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Formal Ontology in Information Systems

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Preface

This volume collects articles presented at the 7th edition of the International Conference on Formal Ontologies in Information Systems (FOIS 2012). This edition of this bi-annual conference was held in conjunction with the 3rd edition of the International Conference on Biomedical Ontologies (ICBO 2012), in Graz, Austria.

We received 71 submissions from all continents, in particular, from authors affiliated with institutions in countries such as Algeria, Australia, Austria, Brazil, Canada, China, France, Germany, Hong Kong, Ireland, Italy, Japan, Mexico, Norway, Poland, Russia, Senegal, Singapore, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, United States and United Kingdom. All submissions were carefully reviewed by the members of our international program committee. Based on the reviews, 24 articles were chosen for presentation at the conference. Accepted submissions were organized into 8 sessions: Ontologies and Bioinformatics; Ontologies of Physical Entities; Ontological Aspects of Artifacts and Human Resources; Methodological Aspects of Ontological Engineering; Ontology Evaluation; Ontology, Language and Social Relations; Ontological Aspects of Time and Events; Aspects of Ontology Representation. The wide range of topics addressed in these sessions demonstrates that formal ontology is an active area of research which addresses problems ranging from theoretical questions regarding the ontology of time to the applications in the sciences and engineering.

Ontologies and Bioinformatics: in the first paper in this session entitled *Probability assignments to dispositions in ontologies*, Adrien Barton, Anita Burgun and Régis Duvauferrier investigate the probabilistic dimension of dispositions, with a particular interest on Biomedical ontologies. The authors investigate the determination of which kinds of dispositional entities (individuals, universals, both) a probability value can be assigned to; in *Maturation of Neuroscience Information Framework: An Ontology Driven Information System for Neuroscience*, Fahim T. Imam and colleagues discuss the main ontology-based components of the Neuroscience Information Framework (NIF). In the context of the NIF project, the ultimate end product is a semantic search engine and knowledge discovery portal that provides federated access to a vast amount of Neuroscience data and resources over the web. Finally, in *Suggestions for Galaxy Workflow Design Using Semantically Annotated Services*, Alok Dhamanaskar and colleagues propose an extension of the Galaxy open-source web-based framework to assist the user in the construction of Service-based Scientific Workflows. The work is based on proposed extensions to the Ontology for Biomedical Investigations (OBI) which are intended to provide a base for the semantic annotation of Web Services.

Ontologies of Physical Entities: in *The Void in Hydro Ontology*, Torsten Hahmann and Boyan Brodaric extend the DOLCE foundational ontology to a logical theory aimed at representing specific aspects of the physical containment of water studied in hydrology. More specifically, they address the notion of void – empty spaces that can be filled with water; in *The mysterious appearance of objects*, Emanuele Bottazzi, Roberta Ferrario and Claudio Masolo present a constructivist approach to objects. This approach aims at making explicit how objects can be constructed as from the outcome of an apparatus, being it a measurement instrument or our perceptual system, discussing what are the ontological and representational problems faced by such an approach;

finally, in *Towards Making Explicit the Ontological Commitment of a Database Schema on the Geological Domain*, Alda Maria Ferreira Rosa da Silva and Maria Cláudia Cavalcanti propose an approach which combines a set of reverse engineering techniques and the use of a top-level ontology as a way of making explicit the ontological commitment of a conceptual database schema. The proposal combines the OntoClean methodology and the OntoUML meta-categorization in a set of methodological guidelines aimed at producing higher-quality models to support tasks of interoperability and database integration.

Ontological Aspects of Artifacts and Human Resources: In the paper entitled *An Ontology for Skill and Competency Management*, Maryam Fazel-Zarandi and Mark S. Fox present a formal PSL-based ontology for representing, inferring, and validating skills and competencies of Human Resources in a dynamic environment; in *Towards A Unified Definition of Function*, Riichiro Mizoguchi, Yoshinobu Kitamura and Stefano Borgo build on an existing ontological definition of Artifact Functions, generalizing this notion to provide a general unified definition of functions aimed at characterizing both Biological Organisms and Technical Artifacts. Finally, in *Preliminaries to a formal ontology of failure of engineering artifacts*, Luca Del Frate advances a conceptual analysis of the notion of failure in engineering. The paper propose three different notion of failures which are intended to capture practitioners' intuitions and are advocated as an important step towards the definition of a formal ontology of failure.

Methodological Aspects in Ontology Engineering: In the paper entitled *A method for re-engineering a thesaurus into an ontology*, Daniel Kless and colleagues present a general method for re-engineering a standard-compliant thesaurus into an ontology by making use of top-level ontologies; In *Ontology Content "At A Glance"*, Gökhan Coskun, Mario Rothe and Adrian Paschke present a technique to group concepts for ontology documentation by applying community detection algorithms on the graph structure of ontologies. Finally, we have in this session *Interactive Semantic Feedback for Intuitive Ontology Authoring* by Ronald Denaux and colleagues. Their proposal aims at increasing the efficiency and effectiveness of the ontology authoring process by providing interactive, semantic feedback that helps ontology authors to consider relevant logical consequences of their modeling inputs.

Ontology Evaluation: in *Does your ontology make a (sense) difference?*, Pawel Garbacz proposes three logical criteria that an Applied Ontology need to satisfy in order to suitably achieve the task of satisfactorily characterize its terminology. These logical criteria correlate to graded levels of semantic indeterminacy. In sequence, we have two papers by A. Patrice Seyed. In the first of these papers, entitled *A Method for Evaluating Ontologies Introducing the BFO-Rigidity Decision Tree Wizard*, the author proposes an integration of OntoClean's notion of Rigidity with the BFO theory of types to provide a tool-supported decision tree procedure for evaluating ontologies. Moreover, in *Integrating OntoClean's Notion of Unity and Identity with a Theory of Classes and Types: Towards a Method for Evaluating Ontologies*, the author provides a reformulation of OntoClean's notion of Identity and Unity within a formal theory of classes and evaluates how the reformulations apply to BFO's theory of types. This work is aimed at making an additional contribution to ongoing efforts to build automated support to evaluate and standardize OBO Foundry candidate ontologies.

Ontology, Language and Social Relations: in *Axiomatizing Change-of-State Words*, Niloofer Montazeri and Jerry R. Hobbs present a part of their program of developing core theories of fundamental commonsense phenomena. These theories are then employed to define English word senses by means of axioms using predicates explicated

in these theories. In particular, in this paper they focus on structure of events and, more specifically, on the axiomatization of on change-of-state words from the Core Wordnet; in *Elements for a linguistic ontology in the verbal domain*, Lucia M. Tovenia discusses elements of a linguistically-motivated ontology and proposes a novel analysis to the philosophical notion of sortal in order to address aspects of essence and discretization of events; in *Toward a Commonsense Theory of Microsociology: Interpersonal Relationships*, Jerry R. Hobbs, Alicia Sagae and Suzanne Wertheim present a part of a formal ontology of microsociology (focused on small-scale social groups). The discussed part focuses on interpersonal relationships addressing concepts such as commitments, shared plans and good will and aimed at formally characterizing relationships such as the host-guest relationship and friendship in order to support inter-cultural communication.

Ontological Aspects of Time and Events: in *The Data-Time Vocabulary*, Mark H. Linehan, Ed Barkmeyer, and Stan Hendryx present a new OMG specification that models a Foundational Vocabulary of Time and related notions (e.g., continuous time, discrete time, the relationship of events and situations to time, language tense and aspect, time indexicals, timetables, and schedules). The proposal offers a linguistic-oriented vocabulary and ontology intended for supporting the specification of business rules in different business domains; in *States, Processes and Events, and the Ontology of Causal Relations*, Anthony Galton elaborates on the difficult subject of causation by advancing aspects of an ontology of particulars. This ontology elaborates on notions such as events, states and processes (taking a particular view on the latter two) as well as different causal and causal-like relations (e.g., initiation, termination, perpetuation, enablement and prevention) holding among them; Finally, in *Ontology of Time in GFO*, Ringo Baumann, Frank Loebe, and Heinrich Herre present a novel formal ontology of time as a part of the GFO research program. Besides presenting this formal theory, the authors revisit a number of problematic cases related to temporal representation and reasoning. Finally, a metalogical analysis for this theory is presented (including consistency, completeness and decidability results).

Aspects of Ontology Representation: in *Using Partial Automorphisms to Design Process Ontologies*, Bahar Aameri proposes a methodology for the design and verification of domain-specific process ontologies that are extensions of generic process ontologies by using the notion of partial automorphism (a mapping from a model to itself which preserves some substructures of the model); in *A Temporal Extension of the Hayes/ter Horst Entailment Rules and an Alternative to W3C's N-ary Relations*, Hans-Ulrich Krieger propose a novel approach that contains extended entailment rules for RDFS and the OWL Horst dialect and is designed to efficiently support encoding of temporally changing information in OWL and RDF; finally, in *Three Semantics for the Core of the Distributed Ontology Language*, Till Mossakowski, Christoph Lange and Oliver Kutz present the abstract syntax and new? kind of semantics for the meta-level constructs of the DOL (Distributed Ontology Language). A DOL Ontology consists of modules formalized in existing ontology languages (e.g., OWL, Common Logic, F-Logic). The language meta-level constructs can be employed to express different types of links between these heterogeneous ontologies.

As program chairs we would like to thank all of the authors who submitted their work and the reviewers who helped us to select the best papers from a pool of high quality submissions.

Contents

Preface	v
Part 1. Ontologies and Bioinformatics	
Probability Assignments to Dispositions in Ontologies <i>Adrien Barton, Anita Burgun and Régis Duvauferrier</i>	3
Maturation of Neuroscience Information Framework: An Ontology Driven Information System for Neuroscience <i>Fahim T. Imam, Stephen Larson, Anita Bandrowski, Jeffrey S. Grethe, Amarnath Gupta and Maryann E. Martone</i>	15
Suggestions for Galaxy Workflow Design Using Semantically Annotated Services <i>Alok Dhamanaskar, Michael E. Cotterell, Jie Zheng, Jessica C. Kissinger, Christian J. Stoeckert Jr. and John A. Miller</i>	29
Part 2. Ontologies of Physical Entities	
The Void in Hydro Ontology <i>Torsten Hahmann and Boyan Brodaric</i>	45
The Mysterious Appearance of Objects <i>Emanuele Bottazzi, Roberta Ferrario and Claudio Masolo</i>	59
Towards Making Explicit the Ontological Commitment of a Database Schema on the Geological Domain <i>Alda Maria Ferreira Rosa da Silva and Maria Cláudia Cavalcanti</i>	73
Part 3. Ontological Aspects of Artifacts and Human Resources	
An Ontology for Skill and Competency Management <i>Maryam Fazel-Zarandi and Mark S. Fox</i>	89
Towards a Unified Definition of Function <i>Riichiro Mizoguchi, Yoshinobu Kitamura and Stefano Borgo</i>	103
Preliminaries to a Formal Ontology of Failure of Engineering Artifacts <i>Luca del Frate</i>	117
Part 4. Methodological Aspects in Ontology Engineering	
A Method for Re-Engineering a Thesaurus into an Ontology <i>Daniel Kless, Ludger Jansen, Jutta Lindenthal and Jens Wiebensohn</i>	133

Ontology Content “At a Glance”	147
<i>Gökhan Coskun, Mario Rothe and Adrian Paschke</i>	
Interactive Semantic Feedback for Intuitive Ontology Authoring	160
<i>Ronald Denaux, Dhaval Thakker, Vania Dimitrova and Anthony G. Cohn</i>	
Part 5. Ontology Evaluation	
Does Your Ontology Make a (Sense) Difference?	177
<i>Pawel Garbacz</i>	
A Method for Evaluating Ontologies – Introducing the BFO-Rigidity Decision Tree Wizard	191
<i>A. Patrice Seyed</i>	
Integrating OntoClean’s Notion of Unity and Identity with a Theory of Classes and Types – Towards a Method for Evaluating Ontologies	205
<i>A. Patrice Seyed</i>	
Part 6. Ontology, Language and Social Relations	
Axiomatizing Change-of-State Words	221
<i>Niloofar Montazeri and Jerry R. Hobbs</i>	
Elements for a Linguistic Ontology in the Verbal Domain	235
<i>Lucia M. Toveni</i>	
Toward a Commonsense Theory of Microsociology: Interpersonal Relationships	249
<i>Jerry R. Hobbs, Alicia Sagae and Suzanne Wertheim</i>	
Part 7. Ontological Aspects of Time and Events	
The Date-Time Vocabulary	265
<i>Mark H. Linehan, Ed Barkmeyer and Stan Hendryx</i>	
States, Processes and Events, and the Ontology of Causal Relations	279
<i>Antony Galton</i>	
Ontology of Time in GFO	293
<i>Ringo Baumann, Frank Loebe and Heinrich Herre</i>	
Part 8. Aspects of Ontology Representation	
Using Partial Automorphisms to Design Process Ontologies	309
<i>Bahar Ameri</i>	

A Temporal Extension of the Hayes/ter Horst Entailment Rules and an Alternative to W3C's N-ary Relations <i>Hans-Ulrich Krieger</i>	323
Three Semantics for the Core of the Distributed Ontology Language <i>Till Mossakowski, Christoph Lange and Oliver Kutz</i>	337
Subject Index	353
Author Index	355