

JOWO 2021

The Joint Ontology Workshops

Proceedings of the Joint Ontology Workshops 2021
Episode VII: The Bolzano Summer of Knowledge 2.0
co-located with FOIS 2021 and ICBO 2021

Virtual & Bozen-Bolzano, Italy, September 10–18, 2021

Edited by

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and for

CAOS | FOMI | FOUST IV
OntoCom | ROBOTICS | SoLEE
S4BioDiv | IFOW
FOIS ECS | FOIS Demo | FOIS Ontology Showcase

FOIS 2021 Workshops

| | |
|--|-------------|
| M. M. Hedblom, O. Kutz, G. Righetti | (CAOS V) |
| D. Šormaz, W. Terkaj | (FOMI) |
| T. P. Sales, E. M. Sanfilippo | (FOUST V) |
| S. de Cesare, F. Gailly, G. Guizzardi, M. Lycett, C. Partridge, O. Pastor | (OntoCom) |
| D. Beßler, S. Borgo, M. Diab, A. Gangemi, A. Olivares-Alarcos, M. Pomarlan, R. Porzel | (RobOntics) |
| L. Jansen, M. Brochhausen, G. Guizzardi, D. Porello | (SoLEE) |

ICBO 2021 Workshops

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| A. Algergawy, N. Karam, F. Klan, F. Michel, I. Rosati | (S4BioDiv) |
| D. Dooley, R. Warren, H. K. McGinty, M. Lange | (IFOW) |

Other FOIS Satellite Events

| | |
|--------------------------|--------------------------|
| P. Garbacz, S. Seppälä | (Early-Career Symposium) |
| M. Grüninger | (Ontology Showcase) |
| R. Hoehndorf, A. Vizedom | (Demonstrations) |

<https://www.iaoa.org/jowo/2021/>

PREFACE

JOWO – The Joint Ontology Workshops

These proceedings include the papers presented at JOWO 2021, the seventh edition of the Joint Ontology WORKshops (JOWO). JOWO is a venue of workshops that, together, address a wide spectrum of topics related to ontology research, ranging from cognitive science to knowledge representation, natural language processing, artificial intelligence, logic, philosophy, and linguistics.

JOWO’s mission is to provide a platform for the diverse communities interested in building, reasoning with, and applying formalised ontologies both in theory and applications.

The previous editions of the JOWO series were the following:

- The first JOWO edition was ‘Episode I: 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 II: 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 III: The Tyrolean Autumn’, hosted by the Free University of Bozen-Bolzano in Bolzano, Italy, in September 21–23, 2017. The proceedings of JOWO 2017 appeared as volume 2050 of CEUR.³
- The fourth JOWO edition was ‘Episode IV: The South African Spring (JOWO 2018 @ FOIS 2018)’, held in Cape Town, South Africa, in co-location with the 10th International Conference on Formal Ontology in Information Systems (FOIS 2018). The proceedings of JOWO 2018 appeared as volume 2205 of CEUR.⁴
- The fifth JOWO edition was ‘Episode V: The Styrian Autumn of Ontology (JOWO 2019)’, held in Graz, Austria, on September 23–25, 2019. The proceedings of JOWO 2019 appeared as volume 2518 of CEUR.⁵
- The sixth JOWO edition was ‘Episode VI: The Bolzano Summer of Knowledge (JOWO 2020)’, (virtually) held in Bolzano, Italy, between August 31st and October 7th, 2020. The proceedings of JOWO 2020 appeared as volume 2708 of CEUR.⁶

¹See <http://ceur-ws.org/Vol-1517/>.

²See <http://ceur-ws.org/Vol-1660/>.

³See <http://ceur-ws.org/Vol-2050/>.

⁴See <http://ceur-ws.org/Vol-2205/>.

⁵See <http://ceur-ws.org/Vol-2518/>.

⁶See <http://ceur-ws.org/Vol-2708/>.

JOWO 2021 comprised a confederation of 11 ontology workshops that were associated with the 12th International Conference on Formal Ontology in Information Systems (FOIS 2021) or the 12th International Conference on Biomedical Ontologies (ICBO 2021). The workshops were, just like the main conferences themselves, held in a hybrid format with the physical component taking place at the Free University of Bozen-Bolzano, Italy.

The workshops cover a broad spectrum of contemporary applied ontology research, including its foundational aspects (FOUST V, OntoCom) as well as the application of ontologies in specific domains, in particular, cognitive science (CAOS V), industry (FOMI), robotics (RobOntics), social, legal and economic domains (SoLEE), life sciences (S4BioDiv, IFOW).

A total of 95 workshop papers were submitted for this volume, of which 79 were accepted.

FOIS workshop proceedings published in this volume:

- **CAOS V:** 5th International Workshop on Cognition And Ontologies⁷
- **FOMI:** 11th International Workshop on Formal Ontology meets Industry⁸
- **FOUST V:** 5th Workshop on Foundational Ontologies⁹
- **OntoCom:** 8th International Workshop on Ontologies and Conceptual Modelling¹⁰
- **RobOntics:** 2nd International Workshop on Ontologies for Autonomous Robotics¹¹
- **SoLEE:** 2nd International Workshop on Ontology of Social, Legal and Economic Entities¹²

ICBO workshop proceedings published in this volume:

- **IFOW:** 2nd Integrated Food Ontology Workshop¹³
- **S4BioDiv:** 3rd International Workshop on Semantics for Biodiversity¹⁴

In addition, this volume publishes the short papers from three satellite events associated with FOIS 2021:

- **Early Career Symposium:** A venue for current graduate students to present and discuss their research programme with the ontology community
- **Ontology Showcase:** Short papers that describe existing ontologies in order to facilitate the sharing and reuse of ontologies
- **Demonstrations:** Short papers that accompany demonstrations of software, methodologies, patterns, dynamics, and challenges arising in use of ontologies at FOIS 2021

⁷See <http://caos.inf.unibz.it/>.

⁸See <https://www.ohio.edu/fomi2021/>.

⁹See <https://foust.inf.unibz.it/>.

¹⁰See <https://www.mis.ugent.be/ontocom2021/>.

¹¹See <https://robotics2021.github.io/>.

¹²See <https://soleeworkshop.wordpress.com/>.

¹³See <https://foodon.org/ifow-2021-workshop/>.

¹⁴See <https://fusion.cs.uni-jena.de/s4biodiv2021/>.

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 Free University of Bozen-Bolzano for their generous event support and sponsoring and the International Association for Ontology and its Applications (IAOA)¹⁵ for providing support and facilities.

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¹⁵See <http://iaoa.org>.

JOWO 2021:
FOIS 2021 Workshops

CAOS V

5th International Workshop on Cognition And Ontologies

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Ever since its first edition was held in Annecy, France, in July 2016, ‘CAOS: Cognition And Ontologies’ is devoted to the formal modelling, the ontology, and the simulation and representation of the relationships between cognition, behaviour and thought. With the primary focus on how key cognitive phenomena and behaviours can be formally represented to aid the advancement of artificial intelligence, knowledge representation and cognitive robotics towards more cognitively plausible, explainable, and human-friendly directions, CAOS has become a venue for researchers on all career levels to discuss their work.

CAOS thus aims to engage a diverse and interdisciplinary audience coming from research areas in philosophy and linguistics, psychology, cognitive science and computer science, and related fields. The purpose of the workshop is to promote the development of excellent research, strengthen research collaborations, and to offer a venue where unconventional topics can be discussed in an open, yet challenging and ambitious environment. Therefore, we are happy that the fifth edition of CAOS has accepted papers from a broad spectrum of topics.

Contributions to the workshop range from logical treatments of areas such as formal concept combinations and narrative structure, to ontological issues of cognitive bias and rhetorical figures. In addition, it includes works that investigate more applied areas within cognitive ontologies, such as the use of image schemas in cognitive robotics, hybrid AI systems combining neural networks with semantics, and the lexicalisation of visual properties of concepts. Perhaps due to the hybrid format of the workshop, we are proud to announce that the eight accepted submissions are authored by people from four different countries and seven different institutions. The interdisciplinary CAOS community also shows an excellent gender balance, with half of the accepted papers first-authored by women (and a total of around 25 percent female authors). Likewise, our program committee consists of a wide variety of scholars with expertise from different scientific backgrounds and 16 different institutions.

FOMI

11th International Workshop on Formal Ontology meets Industry

Programme Chairs

| | |
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| Dušan Šormaz | Department of Industrial and Systems Engineering, Ohio University, USA |
| Walter Terkaj | Institute for Intelligent Industrial Systems and Technologies for Advanced Manufacturing (STIIMA-CNR) Italy |

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FOMI is an international forum where academic researchers and industrial practitioners meet to analyse and discuss application issues related to methods, theories, tools and applications based on formal ontologies. There is today wide agreement that knowledge modelling and the semantic dimension of information play an increasingly central role in networked economy: semantic-based applications aim to provide a framework for information and knowledge sharing, reliable information exchange, meaning negotiation and coordination between distinct organizations or among members of the same organization. Theoretical ideas seem often very promising but their actual implementation brings up unexpected problems and issues. The FOMI 2021 Workshop deals with:

1. Experience with problems in ontology application;
2. New insights on known problematic issues;
3. New results;
4. Successes and observations in ontology implementation;
5. Lessons learned on the best way to apply ontological methodologies to real-world situations

FOMI 2021 will facilitate open discussion and experience sharing. Very similar problems arise in disparate ontology applications and an open discussion helps to highlight commonalities and to spread ideas for possible solutions. For this reason, FOMI welcomes researchers and practitioners that embrace this perspective without restrictions on the domains they deal with: business, medicine, engineering, finance, law, biology, geography, electronics, etc. Indeed, the accepted contributions at FOMI 2021, nine in total, tackle heterogeneous topics.

Three works are related to the aerospace industry, addressing the reconfiguration of production systems (Arista et al.), the modelling of aircraft assembly processes (Zheng et al.), and the modelling of flight procedures (Tarbouriech et al.). Two more papers deal with the manufacturing domain, in particular maintenance of manufacturing assets (Woods et al.) and modelling of manufacturing resource capabilities (Borgo et al.). Other specific domains are addressed like the construction industry (Cao et al.), the corrosion protection of metallic surfaces (Klein et al.), the modelling of assembled systems (Compagno et al.), and web services to support ontology-driven conceptual modelling (Fonseca et al.). In addition, different foundational ontologies are exploited in the industrial applications, like PSL (Tarbouriech et al.), DOLCE (Borgo et al.), UFO (Fonseca et al.), and BFO (Zheng et al., Woods et al.).

FOUST V

5th Workshop on Foundational Ontology

Programme Chairs

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Foundational ontology is about categories of reality or thought which are common to all or almost all subject-matters. Commonly considered examples of such categories include ‘object’, ‘quality’, ‘function’, ‘role’, ‘process’, ‘event’, ‘time’, and ‘place’. There are several foundational ontologies that provide a systematic formal representation of these categories, their relationships, and interdependencies. Amongst existing foundational ontologies, there is both a substantial measure of agreement and some dramatic disagreements. There is currently no uniform consensus concerning how a foundational ontology should be organised, how far its ‘reach’ should be (e.g., is the distinction between physical and non-physical

entities sufficiently fundamental to be included here?), and even what role it should play in relation to more specialised domain ontologies.

The main use of foundational ontologies is as a starting point for the development of domain ontologies and application ontologies. A foundational ontology provides an ontology engineer with a conceptual framework that enables her to analyse a given domain, identify the entities in the domain as specialisations of the generic categories in the foundational ontology, and often reuse relationships (e.g., part-hood) from the foundational ontology. The utilisation of foundational ontologies for the development of domain and application ontologies has two main benefits. Firstly, the ontology engineer can reuse an existing set of well-studied ontological distinctions and design principles instead of having to develop an ad-hoc solution. Secondly, if two domain ontologies are based on the same foundational ontology, it is easier to integrate them.

FOUST is an ontology workshop series that offers researchers in foundational ontology an opportunity to present their results. This includes work on specific areas of foundational ontology as well as work on a particular foundational ontology. Topics covered in this edition of FOUST include, amongst others, processes, events, functions, roles, and identity criteria.

OntoCom

8th International Workshop on Ontologies and Conceptual Modelling

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| | |
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| Chris Partridge | BORO Solutions Ltd., UK; University of Westminster, UK |
| Oscar Pastor | Universitat Politècnica de Valencia,, Spain |

The International Workshop on Ontologies and Conceptual Modelling (OntoCom) is an academic workshop that concerns the practical and formal application of ontologies to conceptual modelling. While models pervade the information systems lifecycle from requirements to implementation, there appears to be a lack of theoretical foundation in the way that models are developed. As a result it is quite common for practitioners, even working together, to produce different representations of the same real world domain or system. Conversely, a preferred approach would be one in which IS practitioners have the necessary conceptual tools to enable them to accurately represent the things that exist in the real world. Foundational or upper ontologies have the potential to resolve the difficult problems that derive from a lack of a consistent and sound ontological theory. The

benefits that can derive from the application of a foundational ontology include improved mapping to the real world domain, increased level of communication and understanding among stakeholders, model reuse, semantic integration and interoperability and increased overall efficiency and effectiveness of information systems development and evolution. The theme of OntoCom continues to be foundational ontologies and their meta-ontological choices. The workshop will be both theoretically and practically oriented with discussions and worked examples.

RobOntics

2nd International Workshop on Ontologies for Autonomous Robotics

Programme Chairs

| | |
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| Daniel Beßler | University of Bremen, Germany |
| Stefano Borgo | Laboratory for Applied Ontology (ISTC-CNR), Italy |
| Mohammed Diab | Imperial College London, UK |
| Aldo Gangemi | University of Bologna, Italy; ISTC-CNR, Italy |
| Alberto Olivares-Alarcos | Institut de Robòtica i Informàtica Industrial (CSIC-UPC), Spain |
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| Robert Porzel | University of Bremen, Germany |

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| Paulo Jorge Sequeira Gonçalves | Polytechnic Institute of Castelo Branco, Portugal |
| Elisa Tosello | University of Padova, Italy |
| Abhijit Vyas | University of Bremen, Germany |

RobOntics focuses on the area of robot autonomy enabled by knowledge-driven approaches, and in particular formal ontologies. It aims to foster interaction across robotics, ontology, and knowledge representation and reasoning, to match open problems to promising approaches, and to review progress in knowledge-driven robotics.

A partial list of topics of interest includes:

- Foundational issues: which ontological approaches are better suited for autonomous robotics? how should notions such as capability or context be modelled?
- Robustness: how can ontologies help robots cope with the variety and relatively fluid structure of human environments?

- Ontologies in the perception-action loop: how might ontologies be used to recognize action possibilities?
- Interactivity: how should conversations be formalized, in particular the giving of instructions?
- Normed behavior: how can we represent, and then have a robot act according to, norms on behavior?
- Explainability: what is an explanation, and how can one be generated from a collection of knowledge items?

SoLEE

2nd International Workshop on Ontology of Social, Legal and Economic Entities

Programme Chairs

| | |
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| Ludger Jansen | University of Rostock, Germany |
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| Giancarlo Guizzardi | Free University of Bozen-Bolzano, Italy; University of Twente, The Netherlands |
| Daniele Porello | University of Genova, Italy |

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| Mattia Fumagalli | Free University of Bozen-Bolzano, Italy |
| Cristine Griffo | Free University of Bozen-Bolzano, Italy |
| Paul Johannesson | Royal Institute of Technology, Sweden |
| Riichiro Mizoguchi | JAIST, Japan |
| J. Neil Otte | Johns Hopkins University, USA |
| Tiago Prince Sales | Free University of Bozen-Bolzano, Italy |
| Barry Smith | University at Buffalo, USA |

Understanding the ontological nature of social, legal and 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, social, and legal sciences (such as value, risk, capability, good, service, exchange, transaction, competition, social norm, group, institution) have only recently been approached from a specifically ontological perspective. It is therefore important to offer a venue to gather the recent contributions to this topic. The workshop encouraged submissions on both theoretical and methodological issues in the use of ontologies for modelling social, legal and economic concepts and institutions, as well as submissions on concrete use of ontologies in application for these domains.

The first SoLEE workshop took place in 2019 at JOWO in Graz, Austria, continuing strands of discussions from two previous events, SoLE-BD and Ontology of Economics 2018. The SoLEE workshop intends to broaden the focus in order to explore the emerging question of how to deal with social entities in general, and to connect well established domains like biomedicine and business ontologies in this respect. As its precursors, SoLEE 2021 collects approaches to deal with social, legal and economic entities in foundational and applied ontologies and discusses applications of these approaches to social, legal and economic entities in ontologies for biomedicine and business informatics.

ICBO 2021 Workshops

IFOW

2nd Integrated Food Ontology Workshop

Programme Chairs

| | |
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| Damion Dooley | Simon Fraser University, Canada |
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| Matthew Lange | Int. Center for Food Ontology Operability Data and Semantics |

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| Lauren Chan | Oregon State University, USA |
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| Damion Dooley | University of British Columbia, Canada |
| Jessica Singer | Myra Analytics, Canada |

Ontologies are new entrants into the food controlled vocabulary domain, bringing a wave of Semantic Web technology and philosophy to bear on the issue of data sharing and modeling of food-related activity and research which are becoming critical in the face of rapid change to our environment and anthroposphere. Examples range from BBC's Food Ontology, driving its culinary media universe, to recent research laboratory initiated ontologies like OBOFoundry members FoodOn, the Food Biomarker Ontology (FOBI), the Ontology for Nutritional Studies (ONS), the Ontology for Nutritional Epidemiology (ONE), the Food Interactions with Drugs Evidence Ontology (FIDEO), and the Crop Dietary Nutrition Ontology (CDNO). Underpinning these mid-level, model-focused ontologies are environmental, chemical, biological, anatomical, disease and phenotype ontologies.

Academic, agricultural and public health agencies are considering the benefits and complexities of adopting ontology in their research and data management and reporting infrastructure. How can ontologies interface to legacy datasets and online databases described by existing vocabularies? What vocabulary, tool ecosystem and data models are needed to correlate agricultural treatments, nutritional data, eating patterns, biomarkers, pathogens, and phytochemical levels with disease and health phenotypes? Encouraged by the success of the inaugural 2020 IFOW workshop, this second round in 2021 will explore the evolution of food-related

ontologies as they integrate ecological, agricultural, nutritional, dietary, public health, one health surveillance, food security, and trade domain vocabulary, and the use of curation, validation, mapping and visualization tools for food ontology maintenance.

S4BioDiv

3rd International Workshop on Semantics for Biodiversity

Programme Chairs

| | |
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| Naouel Karam | Fraunhofer Institute for Open Communication Systems (FOKUS) & Institute for Applied Informatics (InfAI e.V.), Germany |
| Friederike Klan | Institute of Data Science, German Aerospace Center (DLR e.V.), Germany |
| Franck Michel | Université Cote d'Azur, CNRS, Inria, France |
| Ilaria Rosati | Research Institute on Terrestrial Ecosystems (IRET) – Italian National Research Council (CNR) & LifeWatch Italy |

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| Barabara Magagna | Environmental Agency, Austria |
| Birgitta Koenig-Ries | FSU Jena, Germany |
| Caterina Bergami | ISMAR, National Research Council, Bologna, Italy |
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| Catherine Roussey | IRSTEA Clermont-Ferrand, France |
| Claire Nédellec | MaIAGE, INRA Jouy-en-Josas, France |
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| Konstantin Todorov | LIRMM, University of Montpellier, France |
| Mark Schildhauer | National Center for Ecological Analysis and Synthesis, USA |
| Nicola Fiore | LifeWatch ERIC, Italy |
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| Pierre Larmande | DIADE, IRD, France |
| Salima Benbernou | Université Paris 5, France |

Biodiversity deals with heterogeneous data and concepts generated from a large number of disciplines in order to build a coherent picture of the extent of life on earth. The presence of such a myriad of data resources makes integrative biodiversity research increasingly important, as well as challenging given the variety

of ways in which data and information are produced and made available. The Semantic Web approach enhances data discoverability, sharing, interoperability and integration through a formalized conceptual environment providing common formats, standards, and terminological resources. This workshop aims to bring together computer scientists and biologists, working on Semantic Web approaches for biodiversity, ecology and related areas such as plant sciences, agronomy, agro-ecology or citizen science related to biodiversity. The goal is to exchange experiences, build a state of the art of realizations and challenges, and reuse and adapt solutions that have been proposed in other domains. The workshop focuses on presenting challenging issues and novel solutions for the design of high-quality biodiversity information systems leveraging Semantic Web techniques.

S4BioDiv 2021 welcomed topics related to the application and development of semantic web technologies to support research in the biodiversity domain and related areas. These include, but are not limited to the following areas:

- Applications of Semantic Web technologies for biodiversity
- Semantic representation of biodiversity data
- Ontology (or semantic resource) development for biodiversity
- Knowledge extraction and text mining
- Semantic annotation of biodiversity data
- Semantic data integration
- Development and design of domain-specific ontologies
- Ontology-based applications
- Semantic approaches for the discovery of biodiversity data and research data services
- Semantic support for scientific workflows
- Data provenance and reproducibility
- Data lifecycle management
- Ontology learning
- Standards for biodiversity Data
- Linked Open biodiversity Data
- Interoperability of biodiversity and earth observation data
- FAIR biodiversity data with semantics
- Interoperability of biodiversity and earth observation data
- Enhancement of machine learning approaches with Semantic Web technologies

Application domains:

- Biodiversity
- Agronomy, agro-ecology, agro-biodiversity
- Plant sciences
- Citizen Science related to biodiversity and related fields

The workshop is a full-day event on September 15th co-located with the 12th International Conference on Biomedical Ontologies (ICBO 2021), September 15-18, Bolzano, Italy. In total, 11 paper submissions presenting new research results and ongoing projects have been submitted. All of these were reviewed by at least three members of the program committee. Out of the submitted contributions, four full

papers, two short papers, and four poster papers were accepted for presentation at the workshop and publication in these proceedings. The program included two keynote talks highlighting two vital and challenging topics related to biodiversity research and Open Science in general. Michael Diepenbroek, Senior consultant at the National Research Data Infrastructure for Biodiversity (NFDI4BioDiversity) and senior head of the World Data Center PANGAEA, talked about "The application of semantic resources and technologies for the discovery and integration of geo- and biosciences data". Mark Schildhauer, was the Director of Computing at NCEAS from its opening in 1995 until 2017, presented his thoughts on ""

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Other FOIS 2021 Satellite Events

FOIS 2021 Early Career Symposium

Programme Chairs

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| Pawel Garbacz | The John Paul II Catholic University of Lublin, Poland |
| Selja Seppälä | University College Cork, Ireland |

Programme Committee/Mentors

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|----------------------|---|
| Mara Abel | Universidade Federal do Rio Grande do Sul, Brazil |
| Adrien Barton | Institut de Recherche en Informatique de Toulouse, France |
| Olivier Bodenreider | US National Library of Medicine, USA |
| Maureen Donnelly | SUNY Buffalo, USA |
| Pawel Garbacz | The John Paul II Catholic University of Lublin, Poland |
| Giancarlo Guizzardi | Federal University of Espirito Santo (UFES), Brazil |
| Emilio M. Sanfilippo | Laboratory for Applied Ontology (ISTC-CNR), Italy |
| Selja Seppälä | University College Cork, Ireland |
| Barry Smith | SUNY Buffalo, USA |

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 strengthening 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 contextualisation within FOIS, it welcomes research addressed in an interdisciplinary way with an open-minded aptitude towards philosophical ontology, cognitive science, and linguistics.

This year, the ECS committee accepted seven students that were invited to present their work in the ECS. The topics covered diverse areas: formal approaches to procedures, construed in terms of canonical forms, and to events, construed as transitions among situations; goal-oriented conceptual modelling; use of upper-level ontologies to improve metrics for semantic similarity and relatedness evaluation; use of domain ontologies in explainable AI in legal classification systems; ontological engineering for offshore petroleum production plants; and principles of conceptual modelling based on dialectical materialism.

We wish to thank the PC members for their constructive feedback.

FOIS 2021 Demonstrations

Programme Chairs

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| Amanda Vizedom | Credit Suisse, USA |
| Robert Hoehndorf | King Abdullah University of Science and Technology, Saudi Arabia |

Programme Committee

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|--------------------------------|---|
| Dean Allemang | Working Ontologist LLC, USA |
| Jennifer Cooper | Apple, USA |
| Anna Maria Masci | Duke University, USA |
| Núria Rosinach | Leiden University Medical Center, The Netherlands |
| Jesualdo Tomás Fernández-Breis | Universidad de Murcia, Spain |
| Meika Ungricht | Semantic Arts, Inc., USA |

New to FOIS this year, the demonstrations track sought to complement the research tracks by offering a series of action, interaction, and process-focused events. The scope was drawn broadly to include software, methodologies, patterns, dynamics, and challenges. A goal of FOIS Demonstrations is to raise the visibility and foster understanding of the dynamic, integrative, and use-oriented aspects of applied ontology and its tools. The emphasis is on what happens.

This year's demonstrations include, in various combinations, software, software architecture, ontology design patterns, and methodologies. Huffer and Handley present a pipeline in which ontologies and machine learning are used to create metadata for datasets in NASA's vast collection, then to make those datasets discoverable and reusable. Bouter, Krüger, and Verhoosel offer a data processing and integration tool that uses a domain-independent ontology to generalize an Ontology-Based Data Access method originally developed in the context of horticulture. Flügel, Kleinau, Neuhaus, Glauer, and Hastings present a tool for translating OWL ontologies to FOL, aiming at an expressivity gap that often impedes integration of domain and upper ontologies. Fornara and Sterpetti present a system architecture that uses OWL reasoning and forward chaining to monitor conditions in relation to norms. Queralt-Rosinach, Wilkinson, Kaliyaperumal, Bernabé, Long, Dumontier, Schofield, and Roos present a design pattern and a method for applying it in modeling of heterogeneous health care datasets, improving interoperability. Hunt offers a design pattern for modeling heterogeneous data while satisfying real-world requirements, via canonical entities.

FOIS 2021 Ontology Showcase

Programme Chair and Programme Committee

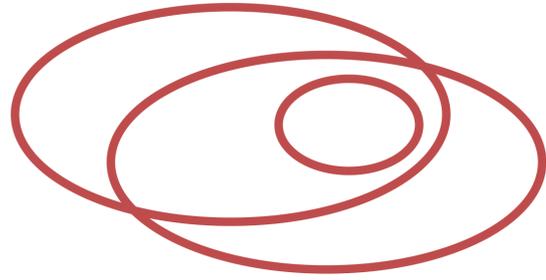
Michael Grüninger
Roberta Ferrario

University of Toronto, Canada
Laboratory for Applied Ontology (ISTC-CNR), Italy

As the Applied Ontology community, we have reached the point where an impressive variety of ontologies have been developed across a wide range of domains. For the most part, however, there has been a lack of coordination among these efforts and even a lack of awareness about the work that is being done by groups within the community. How can we best support ontology repositories so that curated ontologies are findable and accessible? What are the barriers to sharability and reusability that still exist? The Ontology Showcase will be the venue that facilitates the sharing and reuse of ontologies, with the goal of achieving the vision of seamless semantic interoperability of curated ontologies within their applications. Submissions should follow the scope and evaluation criteria for the main track for FOIS, giving an overview of the ontology and its application. In particular, submissions should address the following questions:

- What is the domain of the ontology?
- How is the ontology being used? e.g. search, question answering, semantic integration
- What datasets are used in these applications?
- What other ontologies are reused?
- Are there other ontologies within the same domain?
- What are the competency questions used for the design and evaluation of the ontology?

The Ontology Showcase will facilitate open discussion and experience sharing. Very similar problems arise in disparate ontology applications and an open discussion helps to highlight commonalities and to spread ideas for possible solutions. For this reason, FOMI welcomes researchers and practitioners that embrace this perspective without restrictions on the domains they deal with: business, medicine, engineering, finance, law, biology, geography, electronics, etc.



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