Based on Local Image Features and Contour Processing Techniques . . . . .</b>	42
Remigiusz Baran, Pavol Partila, and Rafal Wilk	
<b>Continuous Model Based System Engineering (MBSE) Improvement via Human System Integration and Customer Change . . .</b>	49
Robert A. Sharples	
<b>Injecting Digitized Knowledge into the Technical Support Dialog . . . . .</b>	55
Don Allen	
<b>Artificial Intelligence and Interaction Design for a Positive Emotional User Experience . . . . .</b>	62
Cristina Caramelo Gomes and Sandra Preto	
<b>The Cognitive Airport Signage System Design: Comparative Case Study Between American Airport and Chinese Airport . . . . .</b>	69
Yan Gan and Zhi Peng Feng	
<b>Legal Risks and the Countermeasures of Developing Intelligent Investment Advisor in China . . . . .</b>	76
Cgeng-yong Liu	
<b>Reactive Operation: A Framework for Event Driven Low Voltage Grid Operation . . . . .</b>	83
Ralf Mosshammer, Konrad Diwold, Alfred Einfalt, and Christoph Groiss	
<b>Task Analysis of Diagnostic Ultrasound System Use: Comparison Between Sonographers' and Physicians' Use in Different Clinical Applications . . . . .</b>	89
Giuseppe Andreoni, Marco Delpiano, Nicola Guraschi, and Leonardo Forzoni	
<b>Evaluation of the Quality of Internet Breast Cancer Information: Fuzzy VIKOR Approach . . . . .</b>	95
Zuhaira Muhammad Zain	
<b>Research on an Improved Fall Detection Algorithm for Elder People . . . . .</b>	102
Qi Luo	
<b>Estimating Driver Workload with Systematically Varying Traffic Complexity Using Machine Learning: Experimental Design . . . . .</b>	106
Udara E. Manawadu, Takahiro Kawano, Shingo Murata, Mitsuhiro Kamezaki, and Shigeki Sugano	

**User Context Query Service Supporting Home Person-Centered Care for Elderly People** . . . . . 112  
 Haruhisa Maeda, Sachio Saiki, and Masahide Nakamura

**Significance of Social Factors for Effective Implementation of Smart Energy Management Systems in End-User Households** . . . . . 119  
 Jaroslaw Kowalski, Cezary Biele, Marek Mlodozieniec, and Marcel Geers

**“Intelligent Bathroom” - Intelligent Decision for Health** . . . . . 125  
 Anna Jaglarz

**Influence of Human Based Factors on Small Neighbourhood vs. Household Energy Load Prediction Modelling** . . . . . 131  
 Pawel Kobylinski, Mariusz Wierzbowski, and Cezary Biele

**A Prototype of a Small Tracked Robot for Gas Pipeline Inspection and Maintenance** . . . . . 137  
 Wen Zhao, Mitsuhiro Kamezaki, Kento Yoshida, Minoru Konno, Ryoichi Toriumi, and Shigeki Sugano

**Human Activity Detection Patterns: A Pilot Study for Unobtrusive Discovery of Daily Working Routine** . . . . . 143  
 Hicham Rifai, Paula Kelly, Yoshiki Shoji, Damon Berry, and Matteo Zallio

**Eye Movements and Lie Detection** . . . . . 149  
 Yulia V. Bessonova and Alexander A. Oboznov

**What Are the Benefits of Newly Developed Medical Devices When the User Does not Use Them? – An Investigation of Hearing Aid Use**. . . . . 156  
 Verena Wagner-Hartl

**Development of an Active Upper Limb Orthosis Controlled by EMG with Upper Arm Rotation** . . . . . 163  
 Akihiko Hanafusa, Fumiya Shiki, Haruki Ishii, Masaki Nagura, Yuji Kubota, Kengo Ohnishi, and Yoshiyuki Shibata

**Humans and Artificial Cognitive Systems**

**Design and Experimental Validation of Transparent Behavior for a Workload-Adaptive Cognitive Agent** . . . . . 173  
 Yannick Brand, Michael Ebersoldt, Daniel Barber, Jessie Y. C. Chen, and Axel Schulte

**Intelligent Visual Analytics – a Human-Adaptive Approach for Complex and Analytical Tasks** . . . . . 180  
 Kawa Nazemi

<b>CPR: Bright Side of Machine-Human Relationship</b> . . . . .	191
Shaik Farid Abdull Wahab, Ahmad Rasdan Ismail, and Rohayu Othman	
<b>Surface Recalibration as a New Method Improving Gaze-Based Human-Computer Interaction</b> . . . . .	197
Cezary Biele and Pawel Kobylinski	
<b>A Bionic Sphincter for Stress Urinary Incontinence: Design and Preliminary Experiments</b> . . . . .	203
Kenana Al Adem, Sarah S. Bawazir, Khulood Alameri, Gioia Lucarini, Tommaso Mazzocchi, Cesare Stefanini, Paolo Dario, and Arianna Menciassi	
<b>Experimental Validation of Pilot Situation Awareness Enhancement Through Transparency Design of a Scalable Mixed-Initiative Mission Planner</b> . . . . .	209
Fabian Schmitt, Gunar Roth, Daniel Barber, Jessie Chen, and Axel Schulte	
<b>Integrating 3D Facial Model with Person-Centered Care Support System for People with Dementia</b> . . . . .	216
Shota Nakatani, Sachio Saiki, and Masahide Nakamura	
<b>Integration of Cognitive Cybernetics into Intelligent Human Systems</b> . . . . .	223
Zdenko Balaž and Davor Predavec	
<b>Gaze-Aware Cognitive Assistant for Multiscreen Surveillance</b> . . . . .	230
Sébastien Tremblay, Daniel Lafond, Cindy Chamberland, Helen M. Hodgetts, and François Vachon	
<b>Computerized Brain Interfaces for Adaptive Learning and Assessment</b> . . . . .	237
Rosa María Arnaldo, Javier Iglesias, Víctor Fernando Gómez, Javier Crespo, Luis Pérez, José Félix Alonso, and Alvaro Rodríguez Sanz	
<b>Recognition of Affective States via Electroencephalogram Analysis and Classification</b> . . . . .	242
Abeer Al-Nafjan, Manar Hosny, Yousef Al-Ohali, and Areej Al-Wabil	
<b>Non-obtrusive Sleep Detection for Character Computing Profiling</b> . . . . .	249
Alia ElBolock, Rowan Amr, and Slim Abdennadher	
<b>Biological and Social Factors that Exert an Impact on Decision Making During Working-Out of the Convergent Technologies</b> . . . . .	255
Evgeny Kolbachev and Tatiana Kolbacheva	

**Humans and Color Cognition – Using the Brain to Study Human Behavior** . . . . . 261  
 Fernando Moreira da Silva

**Assessing the Effect of Care Treatment Using Face Emotional Analysis and Cognitive Computing** . . . . . 267  
 Arashi Sako, Sachio Saiki, and Masahide Nakamura

**Identify Subconscious Visual Response from Brain Signals** . . . . . 274  
 H. T. M. A. Riyadh, Jahangir Hossain Bhuyain, Zehara Zebin, Khandaker Tabin Hasan, and A. Z. M. Ehtesham Chowdhury

**EEG Analysis from Motor Imagery to Control a Forestry Crane** . . . . . 281  
 Midhumol Augustian, Shafiq ur Réhman, Axel Sandvig, Thivra Kotikawatte, Mi Yongcui, and Hallvard Røe Evensmoen

**Exploring the Usage of EEG and Pupil Diameter to Detect Elicited Valence** . . . . . 287  
 Yasmeen Abdrabou, Khaled Kassem, Jailan Salah, Reem El-Gendy, Mahesty Morsy, Yomna Abdelrahman, and Slim Abdennadher

**Integrating Classes from Different Schools Using Intelligent Teacher Support Systems** . . . . . 294  
 Roberto Araya

**AI Infused Fragrance Systems for Creating Memorable Customer Experience and Venue Brand Engagement** . . . . . 301  
 Anitha Ilapakurti, Jaya Shankar Vuppalapati, Santosh Kedari, Sharat Kedari, Rajasekar Vuppalapati, and Chandrasekar Vuppalapati

**Will Sketching Survive with the Use of Artificial Intelligence Tools?** . . . . . 308  
 Ana Moreira da Silva

**Research on the Construction of the Hierarchical Classification Model of the Urban Intelligent Lighting Appliance (UILA) Based on User Needs** . . . . . 315  
 Junnan Ye, Jianxin Cheng, Chaoxiang Yang, Zhang Zhang, Xinyu Yang, and Lingyun Yao

**Influence of Personal Characteristics and Device Properties on Wearable’s Rank Order** . . . . . 321  
 Thea Radüntz and Uwe Rose

**Comparative Analysis of the Quantitative Parameters of the Different Shapes of the Heart in Human Fetuses** . . . . . 327  
 G. A. Spirina

**A Practice of Flight Deck Evaluation in Civil Aircraft** . . . . . 333  
 Haiyan Liu, Baofeng Li, Dayong Dong, Hongtao Liu, Zhefeng Jin, and Yinbo Zhang

**Operator Response to Failure of a Computerized Procedure System** . . . . . 339  
 Claire Taylor, Michael Hildebrandt, Niv Hughes, and Robert McDonald

**Human-Human Interaction: A Neglected Field of Study?** . . . . . 346  
 Piotr Chynał, Julia Falkowska, and Janusz Sobecki

**Computational Modeling, Simulation and Design**

**Smart Palletisation: Cognitive Ergonomics in Augmented Reality Based Palletising** . . . . . 355  
 Veronika Kretschmer, Thorsten Plewan, Gerhard Rinkenauer, and Benedikt Maettig

**Augmenting the Evaluation and Mapping of Progress in Scientific Research – A Human-Machine Symbiosis Perspective** . . . . . 361  
 Andrej Dobrkovic, Daniel A. Döppner, Maria-Eugenia Jacob, and Jos van Hilleegersberg

**Development and Evaluation of a Virtual Reality Grocery Shopping Application Using a Multi-kinect Walking-in-Place Approach** . . . . . 368  
 Vix Kemanji Ketoma, Philip Schäfer, and Gerrit Meixner

**Influence of VR-Based Slope Images on Walking Pattern** . . . . . 375  
 Yusuke Osawa, Keiichi Watanuki, Kazunori Kaede, Keiichi Muramatsu, and Norihiro Ishizaka

**The Concept of Narrative as a Fundamental for Human Agent-Based Modeling** . . . . . 381  
 Roger A. Parker

**An Agent Based Model of Saudi Household Electricity Consumption** . . . . . 388  
 Yosef Alsuhaibani

**Digital Human Modelling Method for the Evaluation of the Ultrasound System and Transducer Design Adherence to the SDMS Industry Standards** . . . . . 393  
 Giuseppe Andreoni, Carlo Emilio Standoli, Fabio Rezzonico, Luis Rojas, and Leonardo Forzoni

**UX Design in the Localization and Internationalization of NASA’s Eyes on the Earth** . . . . . 402  
 Lamees Alsuhaibani, Amal Alabdulkarim, Kevin Hussey, and Areej Al-Wabil

**Digital Media Art Utilizing Traditional Animation Digital Video Expression Using Projection Mapping and Multi Screen Technique . . . . .** 408  
 Zhipeng Feng and Kiyoshi Tomimatsu

**Guidance of Enterprise Team Division Based on Security Awareness and Interaction . . . . .** 414  
 Yun-lu Zhang and Xue-bo Chen

**Applying Process Mining Techniques to Learning Management Systems for Educational Process Model Discovery and Analysis . . . . .** 420  
 Darko Etinger, Tihomir Orehovački, and Snježana Babić

**Explorations into Deep Learning Mobile Applications . . . . .** 426  
 Alisa Krstova, Alek Petreski, and Sonja Gievska

**Theoretical Propositions and Practical Implementation of the Formalization of Structured Knowledge of the Subject Area for Exploratory Research . . . . .** 432  
 Olga Popova, Yury Shevtsov, Boris Popov, Vladimir Karandey, and Vladimir Klyuchko

**Bayesian Network Construction and Simplified Inference Method Based on Causal Chains . . . . .** 438  
 Yohei Ueda, Daisuke Ide, and Masaomi Kimura

**Image Super Resolution Using Wavelet Transformation and Swarm Optimization Algorithm . . . . .** 444  
 Gunamani Jena, Sudam Sekhar Panda, Bonam Venkata Rajesh, and Subhashish Jena

**Human Posture Tracking System for Industrial Process Design and Assessment . . . . .** 450  
 Francesco Caputo, Egidio D’Amato, Alessandro Greco, Immacolata Notaro, and Stefania Spada

**Instrumentation of an External Fixator for Force and Bone Healing Process Monitoring . . . . .** 456  
 Fatima Ba Fakhir, Cesare Stefanini, Paolo Dario, and Stefano Mazzoleni

**Study of Visual Symbols Used in Food Packaging Identification for the Elderly Affected with Chronic Diseases . . . . .** 462  
 Jiajie Lyu and Delai Men

**Research of a Falling Detection System for the Elderly Based on Three-Dimensional Acceleration . . . . .** 469  
 Qi Luo

**A Qualitative Model to Estimate Users’ Fear of Environmental Conditions for Evacuation Route Guidance** . . . . . 473  
Hiroshi Furukawa and Zhihuan Liu

**The Effects of Enterprise Staff Safety Consciousness Based on Cellular Automata Model** . . . . . 480  
Min Yang and Xue-Bo Chen

**Machine-Man-Task System Approach and NR-17 Regulatory Standard** . . . . . 487  
Norma de Melo Pinto and Kazuo Hatakeyama

**Ambient Intelligence and User Experience**

**User Centered Ecological Interface Design (UCEID): A Novel Method Applied to the Problem of Safe and User-Friendly Interaction Between Drivers and Autonomous Vehicles** . . . . . 495  
Kirsten Revell, Pat Langdon, Mike Bradley, Ioannis Politis, James Brown, and Neville Stanton

**Statistics-IDE: Supporting the Design of Empirical Experiments for Non-experts During Early Stages of Research Projects** . . . . . 502  
Frode Eika Sandnes and Evelyn Eika

**Measuring User Experience of Seniors in Battery Swapping Interactions** . . . . . 508  
Fei-Hui Huang

**Web Page Graphic Design Usability Testing Enhanced with Eye-Tracking** . . . . . 515  
Piotr Chynał, Julia Falkowska, and Janusz Sobecki

**Preliminary Research on Competency Model for High Plateau Airline Pilots** . . . . . 521  
Qi Luo

**User Interface Design in Remote Aerodrome Flight Information Service** . . . . . 526  
Shoka Nagata, Kazuhiko Yamazaki, and Satoru Inoue

**The Robot Brain Server: Design of a Human-Artificial Systems Partnership** . . . . . 531  
Johan F. Hoorn

**Act like a Human: Teach an Autonomous Vehicle to Deal with Traffic Encounters** . . . . . 537  
Jianmin Wang, Jiawei Lu, Fang You, and Yujia Wang

**Design Approach for Sanpoyoshi Principle and Case Study** . . . . . 543  
Kazuhiko Yamazaki

**Identifying Significance of Human Cognition in Future Maintenance Operations** . . . . . 550  
 Prasanna Illankoon, Phillip Tretten, and Uday Kumar

**Collaborative Human-Machine Interaction in Mobile Phone Support Centers: A Case Study** . . . . . 557  
 Kyle Dent, Luke Plurkowski, and John Maxwell

**Crew Resource Management Doctrine Applicability to Human-Machine Interaction in Commercial Aircraft** . . . . . 564  
 Aysen K. Taylor

**The Role of Monitoring and Evaluation in Construction Project Management** . . . . . 571  
 Tengan Callistus and Aigbavboa Clinton

**Transformations in Mass Society and Emergent Properties of Human Behavior in Contemporary Media Space** . . . . . 583  
 Dobrinka Peicheva, Lilia Raycheva, Valentina Milenkova, and Boris Manov

**Modelling the Perceived Pragmatic and Hedonic Quality of Intelligent Personal Assistants** . . . . . 589  
 Tihomir Orehovački, Snježana Babić, and Darko Etinger

**The Brave New E-world of the Human-Centered Media Ecosystem** . . . . . 595  
 Lilia Raycheva and Dobrinka Peicheva

**Identification of Visually Impaired Person with Deep Learning** . . . . . 601  
 Shoichiro Fujisawa, Ranmaru Mandai, Ryota Kurozumi, Shin-ichi Ito, and Katsuya Sato

**The Role of Mental Model in Graphical Password Selection and Design** . . . . . 608  
 Mona A. Mohamed, Joyram Chakraborty, and Josh Dehlinger

**Tablets and Smart Glasses in Modern Production Environments – A Lab Study on Distracted Walking** . . . . . 614  
 Patricia Tegtmeier and Sascha Wischniewski

**A Perception Study of a New Set of Usability Heuristics for Transactional Web Sites** . . . . . 620  
 Freddy Paz, Freddy A. Paz, Juan Jesús Arenas, and Carmen Rosas

**On User eXperience Evaluation: Combining User Tests and Psychometrics** . . . . . 626  
 Virginia Zaraza Rusu, Cristian Rusu, Pablo Cáceres, Virginica Rusu, Daniela Quiñones, and Patricia Muñoz



**Research on Parent-Child Interaction System of Intelligent Children’s Furniture Based on Application Behavior Analysis. . . . .** 633  
Ting Deng, Wei Sun, and Ruiqiu Zhang

**Adaptive Edge Analytics - A Framework to Improve Performance and Prognostics Capabilities for Dairy IoT Sensor. . . . .** 639  
Santosh Kedari, Jaya Shankar Vuppalapati, Anitha Ialapakurti, Sharat Kedari, Rajasekar Vuppalapati, and Chandrasekar Vuppalapati

**Evaluation of Legibility and Visual Fatigue Caused by Luminescent Text Displays . . . . .** 646  
Daiki Saito, Keiichi Watanuki, Keiichi Muramatsu, Kazunori Kaede, Masutsugu Tasaki, Takashi Kanahira, Eiji Ishiguro, and Naoya Mashiko

**Multimodal Interactive Payment Based on Biometrics . . . . .** 652  
Shuxian Liu and Huaming Peng

**Re-modeling the ‘Phonebook’ in a Smart Phone: Personalization Based on Intimacy and Immediacy . . . . .** 659  
Ravi Mokashi Punekar, Shivani Holkar, and Abhishek Yevalkar

**Society, Governance and Smart Systems**

**Smart Shopping Experience. New Materials and Technologies for Social Inclusion Through Daily Activities . . . . .** 667  
Stefania Camplone and Giuseppe Di Bucchianico

**Next Smart Design: Inclusion, Emotions, Interaction in the Concept of Baby Soothing, Caring and Monitoring Smart Solutions . . . . .** 673  
Marinella Ferrara and Anna Cecilia Russo

**Applied Semiotics in the Context of Open Government Data (OGD) Portals in the Arab Gulf. . . . .** 680  
Furat Aljishi, Arwa Alsaati, Areej Al-Wabil, and Anas Alfaris

**Cyclotourism and Social Inclusion: From Service to Product for a Smart Extra-Urban Bike Sharing . . . . .** 686  
Ivo Spitilli, Stefania Camplone, Giuseppe Di Bucchianico, and Antonio Marano

**Service System-Based Urban Mobility System Design for Chinese Metropolis . . . . .** 693  
Jintian Shi and Xiaohua Sun

**Smart Cities-Smart Societies . . . . .** 700  
Gianmarco Cifaldi and Ionut Serban

**City of Future** ..... 708  
 Fabrizio Fornari

**Between a Smart City and Smart Society**..... 714  
 Gianmarco Cifaldi and Ionut Serban

**Hemp for a Healthy and Sustainable Building in Abruzzo**..... 720  
 Donatella Radogna, Luciana Mastrodonardo, and M. Cristina Forlani

**The Creative Space of University  
 as a Cognitive-Generative System**..... 727  
 Alexander O. Karpov

**The Emotional Side of Smartness: Intelligent Materials  
 and Everyday Aesthetics** ..... 733  
 Anna Cecilia Russo

**Mapping ICS Materials: Interactive, Connected,  
 and Smart Materials** ..... 739  
 Stefano Parisi, Davide Spallazzo, Venere Ferraro, Marinella Ferrara,  
 Mauro Attilio Ceconello, Camilo Ayala Garcia, and Valentina Rognoli

**Bio-smart Materials: The Binomial of the Future** ..... 745  
 Sabrina Lucibello, Marinella Ferrara, Carla Langella,  
 Cecilia Cecchini, and Rossana Carullo

**Exploring Scenarios for ICS Materials in the Yacht  
 Design Framework** ..... 751  
 Arianna Bionda and Andrea Ratti

**Advanced Materials Empowering Inclusive Engineering  
 Design Processes**..... 757  
 Micol Costi and Emilio Genovesi

**Interactive, Connected, Smart materials: ICS materiality** ..... 763  
 Marinella Ferrara, Valentina Rognoli, Venanzio Arquilla,  
 and Stefano Parisi

**Study of the Ergonomics Applied to the Reuse and Recycling  
 of Materials** ..... 770  
 Hebert Robert da Silva

**Author Index**..... 777

# Between a Smart City and Smart Society

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**Abstract.** The concept of smart cities and smart societies should start from the base up, from the individuals and not the other way around. The 21<sup>st</sup> century should be about developing the new smart concepts about a smart transportation system combined with the smart energy one. In these concepts, smart technologies like phone apps that provide people with quick information about how to move, where to park, what areas to avoid due to congestions etc., should be affordable for everybody. Apps that interconnect people and cities around states or the European Union with functions like booking a sharing bike or a sharing car should also be available for each individual. Smart transportation, from cars to trains, bikes or planes, all interconnected by a new technology should serve in the future the citizens around the globe.

**Keywords:** Smart cities · Smart societies · Smart transportation · Spin off

## 1 Introduction

The word “smart city” has become widespread in recent years and has entered into our daily lexicon even if we do not always understand the significance and what it follows. In fact, we cannot speak of a smart city unless we are thinking of building an intelligent society, this process of social change must be accompanied by a continuous process of social modernization, otherwise the advantages of such “industrial” revolution would be ineffective and would risk to create a new social gap with a substantial problem of democracy.

## 2 Smart City

This expression identifies an urban area that, through the widespread and pervasive use of advanced technologies, is able to address the social and economic needs of citizens in a new way.

Having different faces, there are so many ways in which a city can become smart. The city that is known to move in the developing territories around it is increasingly congested and therefore needs new mobility management and governance models that enhance public transport, introduce types and models of transport as the shared ones, provide

innovative services for monitoring, analysis, planning and management of citizen and means flows [1].

The city that doesn't know to move, meaning that a city is smart even to the extent that it helps citizens not to move. In particular, a widespread and pervasive use of IT&C services and products allows you to remotely, without moving, a lot of activities: from shopping, to meetings, to group work and project work to training as eLearning [2].

The informed city is that smart city capable of collecting and disseminating information in a capillary and continuous manner, both in terms of normal social and economic life and as regards the management of emergency situations such as natural disasters or terrorist attacks [3].

The virtuous city is that smart city able to exploit all modern energy saving technologies to reduce the impact on the environment and on the planet that comes from the presence and activities of thousands of people and products that in various forms consume energy and they produce waste [4].

The vibrant and dynamic city is that smart city capable of generating and promoting cultural and recreational activities that qualify the territory, attract talents, enrich urban fabric and stimulate creativity and social growth [5].

The participative city is the city where the size and the progressive turn into big agglomerations lose the dimension of the "medieval square", and it makes more and more concrete the danger of the loss of social cohesion and the impoverishment of moments of encounter and socialization [6–19].

A smart city is capable of inventing new forms of participation that, by combining the use of new technologies and new forms of social encounter, are able to renew and recreate the fabric of human relationships and opportunities for dialogue and dialogue [20–22].

The safe city is that city that increases the security of people and belonging. A smart city raises the level of security through the use of innovative landscape surveillance and citizen assistance.

### 3 The Well-Governed City

Last but not least, that smart city offers new forms of government that can both monitor and manage the territory and the dynamics that it develops, and to enhance the continuous and bidirectional relationship with citizens, businesses, the living entities that operate and grow on it.

A smart city is a place where all vital and neuralgicidal processes of social life are re-released, thanks also to the use of technologies, in order to radically improve the quality of life, opportunity, welfare, social and economic development.

In the world, various are the proposals to interpret the construction of smart cities, in Japan the prof. Fairy Matsushima proposes integrated development strategy to address 4.0 industry, digitization and data sharing, and aim at the future of company 5.0 [23–31].

Japan is in the process of addressing 4.0 industry and digitalisation as a whole, so that this is one of the main items of the government-sponsored strategic project plan of 600 billion yen in public-private investment, equivalent to 4 billion euro in total. At the

same time, on the theme of data sharing, the Japanese model is aiming at a next goal: the spread of the company 5.0. This concept implies a new, intelligent society that embraces the innovations of the fourth industrial revolution not only to improve productivity but also to help solve social problems [32].

It is the “human technology oriented” model chosen by Japan as a reference guide for the future, which puts technology at the service of the person and has the “Connected Industries” pillar. The heart of the Japanese development strategy is small and medium-sized enterprises, which are the country’s productive reference fabric, identified to achieve the medium and long-term sustainable growth needed for society 5.0. The connected industry is the connection between manufacturing industries, service companies, public organizations, machines and people [33].

This model, through the Internet of Things, the use of robots and Big Data, improves productivity, quality of work and reduces costs, thanks to smart working allowing men, women and the elderly to easily access the labour market.

The real revolution, however, is to overcome the conquests of the “Connected Industries” on a large scale. It may sound surprising, but digitization has the potential to help change trades to the detriment of alienating ones, to create new value by reducing unemployment and shrinking social inequities, solving problems such as aging, lack of staff, environmental and energy constraints.

For example, in the field of new professions, technology is helping to redesign productive activities, companies can give up a “physical” workforce and the “physical” workforce can avoid wacky and damaging activities. In other words, low-value activities will be reduced. More and more, it will be necessary to replace the “labor” with the “knowledge work”, more and more our companies will be hungry for knowledge professions.

To make the intelligent society sustainable in the near future, one cannot think of halting the digital revolution, but we must work to find a new balance between man and technology, raising the breadth of our goals and aiming for a better quality of life. A new equilibrium that requires us to be thinking men.

Governance policies and company policy choices must therefore be focused on people’s growth and the development of new high-value-added skills. In the fourth industrial revolution, the human factor plays an even more central role in the management of new tools, especially in order to bring them to the service of the community. This is the counterweight that will make us reach a new sustainability, this is the challenge of society 5.0 [34].

## 4 Smart Society Spin off

One of the initiatives promoted by the Italian university is the Spin off smart society of Chieti-Pescara University, conceived by prof. Gianmarco Cifaldi.

The project wants to overthrow the paradigm, that is, to make a smart city, you must first build an intelligent society; the city is hardware as the inhabitants become its software. A city can be called smart when traditional and modern infrastructure provides sustainable economic development and high quality of life, wise management of natural

resources, through the commitment and action of the participating citizen, to produce a model of urban and social security.

- Create a local network consisting of public and private institutions that allow citizens to easily access services and improve their quality of life by consulting and sharing information that is constantly available.
- Implement mobile connection systems in urban areas.
- Facilitate the knowledge and use of new communication channels to support the interaction and socialization of citizens in their own territory.
- Disclose the use of smart technologies and culture to improve the quality of life of citizens.

The Spin off has developed a Tile Info System, consisting of a “QR Code” (horizontal signs positioned on the road surface) where the QR code of the reference organization is inserted, made of material that provides resistance to all weather conditions (Fig. 1).



**Fig. 1.** The placement of Tile information on the road surface ([www.smartsociety.it](http://www.smartsociety.it))

The service, through the placement of Tile information on the road surface and not only, is the junction between the real world (roads and the city in general) and the virtual world (data on a server) and allows it to represent content, divulge information, activate functions, services, and interactions.

Placing a Tile Info in a street or square enables citizens to communicate and receive information at any time, in a direct and up-to-date manner.

## References

1. Aurigi, A.: *Making the Digital City: The Early Shaping of Urban Internet Space*. Ashgate Publishing Company, Farnborough (2005)
2. Babry, E.: The internet of things, legal aspects. What will change (Everything). *Commun. Strategy* **87**(3), 83–100 (2012)
3. Bătăgan, L.: Smart cities and sustainability models. *Informatica Economică* **15**(3), 80–87 (2011)
4. Batty, M., Axhausen, K.W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., Ouzounis, G., Portugali, Y., et al.: Smart cities of the future. *Eur. Phys. J. Spec. Top.* **214**(1), 481–518 (2012)
5. Beall, J., Fox, S.: *Cities and Development*. Routledge, London (2009)
6. Begg, I.: Cities and competitiveness. *Urban Stud.* **36**(5–6), 795–810 (1999)
7. Bell, S.: System city: urban amplification and inefficient engineering. In: Gandy, M. (ed.) *Urban Constellations*, pp. 71–74. Jovis, Berlin (2011)
8. Benton-Short, L., Short, J.R.: *Cities and Nature*. Routledge, London (2007)
9. Boyle, D., Yates, D., Yeatman, E.: Urban sensor data streams: London 2013. *IEEE Internet Comput.* **17**(6), 12–20 (2013)
10. Brooker, D.: From ‘Wannabe’ silicon Valley to Global Back Office? Examining the socio-spatial consequences of technopole planning practices in Malaysia. *Asia Pac. Viewpoint* **54**(1), 1–14 (2013)
11. Bunnell, T.: Multimedia Utopia? A geographical critique of high-tech development in Malaysia’s multimedia super corridor. *Antipode* **34**(2), 265–295 (2002)
12. Burdett, R., Sudjic, D. (eds.): *The Endless City*. Phaidon, London (2007)
13. Camagni, R.: On the concept of territorial competitiveness: sound or misleading? *Urban Stud.* **39**(13), 2395–2411 (2002)
14. Camagni, R.: Territorial capital and regional development. In: Capello, R., Nijkamp, P. (eds.) *Handbook of Regional Growth and Development Theories*, pp. 118–132. Edward Elgar Publishing, Northampton (2009)
15. Campbell, T.: *Beyond Smart Cities: How Cities Network, Learn and Innovate*. Earthscan, Abingdon (2012)
16. Caragliu, A., Del Bo, C., Nijkamp, P.: Smart cities in Europe. *J. Urban Technol.* **18**(2), 65–82 (2011)
17. Carta, M.: *Creative City: Dynamics, Innovations, Actions*. ListLab, Trento-Barcelona (2007)
18. Carta, M.: *Creative City 3.0: New Scenarios and Projects*, Monograph it. No 1. (2009). [http://issuu.com/mcarta/docs/181\\_creative\\_city\\_3.0\\_monograph](http://issuu.com/mcarta/docs/181_creative_city_3.0_monograph)
19. Carta, M.: *Reimagining Urbanism, Creative, Smart and Green Cities for the Changing Times*. ListLav, Trento-Barcelona (2014)
20. Castells, M.: *The Rise of the Network Society. The Information Age: Economy, Society and Culture.*, vol. 1. Oxford, Wiley Blackwell, Malden (1997)
21. Choay, F.: *The Rule and the Model: On the Theory of Architecture and Urbanism*. MIT Press, Cambridge (1997)
22. Coe, A., Paquet, G., Roy, J.: E-governance and smart communities: a social learning challenge. *Soc. Sci. Comput. Rev.* **19**(1), 80–93 (2001)
23. Cohen, B.: What Exactly is a Smart City? Co.Exist, 19 September (2012). <http://www.fastcoexist.com/1680538/what-exactly-is-a-smart-city>. (Accessed 9 Oct 2017)
24. Considine, M., Lewis, J.: Governance at ground level: the front-line bureaucrat in the age of markets and networks. *Public Adm. Rev.* **59**(6), 467–480 (1999)

25. Coyle, S.J.: *Sustainable and Resilient Communities: A Comprehensive Action Plan for Towns, Cities and Regions*. Wiley, Hoboken (2011)
26. Deakin, M.: From city of bits to e-Topia: taking the thesis on digitally-inclusive regeneration full circle. *J. Urban Technol.* **14**(3), 131–143 (2007)
27. Deakin, M.: The IntelCities community of practice: the eGov services model for socially-inclusive and participatory urban regeneration programmes. In: Reddick, C. (ed.) *Research Strategies for eGovernment Service Adoption*, pp. 83–104. Idea Group Publishing, Hershey (2009)
28. Deakin, M.: Review of city portals: the transformation of service provision under the democratization of the fourth phase. In: Reddick, C. (ed.) *Politics, Democracy and E-Government: Participation and Service Delivery*. IGI Publishing, Hershey (2010)
29. Deakin, M. (ed.): *Creating smarter cities*. *J. Urban Technol.* **18**(2) (2011). Special issue guest-edited by M. Deakin
30. Deakin, M.: Intelligent cities as smart providers: CoPs as organizations for developing integrated models of eGovernment services. *Innov. Eur. J. Soc. Sci. Res.* **25**(2), 115–135 (2012)
31. Deakin, M.: *Smart Cities: Governing, Modelling and Analysing the Transition*. Routledge, London (2014)
32. Deakin, M., Allwinkle, S.: Urban regeneration and sustainable communities: the role networks, innovation and creativity in building successful partnerships. *J. Urban Technol.* **14**(1), 77–91 (2007)
33. Deakin, M., Al Waer, H.: From intelligent to smart cities. *Intell. Build. Int.* **3**(3), 140–152 (2011)
34. Denhardt, R.B., Denhardt, J.V.: The new public service: serving rather than steering. *Public Adm. Rev.* **60**(6), 549–559 (2000)