

## Editor-in-Chief

*Kai Rannenber, Goethe University Frankfurt, Germany*

## Editorial Board

TC 1 – Foundations of Computer Science

*Jacques Sakarovitch, Télécom ParisTech, France*

TC 2 – Software: Theory and Practice

*Michael Goedicke, University of Duisburg-Essen, Germany*

TC 3 – Education

*Arthur Tatnall, Victoria University, Melbourne, Australia*

TC 5 – Information Technology Applications

*Erich J. Neuhold, University of Vienna, Austria*

TC 6 – Communication Systems

*Aiko Pras, University of Twente, Enschede, The Netherlands*

TC 7 – System Modeling and Optimization

*Fredi Tröltzsch, TU Berlin, Germany*

TC 8 – Information Systems

*Jan Pries-Heje, Roskilde University, Denmark*

TC 9 – ICT and Society

*Diane Whitehouse, The Castlegate Consultancy, Malton, UK*

TC 10 – Computer Systems Technology

*Ricardo Reis, Federal University of Rio Grande do Sul, Porto Alegre, Brazil*

TC 11 – Security and Privacy Protection in Information Processing Systems

*Steven Furnell, Plymouth University, UK*

TC 12 – Artificial Intelligence

*Ulrich Furbach, University of Koblenz-Landau, Germany*

TC 13 – Human-Computer Interaction

*Marco Winckler, University Paul Sabatier, Toulouse, France*

TC 14 – Entertainment Computing

*Matthias Rauterberg, Eindhoven University of Technology, The Netherlands*

## **IFIP – The International Federation for Information Processing**

IFIP was founded in 1960 under the auspices of UNESCO, following the first World Computer Congress held in Paris the previous year. A federation for societies working in information processing, IFIP's aim is two-fold: to support information processing in the countries of its members and to encourage technology transfer to developing nations. As its mission statement clearly states:

*IFIP is the global non-profit federation of societies of ICT professionals that aims at achieving a worldwide professional and socially responsible development and application of information and communication technologies.*

IFIP is a non-profit-making organization, run almost solely by 2500 volunteers. It operates through a number of technical committees and working groups, which organize events and publications. IFIP's events range from large international open conferences to working conferences and local seminars.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is generally smaller and occasionally by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is also rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

IFIP distinguishes three types of institutional membership: Country Representative Members, Members at Large, and Associate Members. The type of organization that can apply for membership is a wide variety and includes national or international societies of individual computer scientists/ICT professionals, associations or federations of such societies, government institutions/government related organizations, national or international research institutes or consortia, universities, academies of sciences, companies, national or international associations or federations of companies.

More information about this series at <http://www.springer.com/series/6102>

Kecheng Liu · Keiichi Nakata  
Weizi Li · Cecilia Baranauskas (Eds.)

# Digitalisation, Innovation, and Transformation

18th IFIP WG 8.1 International Conference  
on Informatics and Semiotics in Organisations, ICISO 2018  
Reading, UK, July 16–18, 2018  
Proceedings

*Editors*

Kecheng Liu  
University of Reading  
Reading  
UK

Keiichi Nakata  
University of Reading  
Reading  
UK

Weizi Li  
University of Reading  
Reading  
UK

Cecilia Baranauskas  
State University of Campinas  
Campinas  
Brazil

ISSN 1868-4238

ISSN 1868-422X (electronic)

IFIP Advances in Information and Communication Technology

ISBN 978-3-319-94540-8

ISBN 978-3-319-94541-5 (eBook)

<https://doi.org/10.1007/978-3-319-94541-5>

Library of Congress Control Number: 2018947432

© IFIP International Federation for Information Processing 2018

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by the registered company Springer International Publishing AG part of Springer Nature

The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

# Preface

The 2018 edition of the International Conference on Informatics and Semiotics in Organisations (ICISO 2018) is an IFIP WG 8.1 Working Conference and part of a series of international events devoted to current research and application of informatics and semiotics in organizations (see [www.orgsem.org](http://www.orgsem.org) for earlier conferences since 1995). ICISO 2018 continued the innovative work of the international research community in the development of organizational semiotics, focusing not only on theory building, but also on practical benefits gained through applications of methods and techniques derived from various organizational semiotics approaches. The conference theme, “Digitalization, innovation and transformation,” allows us to consider how these three concepts are driving changes globally.

Digitalization, innovation, and transformation impact both modern businesses and organizations. Business landscapes are rapidly evolving into more dynamic environments for value-creation across a wide range of industries, such as healthcare, education, public governance, agriculture, environment, accounting, and finance. The digital transformation has been predominantly enabled by information and communication technologies (ICTs), which has in turn stimulated products and services innovation. Emerging technologies, such as IoT, artificial intelligence, robotics, virtual and augment reality, 3D printing, and blockchain, have profoundly transformed the social, economic, human-centered and organizational activity across multiple sectors. Top management has evolved from a traditional leadership approach, to a more digital leadership mindset in order to manage the innovative modern business. The digital evolution within our modern society will continue to take place and transform organizations into new forms in the foreseeable future.

Organizational semiotics, with its profound theories, methods, and techniques, provides an effective approach to explore the nature and characteristics of digitalization, innovation, and transformation within the complex business landscape. Organizational semiotics, as a discipline of the study of sign, information, and human communication within organizational contexts, guides academics and practitioners with valuable insight into actionable outcomes of human interplay among the sign-based and physical worlds.

ICISO 2018 received 38 paper submissions from 12 countries, demonstrating the success and global dimension of this conference. From the papers submitted, 30 were accepted for presentation while four were accepted as posters. These numbers show the intention of preserving a high level of quality for future editions of this conference. The papers in the proceedings are organized around four topics: (1) organizational semiotics: theory and application, (2) digital business ecosystems and value networks, (3) socially aware knowledge engineering, and (4) business intelligence and analytics.

The high quality of the papers received imposed difficult choices in the review process. To evaluate each submission, two rounds of paper review were performed by the Program Committee and reviewing panels, whose members are highly qualified

researchers in the conference topic areas. Moreover, ICISO also featured a number of keynote lectures delivered by internationally recognized experts, namely, Dr. Carsten Sørensen from the Department of Management, London School of Economics and Political Science, UK, Professor Cecilia Baranauskas from the Institute of Computing, University of Campinas, Brazil, and a special contribution from Professor Ronald Stamper. These keynote lectures brought significant value to the conference.

Building an interesting and successful program for the conference required the dedicated effort of many people. We would like to express our thanks to all authors including those whose papers were not included in the program. We would also like to express our gratitude to all members of the Program Committee and additional reviewers, who helped us with their expertise and valuable time. Furthermore, we thank the invited speakers for their invaluable contributions and for taking the time to synthesize and prepare their talks.

Moreover, we thank the session chairs, whose contribution to the diversity of the program was essential. Finally, we gratefully acknowledge the professional and organizational support from the Informatics Research Centre, Henley Business School, University of Reading, UK.

July 2018

Kecheng Liu  
Keiichi Nakata  
Weizi Li  
Cecilia Baranauskas



Yanqing Duan	University of Bedfordshire, UK
John Effah	University of Ghana Business School, Ghana
Florin Gheorghe Filip	Romanian Academy of Sciences, Romania
Joaquim Filipe	EST-Setubal/IPS, Portugal
Daniel Galarreta	CNES, France
Ricardo Gudwin	University of Campinas, Brazil
Stephen Gulliver	University of Reading, UK
Selcuk Burak Hasiloglu	Pamukkale University, Turkey
Paul Johanneson	Royal Institute of Technology, Sweden
Angela Lacerda-Nobre	ESCE-IPS, Portugal
Weizi Li	University of Reading, UK
Kecheng Liu	University of Reading, UK
Ecivaldo Matos	Universidade Federal da Bahia, Brazil
Alessio Miranda Júnior	Cefet-MG Campus Timóteo, Brazil
Keiichi Nakata	University of Reading, UK
Vânia Neris	UFSCar, Brazil
Dan Oleary	University of Southern California, USA
Stephen Opoku-Anokye	University of Reading, UK
Yu-Chun Pan	University of West London, UK
Roberto Pereira	University of Campinas, Brazil
LaraPiccolo	The Open University, UK
Simon Polovina	Sheffield Hallam University, UK
Luis Quezada	University of Santiago, Chile
Kamila Rodrigues	University of São Paulo, Brazil
Wenge Rong	Beihang University, China
Vagner Santana	University of Campinas, Brazil
Keng Siau	Missouri University of Science and Technology, USA
Lily Sun	University of Reading, UK
Chekfong Tan	University of West London, UK
Christina Tay	Chinese Culture University, China
Jasmine Tehrani	University of Bedfordshire, UK
Hans Weigand	Tilburg University, The Netherlands
Shen Xu	King's College London, UK
Mohammad Yamin	King Abdelaziz University, Saudi Arabia
Zhijun Yan	Beijing Institute of Technology, China

### **Additional Reviewers**

Eric Afful-Dadzie	University of Ghana Business School, Ghana
Maksim Belitski	University of Reading, UK
Michael Dzandu	University of Reading, UK
Diego Fuentealba	University of Reading, UK
Elaine C. Hayashi	University of Campinas, Brazil
Lei Hou	University of Reading, UK
Caine Jamie	Sheffield Hallam University, UK
Qi Li	University of Reading, UK



Shixiong Liu  
Anupam Nanda  
Xue Pan

University of Reading, UK  
University of Reading, UK  
University of Reading, UK

## Sponsors



In cooperation with



# **Abstract of Keynotes**

# Coupling the Digital, the Physical and the Social: New Demands for Information Systems Understanding?

M. Cecilia C. Baranauskas

Institute of Computing, University of Campinas,  
UNICAMP, Campinas, SP, Brazil  
cecilia@ic.unicamp.br

**Abstract.** The computational technology has become pervasive in our lives and culture, transforming our ways of understanding and living in the world. This presence has led to changes in our relations with technology, with others and with the process of building knowledge. Technology is a human creation, thus there is no neutrality in our relationship with it: we suffer the impact of technology and, at the same time, we are responsible for the form it takes and the effects it causes. Since most of the modern computing experience is about the world we live in (people, places, and things), it makes sense to understand information systems situating them out into the world people live. In the interaction design field, there has been a move away from a perspective that treats people and computers as two separate and distinct entities toward a perspective that acknowledges the need to consider people, digital technology, and traditionally non-computational materials together as a whole, forming our experiences in and of the world. The presence of new technologies and new forms of interaction (tangible, wearable and natural interfaces), coupled with the ubiquity of computing, present challenges that require the consideration of new factors in the design of systems we are naming socio-enactive. The enactive perspective collectively understands perception, cognition, and action as essential factors in the modes of signification. In this talk, I want to provoke a reflection on changes in perspectives the design of such systems, constituted from the coupling of the digital, the physical and the social, demands. Assuming a subjectivist posture and recognizing the situational character of design, I will illustrate ideas from ongoing research Projects (Fapesp#2015/16528-0, #2015/24300-9, and CNPq#306272/2017-2), their epistemological foundations and forms that they are being experienced in different scenarios.

# Digital Infrastructure Innovation Dynamics

## Computing in the Small, in the Large, and at Scale

Carsten Sørensen<sup>1,2,3</sup>

<sup>1</sup> Department of Management,  
London School of Economics and Political Science, UK

<sup>2</sup> University West, Sweden

<sup>3</sup> Halmstad University, Sweden

c.sorensen@lse.ac.uk

**Abstract.** Much data has sped through personal, local, and global data networks since Gore and Bangemann in the 1990 summarised the emergent importance of the Internet in terms of “The Information Superhighway” and “The Global Information Society”. It is difficult to succinctly characterise the changes global data communications have undergone since Tim Berners-Lee published the World Wide Web standard in 1991, and the first widely available Web Browser, Mosaic, followed in 1993. This talk will discuss digital innovation dynamics based on the emergent architecture of: (1) **Computing in the small** through an expanding mobile and ubiquitous device ecology; (2) **Computing in the large** network connectivity through machine-to-machine, personal, local, and global digital infrastructures; and (3) **Computing at scale**, where powerful data-centres engage in heavy-lifting computational tasks utilising the exponential growth in processing power, reduction in storage costs, and increasingly complex capabilities. Based on this architecture, the talk will draw up some of the findings from a series of multi-year studies on the dynamics of digital infrastructures, for example, their reconfiguration as multi-sided digital platforms serving smartphone content and services. A few notes will also be forwarded on the issue of distributed consensus mechanisms on top of digital infrastructures challenging the notion of platform centrality. The talk will be aimed at a broad Information Systems audience and will for the specially interested point towards recent, co-authored papers, published in Management Information Systems Quarterly (MISQ), Information Systems Research (ISR), Journal of Management Information Systems (JMIS), Journal of Information Technology (JIT), etc.

# Organisational Semiotics Viewed as an Institution: How, as a Science in the Organisational Sense, Can it Best Functions?

Ronald Stamper<sup>1,2,3</sup>

<sup>1</sup> Oxford OX3 7SL#38, UK

<sup>2</sup> London School of Economics and Political Science, UK

<sup>3</sup> University of Twente, The Netherlands

stamper.measur@gmail.com

**Abstract.** The English saying: “The cobbler’s child is the least well-shod.” reminds those skilled in any craft or profession to ensure that “their own house is in order” suggesting we might, devote a session during our own annual gathering to checking that our family members benefit from well-crafted semiosis. In lieu of the cobbler’s last, we have our methods of analysis and, for a hammer and tacks, we have our specification tools. I propose, therefore to use these tools on the bench (our meeting), firstly to examine our soles and then, if necessary, to repair them and to modernise them if desirable. Of course, we shall examine our media of communication and how well or ill we use them. Channel capacity matters and so do errors and how we recognise and correct them. The syntax of each language we use for recording and testing our hypotheses and theories probably relates most strongly to our specification languages, where the semantics of the terms we use obviously deserves close attention. Finding appropriate goal will influence strongly every communication of pragmatic force directing us toward a collective body of knowledge and skills, where, at the meta-level are the knowledge of our own conduct as scientists and the body of norms and social commitments that function as the “legislation” to govern our own conduct. I shall make some proposals, pose questions and, I hope, stimulate a productive debate, which should continue during the whole meeting to generate recommendations and even plans for consolidating our work and, perhaps, improve how we do it.

# Contents

## Organisational Semiotics: Theory and Application

Understanding the Boundary Between Information Systems and Organizational Semiotics: POS as Case Study. . . . .	3
<i>Manuel Ibarra, Emerson Ñahuinlla, Wilfredo Soto, Vladimiro Ibañez, Angel Navarro, and Waldo Ibarra</i>	
The Role of Language in Human Information Interaction: A Social Semiotic View. . . . .	12
<i>Enyun Li and Yinshan Tang</i>	
Building a Socio-Technical Perspective of Community Resilience with a Semiotic Approach . . . . .	22
<i>Lara S. G. Piccolo, Kenny Meesters, and Shadrock Roberts</i>	
Norm-Based Abduction Process (NAP) in Developing Information Architecture . . . . .	33
<i>Chekfoung Tan, Sara Abdaless, and Kecheng Liu</i>	
Extending Technology Acceptance Model for Proximity Mobile Payment via Organisational Semiotics. . . . .	43
<i>Yu-Chun Pan, Aimee Jacobs, Chekfoung Tan, and Sanaa Askool</i>	
Towards a Semiotic-Based Approach to the Design of Therapeutic Digital Games. . . . .	53
<i>Paula Maia de Souza, Kamila Rios da Hora Rodrigues, Franco Eusébio Garcia, and Vânia Paula de Almeida Neris</i>	
Intensive Innovation: A Semiotic View . . . . .	63
<i>Daniel Galarreta</i>	
Norm-Based Approach to Incorporate Human Factors into Clinical Pathway: Reducing Human Error and Improving Patient Safety . . . . .	73
<i>Jasmine Tehrani, Vaughan Michell, and Yu-Chun Pan</i>	
A Framework to Evaluate Semiotic Interoperability for Information Sharing . . . . .	83
<i>Shixiong Liu and Weizi Li</i>	
The Social Layer of Stampers Ladder: A Systematic Approach to the Soft Edge of Organizational Transformations. . . . .	94
<i>Auke J. J. van Breemen and Ralf Nieuwenhuijsen</i>	

A Hidden Power of Ontology Charts from Affordances  
to Environmental States . . . . . 105  
*José Cordeiro*

**Digital Business Ecosystems and Value Networks**

Exploring the Cloud Computing Loop in the Strategic Alignment Model . . . . . 117  
*Belitski Maksim, Fernandez Valerie, Khalil Sabine, Weizi Li,  
and Kecheng Liu*

A Framework for Assessing the Social Impact of Interdependencies  
in Digital Business Ecosystems. . . . . 125  
*Prince Kwame Senyo, Kecheng Liu, and John Effah*

Introducing the Strategy Lifecycle: Using Ontology and Semiotics  
to Interlink Strategy Design to Strategy Execution. . . . . 136  
*Jamie Caine and Mark von Rosing*

Role of Digitisation in Enabling Co-creation of Value in KIBS Firms . . . . . 145  
*Mona Ashok*

Cluster Nodes as a Unit for Value Co-creation: The Role of Information  
Technologies in Competitiveness of the Oil and Gas Industry. . . . . 155  
*Vitaly Ambalov and Irina Heim*

**Socially Aware Knowledge Engineering**

Unifying Speech and Computation . . . . . 167  
*Martin John Wheatman*

A Framework to Support the Design of Digital Initiatives in Social Science  
Based Research. . . . . 177  
*Stuart Moran, Sophie Berckhan, and Alison Clarke*

A Metamodel for Supporting Interoperability in Heterogeneous  
Ontology Networks . . . . . 187  
*Rodrigo Bonacin, Ivo Calado, and Julio Cesar dos Reis*

Enactive Systems and Children at Hospitals: For More Socially Aware  
Solutions with Improved Affectibility . . . . . 197  
*Elaine C. S. Hayashi, Roberto Pereira, José Valderlei da Silva,  
and M. Cecilia C. Baranauskas*

Design Practices and the SAwD Tool: Towards the Opendesign Concept. . . . . 208  
*José Valderlei da Silva, Roberto Pereira, Elaine C. S. Hayashi,  
and M. Cecilia C. Baranauskas*



Reformulating Requirements Modelling for Digitalisation: A Structuration and Semiotic Informed Approach . . . . . 218  
*Adrian Benfell and Zoe Hoy*

Getting it Right: A Model for Compliance Assessment . . . . . 228  
*Kwasi Dankwa and Keiichi Nakata*

First Steps in Developing Tangible Artifacts for All: Enabling Ideation and Discussion Processes . . . . . 238  
*Vanessa R. M. L. Maïke and M. Cecília C. Baranauskas*

Does It Pay to Be Socially Responsible for Construction Companies? . . . . . 248  
*Anupam Nanda*

**Business Intelligence and Analytics**

Method of Operational Activities and Processes Optimization Design in Architecture . . . . . 259  
*Xiaoxue Zhang, Aimin Luo, Gang Liu, and Junxian Liu*

Business Intelligence Architecture Informed by Organisational Semiotics . . . . . 268  
*John Effah, Prince Kwame Senyo, and Stephen Opoku-Anokye*

Chaotic Time Series for Copper’s Price Forecast: Neural Networks and the Discovery of Knowledge for Big Data . . . . . 278  
*Raúl Carrasco, Manuel Vargas, Ismael Soto, Diego Fuentealba, Leonardo Banguera, and Guillermo Fuertes*

An Abductive Process of Developing Interactive Data Visualization: A Case Study of Market Attractiveness Analysis. . . . . 289  
*Qi Li and Kecheng Liu*

Local Government Open Data (LGOD) Initiatives: Analysis of Trends and Similarities Among Early Adopters . . . . . 299  
*Eric Afful-Dadzie and Anthony Afful-Dadzie*

**Poster Papers**

Information Systems Governance and Industry 4.0 - Epistemology of Data and Semiotics Methodologies of IS in Digital Ecosystems . . . . . 311  
*Ângela Lacerda Nobre, Rogério Duarte, and Marc Jacquinet*

Value Co-creation and Local Content Development: Transformation, Digitalization and Innovation in the Oil and Gas Industry . . . . . 313  
*Irina Heim*

The Interplay of FDI and R&D: A Study in the Seven Developed Countries . . . . .	315
<i>Yutong Li</i>	
The Pattern of Foreign Direct Investment and International Trade: A Study of 30 OECD Countries from 1981 to 2015 . . . . .	318
<i>Yutong Li</i>	
<b>Author Index</b> . . . . .	321