

ADVANCES ON
INFORMATION
PROCESSING AND
MANAGEMENT

CONFERENCE ORGANIZERS INSTITUTES

The International Conference on Integrated Information is supported by the following Institutes:

Emerald Group Publishing Limited
Technological educational Institute of Athens, Greece
University of Peloponnese, Greece
National And Kapodistrian University of Athens, Greece
Mednet Hellas, The Greek Medical Network
2nd AMICUS Workshop

To learn more about I-DAS, including the Book Series, please visit the webpage
<http://www.i-das.org/>

INTEGRATED INFORMATION

International Conference on Integrated Information

Kos, Greece September, 29 – October, 3 2011

EDITORS

Georgios A. Giannakopoulos
Technological Educational Institute of Athens, Greece

Damianos P. Sakas
University of Peloponnese, Greece

All papers have been peer-reviewed



Piraeus, Greece, 2011

Editors

Georgios A. Giannakopoulos

Technological Educational Institute of Athens
Faculty of Management and Economics
Department of Library Science and Information Systems
Address: Aghiou Spyridonos Street, 12210, Egaleo
E-mail: gian@teiath.gr

Damianos P. Sakas

University of Peloponnese
Faculty of Science and Technology
Department of Computer Science and Technology
Address: End of Karaiskaki St., 22100, Tripolis, Greece
E-mail: D.Sakas@uop.gr

The copyrights will be owned by the authors under the Creative Commons Attribution-Non Commercial license (<http://creativecommons.org/licenses/by-nc/3.0/>), which permits unrestricted use, distribution, and reproduction in any non commercial medium, provided the original work is properly cited.

ISSN:

Printed in the Greece, EU

CONTENTS

PREFACE: Proceedings of the International Conference on Integrated Information (IC-INFO 2011)	1
Georgios A. Giannakopoulos, Damianos P. Sakas	
Conference Details	3
Keynote Speaker	5
SYMPOSIUM ON INFORMATION AND KNOWLEDGE MANAGEMENT	6
Prof. Christos Skourlas	
Towards the Preservation and Availability of Historical Books and Manuscripts: A Case Study	8
Eleni Galiotou	
An Extensive Experimental Study on the Cluster-based Reference set Reduction for Speeding-up the k-nn Classifier	12
Stefanos Ougiaroglou, Georgios Evangelidis and Dimitris A. Dervos	
Exploiting the Search Culture Modulated by the Documentation Retrieval Applications	16
Nikitas N. Karanikolas and Christos Skourlas	
Information and Knowledge Organization: The Case of the TEI of Athens	22
Anastasios Tsolakidis, Manolis Chalaris and Ioannis Chalaris	
Providing Access to Students with Disabilities and Learning Difficulties in Higher Education through a Secure Wireless framework	26
Catherine Marinagi and Christos Skourlas	
Improving Query Efficiency in High Dimensional Point Indexes	30
Evangelos Outsios and Georgios Evangelidis	
Text Segmentation Using Named Entity Recognition and co-Reference Resolution in Greek Texts	34
Pavlina Fragkou	
KINISIS, a Graphical XQuery Language	42
Euclid Keramopoulos, Achilleas Pliakas, Konstantinos Tsekos and Ignatios Deligiannis	
Dimensionality Curse, Concentration Phenomenon and the KDB-tree	46
Nikolaos Kouiroukidis and Georgios Evangelidi	

Applying Balanced Scorecard Strategic Management in Higher Education	50
Manolis Chalaris, Anastasios Tsolakidis and Ioannis Chalaris	
A Web Portal Model for NGOs' Knowledge Management	54
Zuhal Tanrikulu	
The Digital Archives System and Application Optimized for the Tradition Knowledge Archives	58
Jeon Hong. Chan, In Deok. Hwang, Jae Hak. Park, Hyeok. Sim, U won. Gwon and Soon Cheol. Park	
A Semi-automatic Emerging Technology Trend Classifier Using SCOPUS and PATSTAT	62
Seonho Kim, Woondong Yeo, Byong-Youl Coh, Waqas Rasheed, Jaewoo Kang	
Presenting a Framework for Knowledge Management within a Web Enabled Living Lab	66
Lizette de Jager and Albertus AK Buitendag and Potjie (JS) van der Walt	
4TH SYMPOSIUM ON BUSINESS AND MANAGEMENT AND DYNAMIC SIMULATION MODELS SUPPORTING MANAGEMENT STRATEGIES	71
Dr. Damianos Sakas	
New Political Communication Practices: No Budget Events Management. The New Challenge	73
Evangelia N. Markaki, Damianios P. Sakas and Theodore Chadjipantelis	
Free Software – Open Source Software. A Powerful Tool for Developing Creativity in the Hands of the Student	78
Nasiopoulos K. Dimitrios, Damianos P. Sakas, Konstantinos Masselos	
Open Source Web Applications. How it Spread Through the Internet and their Contribution to Education.	82
Nasiopoulos K. Dimitrios, Damianos P. Sakas, Konstantinos Masselos	
Culture in Modern Times in the Frame of Luhmann's System Theory	85
Anastasia J. Chournazidis	
Managing Scientific Journals: A Cultural Viewpoint	87
Marina C. Terzi, Damianos P. Sakas, and Ioannis Seimenis	
A Conceptual Framework for Analyzing Knowledge-based Entrepreneurship	92
Nikos S. Kanellos	

SESSION ON INFORMATION HISTORY: PERSPECTIVES, METHODS AND CURRENT TOPICS	96
Prof. Laszlo Karvalics	
Emerging Research Fields in Information History	98
Laszlo Z. Karvalics	
Information Management through Elementary Data Clusters: New Observations on Pridianum-Type Roman Statistical Documents	102
Gergő Gellérfi	
Information and Secrecy on the Silk Road. Methods of Encryption of Legal Documents in Inner Asia (3th-4th century)	106
Szabolcs Felföldi	
The Role of Information and Disinformation in the Establishment of the Mongolian Empire: A Re-examination of the 13th century Mongolian History from the Viewpoint of Information History	110
Márton Gergő Vér	
Early Warning Systems and the Hospitallers in the Eastern Mediterranean	114
Zsolt Hunyadi	
Information Management as Establishment Dutch Navigational Knowledge on Japan, 1608-1641	118
Gabor Szommer	
Files Everywhere - Register and Training of Men for Military and Civil Purpose in Prussia in the early 18th century	123
Marton Holczer	
SYMPOSIUM ON INTEGRATED INFORMATION: THEORY, POLICIES, TOOLS	126
Prof. Georgios Giannakopoulos	
Approaching Information as an Integrated Field: Educating Information Professionals	128
Georgios Giannakopoulos, Daphne Kyriaki Manesi and Stryidon Zervos	
Special Libraries as Knowledge Management Centers	132
Eva Semertzaki	
Digital Libraries' Developers and their Suitability: A Case Study	136
Maria Monopoli	

A Preliminary Study for the Creation of a Greek Citation index in the Humanities and the Social Sciences (GCI – H&SS)	140
Daphne Kyriaki-Manessi and Evi Sachini	
Archiving as an Information Science. Evidence from a Survey Carried out on a Sample of Greek Students	144
Georgios Giannakopoulos and Ioannis Koumantakis	
Transition Process of E-records Management and Archiving System in Universities: Ankara University	147
S. Özlem Bayram and Fahrettin Ozdemirci	
Government Information: Access and Greece's Efforts for Access	150
Aikaterini Yiannoukakou	
School Archives and their Potentials in Teaching: Aspects of Greek Reality	156
Sonia Geladaki and Panagiota Papadimitriou	
Research on School Libraries in Greece and Suggestions on its Further Development	160
Georgios D. Bikos	
Building Digital Collections for Archeological Sites: Metadata Requirements and CIDOC CRM Extension	164
Georgios S. Gkrous and Mara Nikolaidou	
Museological Claims to Autonomous Knowledge: Rethinking the Conceptual Mode of Display and its Claims to Knowledge	169
Assimina Kaniari and Georgios Giannakopoulos	
Use of Library Loan Records for Book Recommendation	172
Keita Tsuji, Erika Kuroo, Sho Sato, Ui Ikeuchi, Atsushi Ikeuchi, Fuyuki Yoshikane and Hiroshi Itsumura	
Developing a National Database on Librarianship and Information Science. The Case of E-VIVA, the Hellenic Fulltext Database	176
Filippos Ch. Tsimpoglou, Vasiliki V. Koukounidou and Eleni K. Sakka	
Integrated Access to Cultural Heritage Information Pieces in Iran Astan-Quds Razavi's Organization of Libraries, Museums and Documents Center: A Theory of Unionization Disparate Information Assets over Imam Reza's Zarih	181
Ms. Mitra Zarei and Ms. Maliheh Farrokhnia	
Attitudes of University Librarians and Information Scientists towards the Draft Code of	185

Library Ethics to Present a Model for Final Library Ethical Codes Mahsoomeh Latifi, Fatemeh Zandian and Hasan Siamian	
SESSION ON OPEN ACCESS REPOSITORIES: SELF-ARCHIVING, METADATA, CONTENT POLICIES, USAGE Dr. Alexandros Koulouris	188
Geographical Collections in Greek Academic Libraries: Current Situation and Perspectives Ifigenia Vardakosta and Sarantos Kapidakis	189
Information Seeking Behavior: Factors that Affect the Behavior of Greek Astronomers Hara Brindesi and Sarantos Kapidakis	194
Aggregating Metadata for Europeana: The Greek Paradigm Alexandros Koulouris, Vangelis Banos and Emmanouel Garoufallou	198
Integrating a Repository with Research Output and Publications: The Case of the National Technical University of Athens Dionysis Kokkinos	202
Implementation of Workflows as Finite State Machines in a National Doctoral Dissertations Archive Nikos Houssos, Dimitris Zavaliadis, Kostas Stamatis and Panagiotis Stathopoulos	205
Practices of “Local” Repositories of Legally Protected Immovable Monuments. A Global Scheme for ‘Designation – Significance’ Information Michail Agathos and Sarantos Kapidakis	209
Integration of Metadata in BWMETA-2.0.0 Format Katarzyna Zamlynska, Jakub Jurkiewicz and Lukasz Bolikowski	213
SESSION ON EVIDENCE-BASED INFORMATION IN CLINICAL PRACTICE Dr. Evangelia Lappa	216
Applicability of Data Mining Algorithms on Clinical Datasets Wilfred, Bonney	218
Changing Roles of Health Librarians with Open Access Repositories Christine Urquhar and Assimina Vlachaki	221
From Medical Records to Health Knowledge Management Systems: The Coding to Health Sector Evangelia C. Lappa and Georgios A. Giannakopoulos	225

The Survey of Skill, Attitude and Use of Computer and Internet among Faculty Members	229
Hasan Siamian, Azita Bala Ghafari, Kobra Aligolbandi, Mohammad Vahedi and Gholam Ali Golafshani Jooybari	
Trends in Scholarly Communication among Biomedical Scientists in Greece	232
Assimina Vlachaki and Christine Urquhart	
SESSION ON ELECTRONIC PUBLISHING: A DEVELOPING LANDSCAPE	236
Dr. Dimitris Kouis	
E-Journal and Open Access Journal Publishing in the Humanities: Preliminary Results from a Survey among Byzantine Studies Scholars	238
Victoria Tsoukala and Evi Sachini	
Preliminary Results on a Printed VS Electronic Text Books Assessment Through Questionnaire	242
Dimitrios A. Kouis and Kanella Pouli	
An Interpretation of Aristotelian Logic According to George Boole	246
Markos N. Dendrinis	
SESSION ON INFORMATION CONTENT PRESERVATION AS OUTCOME OF CONSERVATION OF CULTURAL HERITAGE: ETHICS, METHODOLOGY AND TOOLS	251
Prof. George Panagiaris and Dr. Spiros Zervos	
Intrinsic Data Obfuscation as the Result of Book and Paper Conservation Interventions	254
Spiros Zervos, Alexandros Koulouris and Georgios Giannakopoulos	
Mass Deacidification: Preserving More than Written Information	258
Michael Ramin, Evelyn Eisenhauer and Markus Reist	
Information Literacy of Library Users: A Case Study of Mazandaran Public Library Users, Iran	260
Hussein Mahdizadeh and Hasan Siamian	
The Narratives of Paper in The Archives of the New Independent Greek State (Mid 19th c.)	264
Ourania Kanakari and Maria Giannikou	
From Macro to Micro and from Micro to Nano: The Evolution of the Information Content Preservation of Biological Wet Specimen Collections	268
Nikolaos Maniatis and Georgios Panagiaris	

Digital images: A valuable scholar's tool or misleading material?	272
Patricia Engel	
Attitudes of University Librarians and Information Scientists Towards the Draft Code of Library Ethics to Present a Model for Final Library Ethical Codes	277
Mahsoomeh Latifi, Fatemeh Zandianand and Hasan Siamian	
Investigation of the Degradation Mechanisms of Organic Materials: From Accelerated Ageing to Chemometric Studies	280
Ekaterini Malea, Effie Papageorgiou and Georgios Panagiaris	
SESSION ON DIVERGENCE AND CONVERGENCE: INFORMATION WORK IN DIGITAL CULTURAL MEMORY INSTITUTIONS	285
Dr. Susan Myburgh	
Extending Convergence and Divergence in Cultural Memory Institutions: The Old Slave Lodge in the New South Africa	287
Archie L Dick	
The Transfer of Knowledge from Large Organizations to Small: Experiences from a Research Project on Digitization in Wales	289
Clare Wood-Fisher, Richard Gough, Sarah Higgins, Menna Morgan, Amy Staniforth and Lucy Tedd	
The Usage of Reference Management Software (Rms) in an Academic Environment : A Survey at Tallinn University	293
Enrico Francese	
Varialog : How to Locate Words in a French Renaissance Virtual Library	297
Marie-Hélène Lay	
The Urge to Merge: A Theoretical Approach	301
Susan Myburgh	
SYMPOSIUM ON ADVANCES INFORMATION FOR STRATEGIC MANAGEMENT	304
Professor Nikolaos Konstantopoulos	
Empowerment in the Tax Office of Greece	306
Antonios E. Giokas and Nikolaos P. Antonakas	
Building Absorptive Capacity Through Internal Corporate Venturing	310
Ioannis M. Sotiriou and Alexandros I. Alexandrakis	

The Monitoring Information System (M.I.S.) - An information and Management System for Projects Co-financed Under the National Strategic Reference Framework (NSRF) and the Community support framework (CSF)	314
Catherina G. Siampou, Eleni G. Fassou and Athanassios P. Panagiotopoulos	
Corruption in Tax Administration: The Entrepreneurs View Point	318
Nikolaos P. Antonakas, Antonios E. Giokas and Nikolaos Konstantopoulos	
Conflicts between the IT Manager and the Software House after the Strategic Choice of Outsourcing of the Information Processes in Maritime Companies.	322
Anthi Z. Vaxevanou, Nikolaos Konstantopoulos, Damianos P. Sakas	
Contemporary Forms of Ordering Between the Supply Department and Ship Chandler Companies in the Shipping Industry	325
Anthi Z. Vaxevanou, Nikolaos Konstantopoulos, Damianos P. Sakas	
Strategies Implemented and Sources Used for the Acquisition of Information on Foreign Markets	329
Myropi Garri, Nikolaos Konstantopoulos and Michail G. Bekiaris	
The Effect of High Performance Working Systems on Informative Technology in Enterprises after Organisation Changes such as Mergers & Acquisitions	333
Nikolaos Konstantopoulos and Yiannis Triantafyllopoulos	
Personnel's Absorptive Capacity as a Guiding Concept for Effective Performance in Informative Technology	337
Nikolaos Konstantopoulos and Yiannis Triantafyllopoulos	
SESSION ON CONTEMPORARY ISSUES IN MANAGEMENT: ORGANISATIONAL BEHAVIOUR, INFORMATION TECHNOLOG, EDUCATION & HOSPITAL LEADERSHIP	341
Dr. Panagiotis Trivellas	
Investigating the Importance of Sustainable Development for Hotel SMES	343
Panagiotis Reklitis and Anestis Fotiadis	
Strategic Alignment of ERP, CRM and E-business: A Value Creation	347
Catherine C. Marinagi and Christos K. Akrivos	
The Impact of Occupational Stress on Performance in Health Care	351
Panagiotis Trivellas Panagiotis Reklitis and Charalambos Platis	

The Impact of Emotional Intelligence on Job Outcomes and Turnover Intention in Health Care	356
Panagiotis Trivellas Vassilis Gerogiannis and Sofia Svarna	
SYMPOSIUM ON BUSINESS MANAGEMENT AND COMMUNICATION STRATEGIES SUPPORTING DECISION MAKING PROCESS IN TOURISM SECTOR	360
Dr. Panagiota Dionysopoulou	
The Human Factor as a Mediator to the Total Quality in the Tourism Companies. The impact of Employees' Motivation to Quality Improvements	362
Christos K. Akrivos and Panagiotis Reklitis	
Tourist Destination Marketing and Management Using Advanced ICTS Technologies	365
Anastasia Argyropoulou, Panagiota Dionyssopoulou, Georgios Miaoulis	
G.N.T.O. (Greek National Tourism Organization) Communication Strategy in Advertising Campaigns 1991-2006	370
George Stafylakis and Panagiota Dionyssopoulou	
GENERAL PAPERS	375
The role of Environmental Education within the Framework of the Environmental Policy of a Regional Municipality	376
Vassiliki Delitheou and Dimitra Thanasia	
Issues of Social Cohesion: A case study from the Greek Urban Scenery	380
Evgenia Tousi	
Merging Activity and Employee Performance: The Greek Banking System	384
Panagiotis Liargovas and Spyridon Repousis	
Sustainable Development and Corporate Social Responsibility in Higher Education: Some Evidence from Greece	387
Anastasios Sepetis and Fotios Rizos	
Exploring the Effects of Organizational Culture on Collaborative vs. Competitive Knowledge Sharing Behaviors	395
Hanan Abdulla Mohammed Al Mehairi and Norhayati Zakaria	

Preface: Proceedings of the International Conference on Integrated Information (IC-ININFO 2011)

GEORGIOS A. GIANNAKOPOULOS

Department of Library Science and Information Systems, Technological Educational Institute of Athens, Aghiou Spyridonos, Egaleo, 12210, Greece

DAMIANOS P. SAKAS

Department of Computer and Technology Science, University of Peloponnese, Praxitelous 89-91, Piraeus, 18532, Greece

Aims and Scope of the Conference

The International Conference on Integrated Information 2011 took place in Kos Island, Greece, between September, 29 and October, 3, 2011. IC-ININFO is an international interdisciplinary conference covering research and development in the field of information management and integration.

The conference aims at creating a forum for further discussion for an Integrated Information Field incorporating a series of issues and/or related organizations that manage information in their everyday operations. Therefore, the call for papers is addressed to scholars and/ or professionals of the fields of Library and Archives Science (including digital libraries and electronic archives), Museum and Gallery Studies, Information Science, Documentation, Information Management, Records Management, Knowledge Management, Data management and Copyright experts the latter with an emphasis on Electronic Publications. Furthermore, papers focusing on issues of Cultural Heritage Management and Conservation Management are also be welcomed along with papers regarding the Management of Nonprofit Organizations such as libraries, archives and museums.

One of the primary objectives of the IC-ININFO will be the investigation of information-based managerial change in organizations. Driven by the fast-paced advances in the Information field, this change is characterized in terms of its impact on organizations that manage information in their everyday operations.

Grouping emerging technologies in the Information field together in a close examination of practices, problems and trends, IC-ININFO and its emphases on integration and management will present the state of the art in the field. Addressed jointly to the academic and practitioner, it will provide a forum for a number of perspectives based on either theoretical analyses or empirical case studies that will foster dialogue and exchange of ideas.

Topics of general Interest

Library Science, Archives Science, Museum and Gallery Studies, Information Science, Documentation, Digital Libraries, Electronic Archives, Information Management, Records / Document Management, Knowledge Management, Data Management, Copyright, Electronic Publications, Cultural Heritage Management, Conservation Management, Management of Nonprofit Organizations, History of Information, History of Collections, Health Information

Symposia

The Conference offered a number of sessions under its patronage, providing a concise overview of the most current issues and hands-on experience in information-related fields.

- Symposium on Integrated information: Theory, Policies, Tools
- 4th Symposium on Business and Management and Dynamic Simulation Models supporting management strategies

- Session on Open Access Repositories: Self-archiving, Metadata, Content policies, Usage
- Session on Evidence-Based Information in Clinical Practice
- Session on Business Management and Communication Strategies supporting Decision Making Process in Tourism Sector
- Session on Electronic Publishing: A Developing Landscape
- Session on Information and Knowledge Management
- Session on Information Content Preservation as Outcome of Conservation of Cultural Heritage: Ethics, Methodology and Tools
- Session on Advances Information for Strategic Management
- Session on Information History: Perspectives, Methods and Current Topics
- Session on Divergence and Convergence: Information Work in Digital Cultural Memory Institutions
- Session on Contemporary issues in Management: Organisational Behaviour, Information Technology, Education & Hospital leadership.

The wide range of aspects that the sessions covered, highlighted future trends in the Information Science.

Paper Peer Review

More than 300 papers had been submitted for consideration in IC-ININFO 2011. From them, 91 were selected for presentation, after peer review in a double blind review process. The accepted papers were presented at IC-ININFO 2011.

Thanks

We would like to thank all members that participated in any way in the IC-ININFO 2011 Conference and especially:

- The famous publishing house Emerald for its communication sponsorship.
- The co-organizing Universities and Institutes for their support and development of a high-quality Conference scientific level and profile.
- The members of the Scientific Committee that honored the Conference with their presence and provided a significant contribution to the review of papers as well as for their indications for the improvement of the Conference.
- All members of the Organizing Committee for their help, support and spirit participation before, during and after the Conference.
- The Session Organizers for their willing to organize sessions of high importance and for their editorial work, contributing in the development of valued services to the Conference.
- PhDC Marina Terzi for her excellent editorial work, contributing in the production of the Conference proceedings.

CONFERENCE DETAILS

Chairs

Georgios A. Giannakopoulos, Technological Educational Institute of Athens, Greece
Damianos P. Sakas, University of Peloponnese, Greece

Co-Chairs

Daphne Kyriaki – Manesi, Technological Educational Institute of Athens, Greece
Dimitrios Vlachos, University of Peloponnese, Greece

Scientific Committee

Amanda Spink, Queensland University of Technology
Andreas Bagias, European Court
Andreas Rauber, Vienna University of Technology
Astrid van Wesenbeeck, SPARC Europe
Christine Urquhart, Aberystwyth University
Christos Schizas, University of Cyprus
Christos Skourlas, Technological Educational Institute of Athens
Claire Farago, University of Colorado at Boulder
Claus-Peter Klas, FernUniversität in Hagen
Costas Vassilakis, University of Peloponnese,
Dimitris Dervos, Technological Educational Institute of Thessaloniki
Eelco Ferwerda, OAPEN
Elena Garcia Barriocanal, University of Alcalá
Emmanuel Garoufallou, Technological Educational Institute of Thessaloniki
Filippos Tsimpoglou, University of Cyprus
Fillia Makedon, University of Texas at Arlington
George Korres, University of Newcastle
Georgios Evangelidis, University of Macedonia
Georgios Panagiaris, Technological Educational Institute of Athens
Johan Oomen, Netherlands Institute for Sound and Vision
José Aldana, University of Malaga
Konstantinos Masselos, University of Peloponnese
Luciana Duranti, The University of British Columbia
Markos N. Dendrinis, Technological Institute of Athens
Milena Dobрева, University of Strathclyde
Prodromos Tsiavos, London School of Economics and Political Science
Sándor Darányi, University of Borås
Sarantos Kapidakis, Ionian University
Sirje Virkus, Tallinn University
Spiros Zervos, Technological Educational Institute of Athens
Susan Myburgh, University of South Australia
Theodoros Pitsios, University of Athens, Faculty of Medicine

Organizing Committee

Alexandros Koulouris (Chair), Technological Educational Institute of Athens
Christos Christopoulos, SCEV Scientific Events Ltd
Marina Terzi, University of the Aegean, Greece
Evangelia Markaki, Aristotle University of Thessaloniki

Assimina Kaniari, Athens School of Fine Arts
Evangelia Lappa, General Hospital Attikis K.A.T.
Dimitris Kouis, Greek Ministry of Education, Lifelong Learning and Religious Affairs
Dionysis Kokkinos, National Technical University of Athens

KEYNOTE SPEAKER



Professor Amanda Spink

Professor Amanda Spink has published over 340 scholarly journal articles, refereed conference papers and book chapters, and 6 books. Many of her journal articles are published in the Journal of the American Society for Information Science and Technology, Information Processing and Management, and the Journal of Documentation. She is Editor of the Emerald journal Aslib Proceedings. Amanda's research has been published at many conferences including ASIST, IEEE ITCC, CAIS, Internet Computing, ACM SIGIR, and ISIC Conferences. Her recent books include Information Behavior: An Evolutionary Instinct and Web Search: Multidisciplinary Perspectives, both published by Springer. Amanda's research focuses on theoretical and empirical studies of information behavior, including the evolutionary and developmental foundations. The National Science Foundation, the American Library Association, Andrew R. Mellon Foundation, Amazon.com, Vivisimo. Com, Infospace.com, NEC, IBM, Excite.com, AlltheWeb.com, AltaVista.com, FAST, and Lockheed Martin have sponsored her research. In 2008 Professor Spink had the second highest H-index citation score in her field from 1998 to 2008 [Norris, M. (2008)]. Ranking Fellow Scholars and their H-Index: Preliminary Survey Results. Loughborough University, Dept of Information Science Report].

Building Digital Collections for Archeological Sites: Metadata Requirements and CIDOC CRM Extension

Georgios S. Gkrous[‡] and Mara Nikolaidou[†]

[†]*Department of Informatics and Telematics, Harokopio University of Athens, 17671, Athens, Greece.
mara (at) hua.gr*

[‡]*Department of Library Science and Information Systems, TEI of Athens, 12210, Athens, Greece
gtgkrous (at) yahoo.gr*

Abstract: *Cultural heritage information management and provision can be improved by the usage of Internet and related technologies. The research effort presented in this paper focuses on the creation of a digital collection representing an archeological site. Such a collection is composed of digital entities representing monuments and describing them using proper metadata. Such a metadata model should provide information for the monuments, ease the visitation of the site by Internet users and promote it. It can be based on CIDOC CRM, which is a formal ontology for the uniform description of cultural resources. CIDOC CRM's specification focuses on museum documentation, thus it is necessary to extend the ontological model to effectively describe archeological sites, emphasizing spatial characteristics and facilitating the integration of the archeological site monuments with exhibits hosted in other sites, for example museums. Thus, metadata fields describing the structure of physical objects, e.g. monuments, and spatial and conceptual correlations between exhibits are explored.*

Keywords: *Digital collection, CIDOC-CRM, Ontology, Cultural heritage, Archeological site*

I. INTRODUCTION

Utilizing information and communication technology (ICT) to promote cultural heritage remains a hot topic (Papaconstantinou, 2008). The explosion of Internet usage indicated an alternative way to advertise the visitation of archeological sites and museums significant to every nation's history. Therefore, especially for countries such as Greece being characterized by cultural richness, promoting archeological sites by enhancing their digital presence on the Web is a task of significant importance.

Information regarding a visit to an archeological site can be categorized to pre-visit and during-visit data (British Museum, 2006). Pre-visit information is usually provided via tourist guides or a Web site, targeting to attract and provoke all interested people to actually visit the site. During-visit information consists of the material used to ease the visitor's walk around in the site and enhance his/her experience by additional information. Special brochures, which include a site map and a short description of all monuments, or audio devices, playing recorded messages related to the monument in multiple languages according to input keys, are usually available. Such tools have specific restrictions. Few pages of a

tourist guide or general data displayed on a web page may not be considered as satisfying by the interested visitor. In such case, he/she may search for additional information after the visit has ended. The attendance of professional guided tours is always an alternative, but as the technology has penetrated every day life, the usage of mobile devices as smart phones, may be considered as a way to provide information to visitor during the visit. In such case, advanced navigation services around the site may be provided along with all kinds of information regarding monuments and exhibits that might be moved away from the site for numerous reasons (for example preservation, security, etc).

A world wide trend is observed regarding the use of telecommunications in the cultural field. Related research efforts exposing the benefits of such cooperation are the creation of a cultural information network on Canada (CHIN), the virtual outdoor museum in Latvia and the preservation of English and French landscapes using image processing (Hemsley *et al.*, 2005).

The benefits of exploring ICT to promote cultural heritage are expressed by the numerous research projects conducted all over the world. This effort is supported by European funded projects regarding digital libraries, digitalization techniques and Internet archives. Digital cultural experiences field refers to the exploitation of edge technology tools for increasing the knowledge and experiences that cultural heritage sources (museums and archeological sites) share to the public and is explored by projects are ARTSENSE, CINeSPACE and CHESS (European Commission, 2011).

Regarding faced restrictions on a archeological site, by using new technologies it is feasible to represent a monument in a digital form and portray its original or current shape (visualization, animation) (Vlachakis *et al.*, 2001). Furthermore, multiple geographical and conceptual connections between monuments can be established in order to present an integrated aspect of History (for example objects with the same creator or similar use). Advanced services such as navigation for mobile users can be provided guiding visitors among the site's monuments (Bonfanti *et al.*, 2007) and giving all additional information according to their position. The provision of such a service can be facilitated by the creation of a digital collection for archeological site, utilizing digital library technology. The collection should contain monument related information and enable navigation. Additional material, for example digital animations representing monuments in their original form, as well as

digital representations of their current state, may also be included. The digital collection may be useful as during-visit, pre-visit and post-visit data, since it might constitute a continuous source of information for the visitor. Museums, for example the Hermitage Museum in St. Petersburg (http://www.hermitagemuseum.org/html_En/12/hm12_0.html) or the Tate Gallery in London (<http://www.tate.org.uk/collection/>) have successfully employed such projects during the last decade.

Such digital collections should be described in a common fashion, supporting their integration in larger collections, as Europeana pan-european cultural digital collection (<http://www.europeana.eu/portal/>), and enable searching their content in a unified fashion. Thus, CIDOC Conceptual Reference Model was proposed by the International Committee for Documentation (CIDOC) of the International Council of Museums (ICOM), as a formal ontology created to support information exchange between heterogeneous cultural sources.

In this paper, we explore the potential of building a digital collection for an archeological site, focusing on digital object structure to depict monuments and the metadata requirement for their efficient description. The adoption of CIDOC CRM is suggested for this purpose, while the proposed extensions are discussed.

II. DIGITAL COLLECTION CHARACTERISTICS

The creation of a digital collection for an archeological site and the rendering of an advanced navigation service using its material is the focus of our effort. Every monument will be represented by a digital entity described by all related data. Multiple connections between objects of the same site (spatial relations) and between objects that are placed on another site or museum (conceptual relations) must be supported. The provision of the advanced navigation service relies upon maintaining all necessary information related to monuments (Gavalas *et al.*, 2005). The benefits of such an effort relate to both the strengthening of the site's digital presence (pre-visit information) and the improvement of services' quality when visiting the site (during-visit information).

The information structure and management must be conducted taking into consideration information heterogeneity, principles of semantic web, simplification of information and interoperability (Ravindranathan, 2004). For this purpose, we identified the requirements the supported metadata scheme should satisfy and explore the potential of using CIDOC CRM.

III. METADATA FOR ARCHEOLOGICAL SITES

A. CIDOC Conceptual Reference Model

The CIDOC Conceptual Reference Model is the outcome of a long term development work carried out by the International Committee for Documentation (CIDOC) of the International Council of Museums (ICOM). Since 2000, the development group responsible for CIDOC, named CIDOC CRM Special Interest

Group, in collaboration with ISO aims to form an international standard (ICOM/CIDOC, 2010).

The main objective of CIDOC CRM is to provide all the semantic clarifications in order to allow the enlargement of local resources to global ones. It provides a formal language concerning cultural heritage, especially museum documentation, for the definition of data relations. It aims to be used as a guide for all interested parties, when structuring and relating cultural information assets, to support associative queries by providing a basic model of associations and to ensure that the implementation of data transformation algorithms will be performed without loss of meaning. The intended scope of CRM is to cover not only museum but all types of collections (arts, archeology, ethnography) and contribute to the harmonization between cultural information, libraries and archives.

The CIDOC CRM model contains classes, properties and inheritance rules. Classes and properties can be identified by their initial code (E for classes and P for properties). By its structure, CRM model is extensible and users are encouraged to create new instances according to their needs (Cripps *et al.*, 2004). The latest released version (Version 5.0.2 January 2010), CIDOC CRM includes 90 classes and 148 properties.

An example representing reasoning about spatial information is shown in Fig.1. The relations between main classes and their subclasses are shown as arrows and properties as rectangles. An exhibit represented by Physical Thing is connected to Place via the action-property Has current location. Place can be identified by Place Name, Address or Spatial Coordinates.

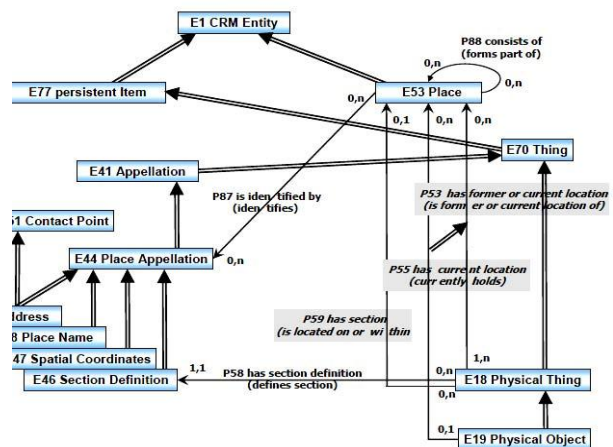


Figure 1. CIDOC CRM spatial information

B. Metadata Requirements

In a digital collection for an archeological site, every monument is represented using a digital object (complex or simple), which encompasses all related information and corresponding connections with the other monuments. The set of digital objects constitute the digital collection of the archeological site. All the information required to fully describe each monument are grouped into two basic categories: *Physical Info*, related

to the monument as perceived in the physical world and *Digital Representation Info*, related to the digital representation of the monument. Each of them, is further decomposed into subcategories, as represented in Fig.2 based on CIDOC CRM concepts and notation.

Subcategories of information consist of metadata, describing the monument or its digital representation and digital material representing the monument. They are discussed in the following:

- *Structural info*: It is divided into two subsets specifying whether the object is part of a monument (Part Of info) or it is contained by/contains other exhibits (Contain Info). The introduction of these relations is necessary for sufficient description of situations, which are very common in cultural heritage, where a monument is divided into constituents or it may contain other artifacts, as sculptures. The location of digital object parts should be specified. This way, in the case where a sculpture found within a building during the excavation of the site is moved to a museum, the visitor may be informed and have access to it during his/her visit in the site.
- *General info*: It contains descriptive info about the exhibit regarding its creator, its cause of creation, its use, the submitted procedures (excavation, reconstruction, restoration, modification) and the responsible persons that have performed these actions, the historic periods that all actions have taken place, the material, the used tools and its owner.

- *Multimedia info*: It is composed of two subsets (images and videos). The subset of Images includes digital processed images that show the original or current form of the exhibit and contribute to an integrated aspect of the object through visualization. The subset of Videos is a gallery of video files from excavation, object modifications and animated representations, related to the monument.

- *Correlation info*: It is consisted of two subcategories that refer to geographical and conceptual correlations (*Spatial info*, *Conceptual info*). The set of spatial information include navigation data to all objects that belong to the monument's surroundings and the corresponding path to be followed. The path is defined by parameters as direction, distance and height that can be processed by a geographical information system (GIS) for assisting the provision of the navigation service (Coors, 2004).

The conceptual information includes links to all objects that are semantically related to the specific monument and their location (other archeological site or museum). Additionally, the reason of objects' similarity is provided, for example they belong to the same collection, they have the same creator or use. The role of this set is quite significant, since conceptually related objects contribute to visitors' understanding of the historical sequence.

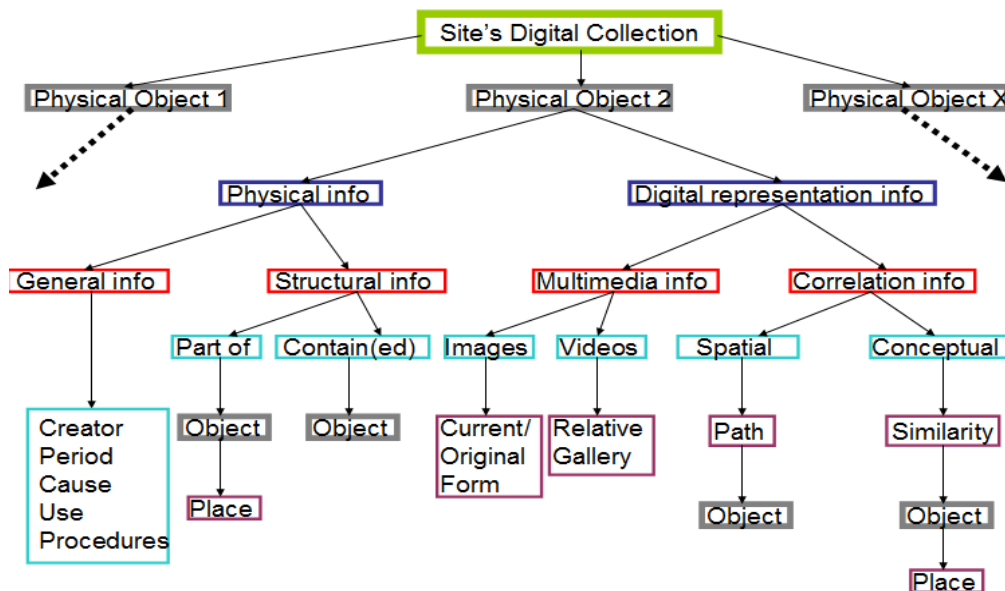


Figure 2. Metadata categories describing archeological monuments

C. CIDOC CRM extension

CIDOC CRM provides concepts for description of museum areas. Supported classes and properties facilitate the administration of museum's content. In the case of an archeological site, CIDOC CRM may support the presentation of some constituents, but is not adequate for the representation of all the information depicted in

Fig.2. In order to overcome these restrictions, we suggest the extension of the model, focused on certain directions.

Detailed classes should be introduced regarding the procedures an object is submitted to (related to General info). Current entities supported by CIDOC for this purpose are Activity, Modification and could be enriched with Excavation, Reconstruction and Restoration. Fur-

thermore, new classes must be added for multimedia data including relative videos and images presenting the current/original form of the exhibit.

Important extensions concern structural and correlation information. Since CIDOC CRM was developed for museum oriented purposes, it does not provide the tools for the exploration of the way an artifact is related to its surroundings. Object's structural data representation is limited by two basic restrictions. Firstly, there are no instances to sufficiently represent a physical artifact as a part of a larger monument (for example a part of Parthenon's aetoma). Furthermore, there is no adequate representation of exhibits being contained by other exhibits (for example the artifacts of an ancient arcade). These circumstances are very commonly met on an archeological site and must be effectively represented in the digital world. New classes and properties must be created to specify, if the object is a part of another one, and also allocate the remaining parts. Similar actions will be performed for detailed description of objects containing or being contained by other objects (addition of contain(ed) tag and connection with the other object). Concerning spatial correlations, CIDOC CRM current release contains only one entity (spatial coordinates) for the definition of object's position. New classes and properties must be defined specifying the surroundings (objects that are in a close distance) of each exhibit and the path that should be followed. Path class will have Direction, Distance and Height as subclasses. This procedure defines a unique path between two objects which is very important for GIS system and the navigation service. Conceptual relations are also not supported by the latest release of CIDOC CRM. New entities and actions must be created to relate similar objects and simultaneously specify the reason of similarity and the location of objects that do not belong to the site.

IV. CONCLUSIONS – FUTURE WORK

The proposed research targets the creation of digital collections for archeological sites supporting pre-visit and during-visit experience. It facilitates the navigation of the visitor on site using a smart mobile phone and enhances the visitor's experience.

Compared to already developed museum navigation services (Cosley *et al.*, 2009), it supports a wider range of provided information, by supporting interrelations to exhibits placed on another site or museum, exceeding the strict boundaries of the archeological site. A wider cultural heritage source is created in order to fulfill all visitor's learning needs.

Digital content organization and management is performed by the usage of the CIDOC CRM ontology model, thus it is extended to describe archeological sites. Metadata requirements for the creation of the proposed digital collection for archeological sites were documented and corresponding CIDOC CRM extensions were identified. New classes and properties must be added to describe structural and correlation

information.

We are currently on the detail definition of an ontological model based on CIDOC CRM and its application on an archeological site. The metadata model will be assessed and technical specifications for its support and provision of the advanced navigation service will be defined.

REFERENCES

- [Bonfanti C., Chiabrando F. and Spano A., "Studies and knowledge fusion in archaeological site maps managed in a 3D GIS", *XXI International CIPA Symposium, 01-06 October, Athens \(2007\)*.](#)
- [British Museum, "Tours of adult ESOL students", \[http://www.britishmuseum.org/pdf/pre-visit%20information%20for%20class%20tutors_aug06.pdf\]\(http://www.britishmuseum.org/pdf/pre-visit%20information%20for%20class%20tutors_aug06.pdf\) \[retrieved 29 July 2011\].](#)
- [Coors, V., "Using Wearable GIS in outdoor applications", *Extended Abstract on International Workshop for Inter-active Applications of Mobile Computing, Germany \(2004\)*.](#)
- [Cosley D., Baxter J., Lee S., Alson B., Nomura S., Adams P., Sarabu C. and Gay C., "A Tag in the Hand: Supporting Semantic, Social and Spatial Navigation in Museums", *Proceedings of the 27th international conference on Human factors in computing systems, Boston \(2009\)*.](#)
- [Cripps P., Greenhalgh A., Fellows D., May K. and Robinson D., "Ontological Modelling of the work of the Centre for Archaeology", *CIDOC CRM Technical papers \(2004\)*.](#)
- [European Commission, "ICT Research in FP7", \[http://cordis.europa.eu/fp7/ict/telearn-digicult/digicult-projects_en.html\]\(http://cordis.europa.eu/fp7/ict/telearn-digicult/digicult-projects_en.html\) \[retrieved 15 July 2011\].](#)
- [Fox E., Gonçalves M., Watson L. and Kipp N., "Streams, structures, spaces, scenarios, societies \(5s\): A formal model for digital libraries", *ACM Trans. Inf. Syst.*, vol.22, pp. 270-312 \(2004\).](#)
- [Gavalas D. and Economou D., "Development Platforms for Mobile Applications: Status and Trends", *Department of Cultural Technology & Communication, IEEE Software*, 28\(1\), 77-86, Mytilene, Lesvos, Greece \(2010\)](#)
- [Hemsley J., Cappellini V. and Stanke G., "Digital Applications for Cultural and Heritage Institutions", Chapter 1, Introduction and International Overview \(2005\).](#)
- [ICOM/CIDOC Documentation Standards Group, "Definition of the CIDOC Conceptual Reference Model", <http://www.cidoc-crm.org/index.html>, \[retrieved 20 July 2011\].](#)
- [Papaconstantinou D., "The materiality of cultural information and its absence: Digital curation from an archaeological perspective", *2008 Annual Conference of CIDOC, Athens \(2008\)*.](#)
- [Ravindranathan U., "Prototyping Digital Libraries Handling Heterogeneous Data Sources - An ETANA-DL Case Study". *Masters Thesis*.](#)

Computer Science, Virginia Tech (2004).
Vlahakis V., Ioannidis M., Karigiannis J. et al.
“AR- CHEOGUIDE: First results of an Augmented
Reality, Mobile Computing System in Cultural
Heritage Sites”, *Proceedings of VAST (2001).*