

JOWO 2018

The Joint Ontology Workshops

Proceedings of the Joint Ontology Workshops 2018
Episode IV: The South African Spring
co-located with the
Tenth International Conference on
Formal Ontology in Information Systems (FOIS 2018)
Cape Town, South Africa, September 17–18, 2018

Edited by

Ludger Jansen | Daniele P. Radicioni | Dagmar Gromann

and for

BOG | CAOS-CEX | EPINON II | Onto.Com | Ontology
of Economics | FOIS Early-Career Symposium | Tutorials

<http://www.iaoa.org/jowo2018/>

JOWO Workshops

Giancarlo Guizzardi, Oliver Kutz, Rafael Peñaloza, Nicolas Troquard (BOG)

Maria M. Hedblom, Tarek R. Besold, Oliver Kutz (CAOS-CEX)

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Oscar Pastor (Onto.Com)

Daniele Porello, Nicola Guarino, Giancarlo Guizzardi (Ontology of Economics)

Other FOIS Satellite Events

Maria M. Hedblom, Emilio Sanfilippo, Zubeida Khan (Early-Career Symposium)

Mike Bennett (Conceptual Ontology Engineering Tutorial)

David Toman, Grant Weddell (Referring Expressions in Ontologies and Query
Answering Tutorial)

PREFACE

JOWO – The Joint Ontology Workshops

These proceedings include the papers presented at JOWO 2018, the Joint Ontology Workshops, together with papers from satellite events of the 10th International Conference on Formal Ontology and Information Systems (FOIS 2018) in Cape Town, with which it was collocated. JOWO 2018 was the fourth edition of the ‘Joint Ontology Workshops’, which comprised a confederation of five ontology workshops and an early career symposium. Previous editions of the JOWO series have been:

- The first JOWO edition was ‘Episode 1: The Argentine Winter of Ontology’, held in Buenos Aires, Argentina, in co-location with the 24th International Joint Conference on Artificial Intelligence (IJCAI 2015). The proceedings of JOWO 2015 appeared as volume 1517 of CEUR.¹
- The second JOWO edition was ‘Episode 2: The French Summer of Ontology’, held in Annecy, France, in co-location with the 9th International Conference on Formal Ontology in Information Systems (FOIS 2016). The proceedings of JOWO 2016 appeared as volume 1660 of CEUR.²
- The third JOWO edition was ‘Episode 3: The Tyrolean Autumn’, hosted by the Free University of Bozen-Bolzano in Bolzano, Italy, from September 21–23, 2017. The proceedings of JOWO 2017 appeared as volume 2050 of CEUR.³

JOWO’s mission is to provide a platform for the diverse communities interested in building, reasoning with, and applying formalised ontologies in the wide spectrum of Information Systems, Artificial Intelligence, Philosophy, Linguistics and Cognitive Science, both in theory and applications.

The 2018 edition of JOWO served as a platform for satellite events for FOIS 2018. It collocated workshops that cover a broad spectrum of contemporary applied ontology research, including its methodological foundations and quality evaluation (BOG), the application of ontologies in particular domains, such as economics (Ontology of Economics) or conceptual modeling (Onto.Com), the role of ontology in related research areas like cognition (CAOS-CEX), and the epistemological stance in formal ontology (EPINON II). A total of twenty-five papers were submitted to the workshops of which fifteen were accepted.

These proceedings document five JOWO 2018 workshops, the FOIS Early Career Symposium, and two FOIS tutorials, which will be described in more detail on the following pages:

¹See <http://ceur-ws.org/Vol-1517/>.

²See <http://ceur-ws.org/Vol-1660/>.

³See <http://ceur-ws.org/Vol-2050/>.

- **BOG** International Workshop on BadOntoloGy⁴
- **CAOS-CEX** International Workshop on Cognition and Ontologies & Comprehensibility and Explanation in AI and ML⁵
- **EPINON II** 2nd International Workshop on Epistemology in Ontologies⁶
- **Onto.Com** 6th Int. Workshop on Ontologies and Conceptual Modelling⁷
- **Ontology of Economics** International Workshop on Ontology of Economics⁸
- **Early Career** The Early Career Symposium⁹
- **Conceptual Ontology Engineering** Tutorial on Conceptual Ontology Engineering¹⁰
- **Referring Expressions in Ontologies and Query Answering** Tutorial on Referring Expressions in Ontologies and Query Answering¹¹

Acknowledgements

We would like to thank all authors and speakers for their contributions, and the programme committee members and additional reviewers for their timely reviewing. Moreover, we would like to thank the local FOIS organiser, Maria C. Keets, and her team, for taking care of running the event smoothly in Cape Town, and the International Association for Ontology and its Applications (IAOA)¹², for providing generous financial support and facilities.

JOWO General Chairs and FOIS Workshops and Tutorials Chairs

Ludger Jansen	Ruhr University Bochum, Germany
Daniele P. Radicioni	University of Torino, Italy

Proceedings Chair

Dagmar Gromann	TU Dresden, Germany
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⁴See <http://bog.inf.unibz.it/>.

⁵See <http://caos.inf.unibz.it/>.

⁶See <http://www.loa.istc.cnr.it/workshops/epinon2018/home.html>.

⁷See <http://www.mis.ugent.be/ontocom2018/>.

⁸See <https://oe.inf.unibz.it/>.

⁹See http://fois2018.cs.uct.ac.za/?page_id=236.

¹⁰See http://www.iaoa.org/jowo2018/?page_id=108.

¹¹See http://www.iaoa.org/jowo2018/?page_id=83.

¹²See <http://iaoa.org>.

JOWO 2018 Workshops

BOG 2018

International Workshop on Bad Ontology

Programme Chairs

Giancarlo Guizzardi	Free University of Bozen-Bolzano, Italy
Oliver Kutz	Free University of Bozen-Bolzano, Italy
Rafael Peñaloza	Free University of Bozen-Bolzano, Italy
Nicolas Troquard	Free University of Bozen-Bolzano, Italy

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Catherine Roussey	Irstea, France
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Claudia Schon	University Koblenz-Landau, Germany
Stefan Schulz	Institute of Medical Informatics, Statistics and Documentation, Graz General Hospital and University Clinics, Austria
Amanda Vizedom	Crédit Suisse, USA

As ontologies are adopted by new practitioners and as they grow in size, bad ontologies become an increasingly common reality. Bad ontologies may be inconsistent, have unwanted consequences, be ridden with anti-patterns. In general, bad ontologies present design mistakes that make their use and maintenance problematic or impossible.

Programming engineers have had access for some time to debuggers to help identify unwanted results and linters to identify stylistic errors and suspicious constructs. Ontology practitioners also need similar tools to aid them correcting bad ontologies. Researchers in ontology engineering have actively been working on engineering methods to assist in the repair of erroneous ontologies: diagnostic, explanation, anti-pattern detection, etc. The workshop welcomed original contri-

butions about all topics related to bad ontologies, including the cataloguing of ontology symptoms, symptoms detection, ontology quality measures, diagnostic methods to explain the symptoms, principled methods for building bad ontologies, or benchmarks of bad ontologies for evaluating repairing methods.

The workshop accepted two submissions. In *The Role of Foundational Ontologies for Preventing Bad Ontology Design*, Stefan Schulz reports on a method to use upper-level domain ontologies and Description Logic classifiers for the detection of modelling mistakes. Several prototypical and generalisable modelling mistakes are used to demonstrate the method. In *Applying evaluation criteria to ontology modules*, Zubeida Casmod Khan presents a set of evaluation criteria for ontology modules. They are all structured into categories and illustrated through a series of examples. The evaluation criteria are then used to experimentally evaluate the modules automatically generated by a modularisation tool.

CAOS-CEX 2018

Third International Workshop on Cognition and Ontologies & Workshop on Comprehensibility and Explanation in AI and ML (CAOS-CEX)

Programme Chairs

Maria M. Hedblom	Free University of Bozen-Bolzano, Italy
Tarek R. Besold	City University London, UK
Oliver Kutz	Free University of Bozen-Bolzano, Italy

Programme Committee

Derek Doran	Wright State University, USA
Scott Friedman	SIFT, USA
Dagmar Gromann	TU Dresden, Germany
Jamie Macbeth	Fairfield University, USA
Fabian Neuhaus	Otto-von-Guericke University, Germany
Alessandro Oltramari	Bosch Research and Technology Center in Pittsburgh, USA
Sarah Schulz	University of Stuttgart, Germany
Gem Stapleton	University of Brighton, UK
Serge Thill	University of Skovde, Sweden
Carlos Zednik	Otto-von-Guericke University, Germany

CAOS is a workshop devoted to bringing together research findings from areas in cognitive science with research on formal ontology. The workshop addresses the difficult question of how key cognitive phenomena and concepts (and the involved terminology) can be found across languages, psychology and reasoning and how this can be formally and ontologically understood, analysed and represented. The workshop devotes itself to investigations to model, simulate and represent a range of cognitive abilities, with the further aim to contribute with these findings to cognitive artificial intelligence.

This includes formal modeling of cognitive building blocks such as affordances and image schemas, the relationship between thought, language and representation, the formal simulation of cognitive abilities such as language acquisition and concept invention as well as formal modeling of socio-cognitive behaviors. This year, CAOS runs its third edition and is joined by the workshop "Comprehensibility and Explanation in AI and ML" (CEX) which focuses on largely overlapping topics but from a more applied direction. The workshop gathered three papers of relevant topics for the research field: In "Ontology Of Social Service Needs: Perspective of a Cognitive Agent" Bart Gajderowicz, Mark Fox and Michael Gruninger introduce the first ontology of social services from a client's perspective; In "Modelling Affordances with Dispositions" Fumiaki Toyoshima investigates the formal realisation of affordances by comparing them to the state of the art in ontology representation, and Antony Galton contributes to the mereological debate of part-whole relationships in "Yet Another Taxonomy of Part-Whole Relations". We particularly thank our invited keynote speaker Alessandro Oltramari for his contribution to the success of the workshop.

EPINON II 2018

Second International Workshop on Epistemology in Ontologies (EPINON II)

Programme Chairs

Daniele Porello	Free University of Bolzano-Bozen, Italy
Claudio Masolo	Institute of Cognitive Sciences and Technologies (ISTC-CNR), Trento, Italy
Simon Scheider	Utrecht University, Netherlands

Programme Committee

Massimiliano Carrara	University of Padua, Italy
Roberta Ferrario	Institute of Cognitive Sciences and Technologies (ISTC-CNR), Italy
Maria Hedblom	Otto-von-Guericke University, Germany
Heinrich Herre	University of Leipzig, Germany
Gilles Kassel	Université de Picardie - Jules Vernes, France
Adila Alfa Krisnadhi	Universitas Indonesia, Indonesia
Nicolas Troquard	Free University of Bolzano-Bozen, Italy
Achille Varzi	Columbia University, USA
Laure Vieu	Institut de Recherche en Informatique de Toulouse (IRIT-CNRS), France

Formal ontologies and knowledge representation mainly focus on characterising how a given domain is structured, i.e., they identify a set of concepts, entities, and relations together with the constraints that hold for this domain. The structure of the characterisation is usually intended to reflect the point of view of significant experts or a realist view of how things about a particular domain are in reality.

The aim of this workshop is to explore an epistemological stance in formal ontology and knowledge representation and focus on the assessment of the modelling provided by the ontology designer. In particular, we are interested in fostering two intertwined research directions. Firstly, we are interested in promoting discussions about the epistemological foundations of formal ontologies and of knowledge representation. A number of timely important problems are related to this point, for instance: the investigations of cognitively adequate ontological representations, the investigations on the provenance of data, the problem of the reliability of the source of information (both human and artificial, e.g. sensors), the problem of the epistemic reliability of the classification provided by ontology users, the problem of finding epistemically and cognitively well-founded rationales for the integration of ontological representations with other representational formats (e.g. deep neural networks, vector space models etc.). Secondly, we are interested in formal and ontological approaches to the definitions of the concepts that are relevant to the assessment of the perspective of the ontology designer. Problems related to this direction include: ontology of general epistemological concepts (e.g. proof, argument, explanation, epistemic reliability, trust), ontology of cognitive concepts (perception, reasoning, sensations), ontology of data and measurements. We aim to address to an interdisciplinary audience, by inviting scholars in philosophy, computer science, logic, conceptual modelling, knowledge representation, and cognitive science to contribute to the discussion.

Onto.Com 2018

Sixth International Workshop on Ontologies and Conceptual Modeling

Programme Chairs

Frederik Gailly	Ghent University, Belgium
Giancarlo Guizzardi	Federal University of Espirito Santo, Brazil
Mark Lycett	Royal Holloway, University of London, UK
Chris Partridge	BORO Solutions Ltd., UK
Oscar Pastor	Universitat Politecnica de Valencia, Spain, Spain
Sergio de Cesare	University of Westminster, UK

Programme Committee

Frederik Gailly	Ghent University, Belgium
Giancarlo Guizzardi	Federal University of Espirito Santo, Brazil
Mark Lycett	Royal Holloway, University of London, UK
Chris Partridge	BORO Solutions Ltd., UK
Oscar Pastor	Universitat Politecnica de Valencia, Spain, Spain
Sergio de Cesare	University of Westminster, UK

The role of formal ontology in Conceptual Modeling (CM) is increasingly being recognized as fundamental by both the research and practitioner communities.

Formal ontology, whose theoretical underpinnings are grounded in disciplines such as Philosophy, Cognitive Sciences and Linguistics, has led to the development of theoretical foundations for conceptual modeling. In particular, a number of ontological theories such as BORO, BWW, DOLCE, GFO and UFO have been successfully applied to the evaluation of conceptual modeling languages, frameworks and standards (e.g., UML, ORM, ER, REA, TROPOS, ARIS, BPMN, RM-ODP, Archimate, OWL and ISO 15926), and to the development of information systems engineering tools (e.g., methodological guidelines, modeling profiles, design patterns) that contribute to the theory and practice of conceptual modeling.

The objective of the OntoCom Workshop is to provide an international forum for exchanging ideas on the latest developments in the emerging area of Ontology-Driven Conceptual Modeling and to address specific questions of relevance to the body of knowledge of this emerging discipline.

The workshop received 7 submissions, from which the Program Chairs selected 6 high quality papers. The 18th of September 2018 the 6 papers will be presented in two separate sessions. The first session will focus on the metaphysical characteristics of some well-known foundational ontologies. The second session will focus on the application of ontology-driven conceptual modeling. We would like to express our gratitude to the authors for considering OntoCom as a forum to publish their research and the FOIS 2018 organizers for all their support.

Ontology of Economics 2018

First International Workshop on Ontology of Economics

Programme Chairs

Daniele Porello	Free University of Bozen-Bolzano, Italy
Nicola Guarino	ISTC-CNR, Italy
Giancarlo Guizzardi	Free University of Bozen-Bolzano, Italy

Programme Committee

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Georgios Papadopoulos	Research Institute for Art and Technology, Austria
Tiago Prince Sales	University of Trento, Italy
Emma Tieffenbach	University of Geneva, Switzerland
Hans Weigand	Tilburg University, Netherlands
Gloria Zuniga	Ashford University, USA

Understanding the ontological nature of economic concepts and institutions is crucial for providing principled modelling in many important domains such as

enterprise modelling, business processes, and social ontology. A significant number of fundamental concepts that are ubiquitous in economics have only recently been approached from an ontological perspective.

For instance: value, risk, preference, utility, capability, good, service, exchange, transaction, competition. We offer a venue to gather the recent contributions to this important topic. We propose contributions from different areas such as (philosophy of) economics, decision theory, social choice theory, business, finance, accounting, economic sociology, and enterprise modelling, to promote the discussion on the ontological foundation of fundamental concepts in economics.

We aim to foster the discussion on both theoretical and methodological issues in the use of ontologies for modelling economic concepts and institutions, as well as the approaches presenting concrete use of ontologies in application to economic domains.

Other FOIS 2018 Satellite Events

FOIS 2018 Early Career Symposium

Programme Chairs

Maria M. Hedblom	Free University of Bozen-Bolzano, Italy
Emilio Sanfilippo	French National Center for Scientific Research (CNRS), France
Zubeida Khan	Council for Scientific and Industrial Research (CSIR), South Africa

For any conference, the Early Career Symposium (ECS) represents the investment done by the current generation of researchers into the future generations of the field. Arguably, while established researchers contribute to strengthen the fundamentals of the research field, it is often the young generation that provides innovation and groundbreaking ideas. In order to foster the state of art in ontology research, the ECS at FOIS welcomes early stage researchers working on innovative and novel research topics for presentation at the conference. The symposium encourages mentorship among established and emerging researchers towards constructive discussions surrounding novel research. As the future remains unwritten, the ECS accepts a wide variety of research topics focused on ontologies and knowledge representation. In particular, because of its contextualization within FOIS, it welcomes research addressed in an interdisciplinary way with an open-minded aptitude towards philosophical ontology, cognitive science, and linguistics. We wish to thank the PC members for their constructive feedback.

Tutorial on Conceptual Ontology Engineering

Organiser

Mike Bennett	Hypercube Limited, UK & EDM Council, UK
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Conceptual modeling as defined within the discipline of software development is the exercise of creating computationally independent model artifacts against which to develop and validate logical and physical model design artifacts. The art of conceptual modeling is one that requires a clear understanding of the notion of a concept and an appreciation of the nature of concepts as distinct from words, labels or database element names. One powerful type of conceptual model is the ‘ontology’ where ontology is understood to be a formal specification of a conceptualization. The word ‘ontology’ is broadly used to cover a number of such specifications. The goal of this tutorial is to present a formal framework within

which to understand these distinctions and to introduce techniques by which attendees may be able to develop ontologies that may serve as conceptual models, focusing on the less technical (and often overlooked) aspects of such ontology development, specifically the ability to appreciate concepts and to model these within the logical formalisms used in ontology development.

Tutorial on Referring Expressions in Ontologies and Query Answering

Organisers

David Toman	University of Waterloo, Canada
Grant Weddell	University of Waterloo, Canada

How individuals are identified when cooperating agents need to communicate is an inherent issue faced by the designers of information systems. Solutions to this problem range from insisting on global often opaque identifiers, such as URIs, to application specific ways of externally identifying individuals, such as primary keys in relational systems. The goal of this tutorial is to introduce a flexible framework based on *referring expressions* that unifies approaches that address these issues.

