BARRY SMITH
Curriculum Vitae • May 6, 2024

Born 4 June 1952 in Bury, England. US citizen

h-index: 103
citations: 49,257
h-Index for Computer Science
Erdös Number: 3
Dijkstra Number: 4
Times cited by patents: 243

List of publications

EDUCATION

Oxford University: Degree of BA in Mathematics and Philosophy (First Class Honours), 1973. Converted to MA (Oxon.), 1977.

University of Manchester: Ph.D. in Philosophy, 1976. Dissertation: *The Ontology of Reference. Studies in Logic and Phenomenology*, xvi + 477pp., a study of theories of meaning and reference in Frege and Husserl. Supervisor: Wolfe Mays.

Abstract: We propose a dichotomy between object-entities and meaning-entities. The former are entities such as molecules, cells, organisms, organizations, numbers, shapes, and so forth. The latter are entities such as concepts, propositions, representations and theories. Frege distinguished analogously between a 'realm of reference' and a 'realm of sense', which he presented in some passages as mutually exclusive. We apply the meaning/object dichotomy to mathematical and fictional entities, and develop a view of mathematical and other abstract objects as the results of certain types of demarcation – as for example the North Sea is the result of demarcations built into naval charts. Such demarcations reflect demarcatory acts, which presuppose complex cognitive and social structures enabling the creation

of maps, of theories (of mathematics, of natural science), and of novels.

ACADEMIC POSTS

1976–1979	Research Fellow, Department of Philosophy, University of Sheffield, England
1979–1989	University Lecturer, Department of Philosophy, University of Manchester, England, with tenure as of 1982
1989–1994	Professor of Philosophy, International Academy for Philosophy, Liechtenstein
1994–2004	Professor of Philosophy and Member of the Center for Cognitive Science, University at Buffalo
1996–2018	Research Scientist, National Center for Geographic Information and Analysis (NCGIA), University at Buffalo
2000–	Julian Park Chair, Department of Philosophy, University at Buffalo
2002–2004	Director, Institute for Formal Ontology and Medical Information Science (IFOMIS), Faculty of Medicine, University of Leipzig
2004-2006	Director, Institute for Formal Ontology and Medical Information Science (IFOMIS), Saarland University, Saarbrücken, Germany.
2004–	SUNY Distinguished Professor, University at Buffalo
2005–	Founding Director, National Center for Ontological Research (NCOR), Buffalo, NY
2006–2020	Research Scientist, Center of Excellence in Bioinformatics and Life Sciences, Buffalo, NY
2008–2020	Affiliate Professor, Department of Neurology, University at Buffalo
2009–	Affiliate Professor, Department of Computer Science and Engineering, University at Buffalo
2013–	Affiliate Professor, Department of Biomedical Informatics, University at Buffalo
2016–	Researcher, Center for Multi-Source Information Fusion (CMIF), University at Buffalo
2017–20	Faculty Affiliate, Sustainable Manufacturing and Advanced Robotic Technologies (SMART) Community, University at Buffalo
2022–	Affiliate Faculty, Institute for Artificial Intelligence and Data Science, University at Buffalo

VISITING POSTS

1984–85	Humboldt Fellow, University of Erlangen, Germany
1987–88	Visiting Professor, University of Graz, Austria
Nov 1988	Directeur d'Etude Associé, Centre d'Analyse et de Mathematiques Sociales, Ecole des Hautes Etudes en Sciences Sociales, Paris
1990	Distinguished Visiting Professor, University of California, Irvine (Winter Quarter)
Sep 1990	Research Fellow in the Department of Philosophy, University of Turku, Finland
1991–93	Visiting Professor, State University of New York at Buffalo
1992	Visiting Professor, University of Innsbruck, Austria
1993	Visiting Researcher at the Istituto per Ricerche di Dinamica dei Sistemi e di Bioingegneria (LADSEB), Consiglio Nazionale delle Ricerche, Padua, Italy (November–December)
Feb 1994	Humboldt Fellow, Fachbereich Informatik, Universität Hamburg, Germany
Aug 1994	Humboldt Fellow, Institut für Philosophie, Universität Konstanz, Germany
Mar 1995	Visiting Professor, University of Malta, Msida, Malta
Apr 1995	Visiting Professor, Rijksuniversiteit, Leiden, Netherlands
Nov 1995	Visiting Professor, Technische Universität, Vienna
Feb 1997	Visiting Professor, University of Malta, Msida, Malta
Mar 1999	Visiting Professor, University of Malta, Msida, Malta
2000	Visiting Professor, University of Koblenz, Germany
2007–	Research Director, Institute for Formal Ontology and Medical Information Science

	(IFOMIS), Saarland University, Saarbrücken, Germany
2008	Visiting Professor, University of Texas Southwestern Medical Center, Dallas (August 2008)
2018	Visiting Professor, Stevens Institute of Technology, Hoboken, New Jersey
2019–2023	Professor, University of Italian Switzerland and Swiss Institute of Artificial Intelligence Research, Lugano (April 2019, May 2020, 2021, 2022, March 2023)
2024	Professor, University of Italian Switzerland Lugano (February 2024)

HONORS AND AWARDS

1970–1973	Open Exhibition and Open Scholarship (Jesus College, Oxford)
1983–1984	Two-Year Fellowship, Alexander von Humboldt Stiftung, Germany for research in the Universities of Louvain (Belgium), Erlangen (Germany) and Graz (Austria)
1989–1998	Honorary Fellow, University of Liverpool
1991	First Marvin Farber Lecturer, State University of New York at Buffalo
Nov 1994	Fifth Gustav Bergmann Lecturer, University of Iowa
Nov 1995	International Conference on Spatial Information Theory, Semmering, Austria. Award for Best Presentation
Feb 1997	UB Committee for the Promotion of Tolerance and Diversity, Certificate of Appreciation for Exemplary Teaching in American Pluralism
Oct 1997	Distinguished Visiting Scholar, James Madison University, Harrisonburg, Virginia
Mar 1999	Fellow of the American Philosophical Society
Nov 2001	Wolfgang Paul Award, Alexander von Humboldt Foundation
Oct 2002	NCOR
May 2002	Stanisław Kamiński Memorial Lecture, Catholic University of Lublin, Poland
Jun 2005	Carl Linnaeus Lecturer, Mälardalen University, Sweden
Dec 2005–	Honorary Professor, Saarland University, Saarbrücken, Germany
Apr 2010	Paolo Bozzi Ontology Prize, University of Turin, Italy
May 2012–	Member, SUNY Distinguished Academy
Nov 2014–	Fellow, American College of Medical Informatics (FACMI)
Apr 2016–	Honorary Professor, International Center for Formal Ontology, Warsaw University of Technology
July 2016	Winner, IAOA Ontology Competition, 9th International Conference on Formal Ontology in Information Systems, Annecy, France
Aug 2016	50 Most Influential Living Philosophers
2017–2020	Member, Faculty of 1000
May 2017	Stanisław Kamiński Memorial Lecture, Catholic University of Lublin, Poland

EXTERNAL GRANTS

Jul	1978	Research grant from the Deutscher Akademischer Austauschdienst, for work in the Bayerische Staatsbibliothek, Munich	$10,000
Jul	1980	Research grant from the British Academy, for research in Vienna, Graz and Budapest	$6,000
Jul	1980	Liberty Fund grant to organize Summer Schools on Austrian Economics for scholars from Eastern Europe, held in Graz (July 1980) and Vienna (July 1982)	$30,000
Jul	1983	Research grant from the Austrian Bundesministerium für Wissenschaft und Forschung, for research in the University of Graz	$6,000
Aug	1986	Research grant from the Austrian Bundesministerium für Wissenschaft und Forschung, for research in the Forschungsstelle und Dokumentationszentrum für Österreichische Philosophie, Graz	$6,600

Sep	1986	Travel grant from the British Council for research in Milan		$5,500
Sep	1988	Travel grant from the British Academy for attendance at an International Symposium on the Philosophy of Science in Cerisy-la-Salle, France		$5,200
Sep	1990	Travel grant from the Finnish Academy of Sciences for lecturing and research in Turku, Finland		$7,000
Aug	1991	Research grant 11-37632.93 from the Swiss National Foundation for a project on the Philosophical Foundations of Artificial Intelligence		$210,000
May	1991	Travel grant from the Swiss National Foundation for a Lecture Tour in Prague		$4,000
Apr	1992	Grants from the Soros and Lynde and Harry Bradley Foundations for the First Monist Colloquium on the topic of Philosophy and Political Change in Eastern Europe		$20,000
Aug	1992	Research grant from the Foundation Pax ex Innovatione for a project on the Ethical Consequences of Scientific and Technological Innovation		$20,000
Aug	1992	Research grant P-08661-HIS from the Austrian Foundation for the Promotion of Scientific Research (FWF) for a project on Apriorism and the History of Austrian Philosophy		$165,000
Oct	1992	Grant from the Lynde and Harry Bradley Foundation for the Second Monist Colloquium on the topic of European Philosophy and the American Academy, held at the Wingspread Conference Center of the Johnson Foundation (Racine, Wisconsin) in February 1993		$40,000
Apr	1993	Travel grant from the Swiss National Foundation for a Lecture Tour in Budapest		$4,000
Jun	1993	Grant from the Foundation Pro Helvetia for work on the Swiss philosopher Anton Marty		$30,000
Aug	1993	Conference grant from the Peter Kaiser-Stiftung (Vaduz) for the organization of the 16th International Wittgenstein Conference, Kirchberg am Wechsel, Austria on Philosophy and the Cognitive Sciences		$17,500
Aug	1993	Research grant from the Foundation “Pax ex Innovatione” for a project on the Ethical Consequences of Scientific and Technological Innovation (Prolongation)		$9,000
Feb	1994	Research grant from the Alexander von Humboldt Stiftung for a research visit to Hamburg, Germany		$24,000
Aug	1994	Research grant from the Alexander von Humboldt Stiftung for a research visit to Konstanz, Germany		$24,000
May	1995	International Research and Exchanges Board (IREX, Washington DC), travel grant for a lecture tour in Poland		$10,000
Apr	1997	Grant from the John C. Brentano Foundation, for work on Brentano’s philosophy of history		$3,000
May	1997	Summer research grant from the National Center for Geographic Information and Analysis, NSF Project Varenius, Grant Number SBR 96-00465		$3,500
May	1997	Pilot Project Grant from the National Center for Geographic Information and Analysis, NSF Project Varenius, Grant Number SBR 96-00465		$2,500
Jul	1998	Summer research grant from the National Center for Geographic Information and Analysis, National Science Foundation Project Varenius, Grant Number SBR 96-00465		$3,500
Mar	1998	National Science Foundation IGERT Program Grant DGE-9870668. Co-PI (with David Mark and others)	8% of $2,349,348	$187,948
Mar	1999	Sabbatical Fellowship, American Philosophical Society		$30,000
May	1999	National Science Foundation Research Grant BCS-9975557: Geographic Categories: An Ontological Investigation. Co-PI (with David Mark)	50% of $199,691	$99,845
May	2000	German Academic Exchange Service (DAAD), Short-Term Research Grant		$8,000
Apr	2002	Wolfgang Paul Prize, Alexander von Humboldt Foundation		$2,600,000

Mar	2003	National Science Foundation Award Number 0242145, to support the conference The Mystery of Capital and the Construction of Social Reality. Co-PI with David Mark and Isaac Ehrlich		$25,546
Aug	2003	European Union 6th Framework Programme for Research, Technological Development and Demonstration Grant NoE 507505: Network of Excellence in Semantic Data Mining and Medical Informatics. PI of IFOMIS subcontract		$600,000
Sep	2003	National Science Foundation IGERT Program Grant DGE-0333417. Co-PI	8% of $3,778,676	$302,294
Apr	2004	Volkswagen Foundation: Forms of Life: Philosophical Dimensions of Contemporary Biomedical Research, PI		$1,191,237
Sep	2005	European Union 6th Framework Programme for Research, Technological Development and Demonstration, RIDE – A Roadmap for Interoperability of eHealth Systems. PI of IFOMIS subcontract		$195,421
Sep	2005	European Union 6th Framework Programme for Research, Technological Development and Demonstration: ACGT: Advancing Clinico-Genomic Trials on Cancer. PI for IFOMIS subcontract		$182,636
Oct	2005	NIH Roadmap Grant U 54 HG004028: National Center for Biomedical Ontology; PI of Buffalo subcontract. Oct 2005-Jul 2010	4% of $33,013,568	$1,393,500
Sep	2007	Duke University NIAID Cooperative Agreement: Ontology support, September 2006-August 2009		$60,405
May	2007	NIH / NIGMS R01 GM080646-01: PRO: A Protein Ontology in Open Biomedical Ontologies. PI of Buffalo subcontract. May 2007-Sep 2011		$366,942
Apr	2007	Burroughs Wellcome Fund 1007105: Workshop on Infectious Disease Ontology.Co-Director with Lindsay Powell.		$50,000
May	2007	Lockheed Marin: Semantic Multi-INT Data Fusion and Social Network Analysis IRAD program, May-September 2007		$10,000
May	2007	Philosophy Documentation Center: PhilOnto Development		$2,000
Aug	2007	NIH / NIAID / Lockheed CA-0774 Bioinformatics and Scientific IT Program (BSIP): Review of Ontology, Terminology and Vocabulary Resources in the Infectious Disease Domain. Co-PI with Lindsay Cowell, 50%		$40,000
Aug	2007	Oishei Foundation: Task Force for Ontology-Based IT Support for Large-Scale Field Studies in Psychiatry. Co-PI	7.5% of $148,328	$11,124
Apr	2008	Burroughs Wellcome Fund: 2nd Workshop on Infectious Disease Ontology. PI		$24,000
Aug	2008	Emcee Partners, LLC: Semantic DB Phase II project		$14,000
Sep	2008	NIH / NIAID R01 AI 77706: Immune System Biological Networks: A Case Study in Improved Data Integration and Analysis. PI of Buffalo Sub-Contract. Sep 2008-Aug 2012		$786,804
Nov	2008	CUBRC 1078142-1-49908: UCore SLX Biometrics Ontology, U.S. Department Of Defense, Nov 2008-Oct 2009. PI		$360,606
Jan	2009	CUBRC 1078142-1-49908: Command and Control (C2) Core Ontology, U.S. Department of Defense (PI), Key scientist Jan 2009-Oct 2009.		$28,403
Feb	2009	NIH / NHGRI 1R13HG005049-01 International Conference on Biomedical Ontology (ICBO). PI. Feb 2009-May 2010		$20,000
Feb	2009	NSF Award 0822201 The Plant Ontology: Plant Genome Research Resource. Consultant		$6,000
Sep	2009	UCore 2.0 Revisions. Key Scientist. Sep 2009-May 2010.		$6,069
Sep	2009	Vocabulary Development and Standard Practices. Sep 2009-May 2010.		$3,357
Jan	2010	ARGOS Transatlantic Observatory for Meeting Global Health Policy Challenges through ICT-Enabled Solutions, European Union Directorate General for External Relations, January 2010- Oct 2012. PI of Buffalo subcontract		$23,124
Feb	2010	CUBRC 07741.01: Biometrics Ontology Information Exchange Model (NIEM)		$21,620
Aug	2010	NIH Roadmap Grant 2 U54 HG004028: National Center for Biomedical Ontology. PI of Buffalo sub-contract. Aug 2010-Jul 2015.	2% of $36,700,411	$734,008

May	2010	CUBRC 07717.01: C2 Core OWL-DL and UCore-SL Vocabulary Best Practices		$22,190
Apr	2011	CUBRC 07796: EOIR-DDF / UCore		$10,225
Apr	2011	NIH / NHGRI R13HG006231-01 International Conference on Biomedical Ontology (ICBO), National Human Genome Research Institute. PI, Apr 2011-Mar 2012		$20,000
Aug	2011	CUBRC 07817: Semantic Enhancement of the Dataspace		$183,973
Sep	2011	NIH / NIGMS R01 GM080646-06 PRO: A Protein Ontology in Open Biomedical Ontologies, National Institute for General Medical Sciences (4-year renewal). Co-PI. Sep 2011-Aug 2020		$2,496,832
Nov	2011	Gesellschaft für Telematikanwendung der Gesundheitskarte (Gematik), EPSOS: European Patients: Smart Open Services. Consultant		$28,680
Oct	2012	CUBRC 07881: Data Tactics Project		$130,666
Oct	2012	NIH / NIAID HHS N272201200028 Bioinformatics Integration Support Contract (BISC) IMMPORT, National Institute of Allergy and Infectious Diseases. PI of Buffalo Sub-Contact. Oct 2012-Sep 2017.		$974,106
Jul	2013	NIH / NIDCR 1 T32 DE023526-01 Advanced Training in Oral Biology, National Institute for Dental and Craniofacial Research. Mentor.		
Dec	2014	NSF Award 1340112: The Planteome Project: Common Reference Ontologies for Plant Science (CROPS). Consultant		$8,000
Jan	2014	CUBRC 07959.01.01: ENTICE Program / DCGS-A Ontologies		$19,800
Feb	2014	CUBRC IC1301401: ReCOURSE II CRA		$20,000
Jun	2014	CUBRC IC1331002: CARMA CRA FA8750-14-C-0165 CRA		$12,500
Aug	2014	CUBRC IC1322307: SIGOPS FA8750-14-C-0168 CRA		$30,000
Aug	2014	CUBRC IC1331101: BlueFRAME II FA8750-14-C0238 CRA		$20,000
Apr	2015	CUBRC 07932.02 SAFETI (OS-MAMA)		$101,400
Aug	2015	NIH / NCATS 1UL1TR001412 Buffalo Clinical and Translational Research Center (CTSA Award). Key personnel.		$360,000
Sep	2015	NIH / NCI 1U24CA199374-01 Pathology Image Informatics Platform for Visualization, Analysis and Management. Co-Investigator	2% of $501,440	$10,014
Feb	2016	CUBRC 08015.01C2: Digital Thread – Digital Twin, Air Force Research Laboratory, Wright-Patterson AFB.		$54,150
Apr	2016	CUBRC: 08021.01C1 MCISRE Ontology Review and Evaluation		$9,600
Dec	2016	DMDII 15-11 Coordinated Holistic Alignment of Manufacturing Processes. PI. Dec 2016-Jan 2018.		$1,255,260
Jun	2017	NIH / NLM T5 Biomedical Informatics and Data Science Research Training Programs. 2017-2022. Mentor		$19,506
Jan	2018	DMDII Wind Turbine Ontology Project. PI. Jan 2018-May 2018.		$56,581
Mar	2018	Naval Postgraduate School N00244-18-1-0003 Data Science Approaches to Automation of Analytic Work Flows. Co-PI	7% of $150,000	$10,000
Aug	2018	Navy SYSCOMs and DoD Ontology (Planning Grant), Systems Engineering Research Center (SERC). PI		$27,000
Sep	2018	Air Force Office of Scientific Research AFOSR- 0007011818 Event Characterization Fusing Hard and Soft Data via Semantic Models. Co-PI. Sep 2018-Aug 2022		$661,447
Oct	2018	ICPostDoc Fellowship ORAU A83344, Oak Ridge Institute for Science and Education, Oct 2018-Sep 2020		$34,000
Jun	2019	CUBRC 08057.04C2: Cognitive Data Framework Phase II	1% of 500K	$6,000
Jun	2019	363rd ISR Wing; Air Defense Forces Ontology ADFO		$5,850
Dec	2019	NIH / NCATS 1UL1TR001412 Buffalo Clinical and Translational Research Center (CTSA Award). Dec 2019-Nov 2024 Key personnel		$290,000
Jan	2020	CUBRC S08057.04C4: Navy Systems Engineering Transformation Cyber Technology. Co-PI		$3,900

Jul	2020	NIH/NLM T15LM012495-01 Buffalo Research Innovation in Genomic and Healthcare Technology (BRIGHT) Education Training Programs, 2020-2021.	$23,651
Aug	2020	MIT Lincoln Labs: Advanced Aviation Teaming Program 3449 (US Army Program Executive Office – Aviation): Collaborative Behavior Ontology. August 2020-September 2021. PI	$145,117
Sep	2020	JAIC (Joint Artificial Intelligence Center) Joint Logistics Program, 141011 Ontology Support. PI	$1,500
Jul	2021	METASTRIKE (Air Force Research Lab, Dayton, OH) Question-and-Answer System for BFO-conformant Ontology Development. July 2021-December 2021	$7,620
Oct	2021	ICPostDoc Fellowship ORAU 174038, Oak Ridge Institute for Science and Education, Oct 2021-Sep 2023. Total funded $234,000	$34,000
Apr	2022	Abrasian Ontology and Database, Edison Welding Institute (EWI), Buffalo, NY.	$6,000
		Ontology Bootcamp, Department of Homeland Security, Tucson, AZ,	$4,800
		Infrastructure Data Taxonomy (Ontology-based revision strategy), Lawrence Llvermore National Lab (LLNL) and Cybersecurity and Infrastructure Security Agency (CISA, DHS)	$14,000
Sep	2023	NIH National Institute of Dental & Craniofacial Research, 1R34DE033592-01, Traumatic Events and Injury: Etiologic Mechanisms for Temporomandibular Disorders	$339,268
		Swiss National Foundation 212493. An Ontology of Production, Products, and By-Products, University of Neuchatel, Switzerland. Sep 2023-Sep 2027. (Project Partner)	n/a
		Total:	$**17,508,825**

INTERNAL GRANTS

Jun	1995	Grant from National Center for Geographic Information and Analysis, for participation in COSIT 1995 (Conference on Spatial Information Theory, Semmering, Austria) ($500)
Apr	1996	Economic Development and Property Rights: An Investigation in Comparative Legal Ontology, grant from University at Buffalo Multidisciplinary Pilot Project Program ($16,116)
May	1996	Grant from University at Buffalo Center for Cognitive Science, to support work on a paper entitled The Cognitive Geometry of War ($300)
Oct	1996	Grant from the Randolph Foundation, New York, to support a conference on Academic Freedom held in Canisius College, Buffalo in April 1997 ($4,000)
May	1997	Grant from the SUNY Conferences in the Disciplines Program for a conference on Applied Ontology in Buffalo, April 1998 ($2,000).
Jun	1997	Grant from National Center for Geographic Information and Analysis, for participation in COSIT 1997 (Conference on Spatial Information Theory), University of Pittsburgh ($500)
Jun	1997	Pilot Project Grant from the UB Cognitive Science Center ($500)
Nov	1997	Grant from the SUNY Conversations in the Disciplines Program for a conference on Applied Ontology in Buffalo, April 1998 ($3,000)
Mar	1998	Software and Intellectual Property: A Pilot Investigation in Legal Ontology, University at Buffalo Multidisciplinary Pilot Project Program ($20,000)
Nov	2002	SUNY Conversations in the Disciplines Grant ($1,700) to support a conference on Mystery of Capital and the Construction of Social Reality
Sep	2004	Center for Brain and Behavior Informatics, University at Buffalo ($2,300,000)

CONSULTANCIES

1999–2001	Formale Ontologie für Kataster und Grundbuch, Fonds zur Förderung der wissenschaftlichen Forschung (FWF), Austria (P125775-GEO)
2000–2008	IEEE (Institute of Electrical and Electronic Engineers) Standard Upper Ontology Project

2001–2003	European Union COST Enterprise on Framework Planning in Cadastral Education
2004–2007	FWF Research Project: The Concept of Person and the Naturalistic Challenge, University of Innsbruck, Austria
2005–	Institute for Liberty and Democracy, Lima, Peru
2006–2010	School of Medicine, Duke University Health System
2006–2012	German Federal Ministry of Health
2007	Lockheed Corporation: Ontology for Multi-Modal Intelligence Integration
2007	University of Pittsburgh Medical Center
2008–2010	US Department of the Army Net-Centric Data Strategy Center of Excellence
2010–11	Modelling Immunity for Defense Center, Mount Sinai School of Medicine
2010–11	Joint Warfighting Center, Joint Forces Command, Department of Defense
2011–12	Intelligence and Information Warfare Directorate (I2WD), US Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Semantic Enhancement of the Dataspace
2012–13	Intelligence and Information Warfare Directorate (I2WD), US Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Distributed Development of a Shared Semantic Resource (DDSSR)
2011	Evicare: Evidence-Based Care Processes – Integrating Knowledge into Clinical Information Systems, University of Oslo and Norwegian University of Science and Technology, Trondheim
2012	Institute of Health Policy Studies Informatics Lab at University of California, San Francisco
2014–16	Air Force Research Laboratory (AFRL), Rome, NY
2014–22	Planteome, NSF Division of Integrative Organismal Systems
2015–17	Air Force Research Laboratory (AFRL), Wright-Patterson AFB, Dayton, OH
2015	Aviation Systems Engineering Company (ASEC)
2016	SPAWAR Atlantic, Charleston, SC
2018–19	De Soto, Inc., Lima Peru
2020	Office of Naval Research AI Taxonomy Working Group
2021	IDSIA (Swiss Institute for Artificial Intelligence Research) InMaX project on integrating Machine Learning with scientific methodology

SCIENTIFIC ADVISORY BOARDS

1983–2010	Meinong-Institut: Forschungsstelle und Dokumentationszentrum für Österreichische Philosophie
2004–	Hegeler Institute, Board of Trustees
2004–10	Centre de Recherche en Philosophie Économique
2005–06	The MGED Network Functional Genomics Investigation Ontology (FuGO)
2006–2011	Gene Ontology Consortium (NIH/NHGRI)
2006–	Ontology for Biomedical Investigations (OBI)
2006–12	Philosophy Documentation Center
2006–08	Multiscale Systems Immunology for Adjuvant Development (NIH/NIAID)
2007–10	The Cleveland Clinic Semantic Database
2008–12	Disease Ontology (NIH/NHGRI)
2010–12	CardioVascular Research Grid Ontology Advisory Board (CVRG) (Johns Hopkins)
2010–12	Ontology for Clinical Research (OCRe) (University of California at San Francisco)
2010–	International Association for Ontology and its Applications (IAOA)
2011–13	NextGen (Next Generation Air Transportation System) Ontology Team, US Government Joint Planning and Development Office (JPDO)

2014–15 Ontolog Foundation, Board of Trustees
2014–15 Intelligence and Information Warfare Directorate (I2WD) Ontologies Governance Board
2014–17 National Center for Geographic Information and Analysis (NCGIA), Buffalo
2016– International Council for Formal Ontology (ICFO)
2020– EU OntoCommons

ONTOLOGY CONSORTIA AND WORKING GROUPS

2006– Open Biomedical Ontologies (OBO) Foundry Coordinating Editorial Board
2007– Protein Ontology (PRO) Consortium (NIH/NIGMS)
2007– Infectious Disease Ontology (IDO) Consortium (NIH/NIAID)
2009–12 Major Histological Complex Ontology Working Group (NIH/NIAID)
2009 Task Force on Representation and Deployment of the Program on Ontologies of Neural Structures (PONS) of the International Neuroinformatics Coordinating Facility (INCF)
2010–12 eagle-I / VIVO Expertise Ontology Working Group
2012–13 CTSAconnect
2012–20 Environment Ontology Core Team (Genomic Standards Consortium)
2015–17 United Nations Environment Programme (UNEP) Sustainable Development Goals Interface Ontology (SDGIO) Community of Practice
2015–17 Pistoia Ontologies Mapping Project
2016–20 ISO/IEC JTC 1/SC 32/WG 2 – MetaData
2016– Industrial Ontologies Foundry (IOF)
2017–20 Semantic Web Technologies for Systems Engineering (SWTSE) group
2017–20 Roswell Park Cancer Institute (RCPI) Cancer Ontology Working Group
2017–22 Editor for International Standards Organization and International Electronical Commission: ISO/IEC 21838-1. Information Technology – Top-Level Ontologies – Requirements; ISO/IEC 21838-2. Information Technology – Top-Level Ontologies – Basic Formal Ontology
2017– Governance Board and Technical Oversight Board, Industrial Ontologies Foundry (IOF), National Institute of Standards and Technology (NIST)
2018– Capabilities Ontology Working Group
2019– Department of Defense and Intelligence Community Ontology Working Group (DIOWG)
2019–22 InterNational Committee for Information Technology Standards (INCITS) Mid-Level Ontology Working Group
2019–21 Member, INCITS DM32 Data Management and Interchange
2019–20 Member, INCITS Artificial Intelligence Working Group
2020– Industrial Ontologies Foundry (IOF) MT-Connect Working Group
2020– Industrial Ontologies Foundry (IOF) Systems Engineering Working Group
2020– Normactivity – Research Network on Human and Non-Human Normativity
2021–22 European Observatory for ICT Standardisation
2021– OntoCommons – Ontology-Driven Data Documentation for Industry Commons (2021–)
2022– Buffalo Toronto Ontology Alliance (BoaT)
2023– Industrial Ontologies Foundry (IOF)
2023– Common Core Governance Board

STUDY SECTIONS AND REVIEW BOARDS

1979– Austrian Fonds zur Förderung der wissenschaftlichen Forschung (FWF)
1994, 1997 Canadian Federation for the Humanities Aid to Scholarly Publications Program.
2003– Deutsche Forschungsgemeinschaft (DFG)

2005	U.S. Civilian Research and Development Foundation (CRDF)
2005–	Netherlands Organization for Scientific Research
2005–2009	Permanent Committee of External Referees, Italian Ministry of Research
2006	Ad hoc Member, NIH Study Section, Biodata Management and Analysis (BDMA)
2006–	German Academic Exchange Service (DAAD)
2006–2009	European Union Networked Ontologies (NeOn) Integrated Project
2007	NSF Review Panel on Ontologies and the Semantic Web
2007–	Leverhulme Trust, UK
2009	Netherlands Genomics Initiative
2011–	Czech Science Foundation
2011–	National Science Centre, Poland
2011–	National Nuclear Security Administration (NNSA), Department of Energy
2012–	Fonds Nationale de Luxembourg
2013	Ad hoc Member, NIH Study Section, National Institute of Dental and Cranofacial Research (Facebase)
2013	French National Research Agency
2013	European Science Foundation
2013	South African National Research Foundation
2013	Fulbright Foundation
2013	Social Sciences and Humanities Research Council of Canada (SSHRC)
2013	AXA Research Fund
2013	Canada Council
2014	Ad hoc Member, NIH/NIDCR Review Panel (Facebase 2)
2014	Ad hoc Member, NIH / BD2K Study Section (Data Discovery Index Coordination Consortium)
2017	Swiss National Foundation (SNF)
2022	European Commission
2022	Austrian Science Fund (FWF)
2022	Swiss National Foundation (SNF)

LEARNED JOURNALS AND SERIES

Editor of *The Monist. An International Quarterly Journal of General Philosophical Inquiry* (1992–2016)

Associate Editor

Applied Ontology (2004–)
BMC Bioinformatics (2011–2015)
Journal of Biomedical Semantics (2009–)

Member of Editorial Board

Advances in Austrian Economics (1996–)
Axiomathes (1993–2011)
BMC Bioinformatics (2011–)
Brentano-Studien (1988–)
Collana di ontologia (2009–)
Dialectica (1988–)
Diametros (2004–)
Encyclopédie philosophique universelle (PUF, 1992)
Episteme (2002–)
Filozofia Nauki / The Philosophy of Science (2018–)
Grazer Philosophische Studien (1995–)
History and Philosophy of Logic (1979–1984, Founding Editorial Board Member)

In Silico Biology (2011–2015)
Interdisciplinary Phenomenology (2003–)
Journal of Biomedical Informatics (2006–2014)
Journal of Biomedical Semantics (2009–)
Journal of Knowledge Structures and Systems (2020–)
Journal of Libertarian Studies (1999–2010, 2019–)
Journal of Social Ontology (2013–)
Logic and Logical Philosophy (1996–)
Logical Analysis and History of Philosophy (1997–)
LOGOS: Freie Zeitschrift für wissenschaftliche Philosophie (2009–)
Meinong Studies (2004–)
Metaphysica (2003–)
Molinari Review (2015–)
Philosophy and Phenomenological Research (1986–1999)
Polish Journal of Philosophy (2006–)
Quarterly Journal of Austrian Economics (1998–)
Reports on Philosophy (2001–)
Roczniki Filozoficzne / Annals of Philosophy (2000–)
Spatial Cognition and Computation (2007–2019)
The Monist (2017–)

Book Series Editor

Philosophia Resources Library (Philosophia, 1987–1992)
The International Carl Menger Library (Philosophia, 1987–1992)
Primary Sources in Phenomenology (Kluwer, 1987–1994; Springer, 2016–)

Book Series Editorial Board Member

Library of Living Philosophers (Open Court, 1991–)
Metaphysical Research (De Gruyter, 2003–)
Philosophical Studies Series (Springer, 2002–)
Studies on the Semantic Web (IOS, Amsterdam, 2011–)
La Collane del Labont (Rome, 2014–)

Refereeing additionally for:

Academic Questions
Acta Academica
Acta Biotheoretica
Advances in Bioinformatics
Annals of the American Association of Geographers
Applied Clinical Informatics
Archives of Virology
Artificial Intelligence in Engineering Design, Analysis and Manufacturing
Artificial Intelligence in Medicine
Artificial Intelligence Review
Australasian Journal of Philosophy
BMC Bioinformatics
BMC Genomics
Future Internet Genome Biology
Geoinformatica
Global Jurist
History of Economic Ideas
Human Mutation
Husserl Studies
Information and Management
In Silico Biology
Inquiry
Intellectica
Interface (Royal Society)
International Journal for Intelligent Defense Support Systems
International Journal of Distributed Sensor Networks
International Journal of Geographical Information Science
Journal of the American Society for Information Science and Technology
Journal of the Association of Information Systems
Journal of the History of Economic Thought
Journal of the History of Ideas
Journal of the History of Philosophy
Journal of Web Semantics
Language Resources and Evaluation
Logique et Analyse
Mind
Minds and Machines
Nature Biotechnology
Nature Reviews
Nature Reviews Nephrology
Open Geosciences
Open Philosophy

BMC Medical Genomics
Bioinformatics
Briefings in Bioinformatics
British Journal for the Philosophy of Science
Bulletin of Symbolic Logic
Computing and Geosciences
Computational Biology and Chemistry
Critical Review
Data and Knowledge Engineering
Database
Dialogue
Diametros
Discipline Filosofiche
Drug Development Today: Biosilico
Economics and Philosophy
Environment and Planning B
Erkenntnis
Ethos (Lublin)
European Journal of the History of Economic Thought
European Journal of Philosophy
Frontiers in Medicine: Translational Medicine
Journal of the American Philosophical Association
International Journal of Distributed Sensor Networks
Journal of Biomedical Semantics
Journal of Database Marketing
Journal of Data Semantics
Journal of Economic Methodology
Journal of Engineering Design
Journal of Function Spaces
Journal of Engineering Design
Journal of Information Science
Journal of Institutional Economics
Journal of Integrative Biology
Journal of Medicine and Philosophy
Journal of Neuroscience
Journal of Neuroscience
Journal of Philosophical Logic
Journal of Sensors
Journal of Supercomputing
Journal of the American Dental Association
Journal of the American Medical Informatics Association
Philosophia Mathematica
Philosophia Scientiae
Philosophical Explorations
Philosophical Quarterly
Philosophy of the Social Sciences
PLoS Computational Biology
PLoS One
Psychology and Economics
Review of Austrian Economics
Review of Philosophy and Psychology
Southern Journal of Philosophy
Southwestern Journal of Philosophy
Studia Neoaristotelica
Studia Phaenomenologica
Synthese
Techné: Research in Philosophy and Technology
Theoretical Biology and Medical Modelling
Theoretical Medicine and Bioethics
Theoria
Transactions of the C. S. Peirce Society
Transactions in GIS

Bloomsbury Publishers, Bradford Books/MIT Press, Cambridge University Press, Center for the Study of Language and Information (Stanford), Chapman and Hall, Chicago University Press, Harvard University Press, IOS Press, MIT Encyclopedia of Cognitive Science, Nijhoff/Reidel/Kluwer, Open Court Publishing Company, Oxford University Press, Routledge, Westview Publishers, Springer Publishing House, Wiley Interscience, University of Chicago Press, Yale University Press.

STANDARDS

Editor, International Standards Organization and International Electrotechnical Commission Joint Technical Committee 1, for ISO/IEC 21838-1 (Top-Level Ontologies) and ISO/IEC 21838-2 (Basic Formal Ontology)

ONLINE COURSES

An Introduction to Biomedical Ontology (2008)
An Introduction to Ontology: From Aristotle to the Universal Core (2009)
From Basic Formal Ontology to the Information Artifact Ontology (2009)
Basic Building Blocks for Biomedical Ontologies (2011)
Problems in Ontology (2012)
Ontology for Intelligence, Defense and Security (2012)
Semantics for Biodiversity (2013)
Analytic Metaphysics (Lecture Couse) (2016)
Building Ontologies: An Introduction for Engineers (2017)
Introduction to Basic Formal Ontology 2.0 (2017)
Ontology for Systems Engineering (2018)
Building Ontologies with Basic Formal Ontology (2018)

TEACHING

University of Sheffield (one-year courses)
Introductory Logic, 1977–78, 1978–79

University of Manchester (one-year courses)
Introduction to Philosophy/History of Philosophy, 1979–80, 1980–81, 1981–82, 1982–83, 1985–86, 1986–87, 1988–89
Philosophical Logic, 1985–86, 1986–87
Elements of Phenomenology and Existentialism, 1979–80
Contemporary European Thought, 1980–81, 1981–82, 1982–83, 1985–86, 1986–87
History of Modern Philosophy: Rationalism and Empiricism, 1985–86, 1986–87, 1988–89
Husserl, 1979–80, 1980–81, 1981–82, 1982–83, 1985–86
Phenomenology, 1979–80, 1980–81, 1981–82, 1982–83
Wittgenstein's *Tractatus*, 1981–82
Cognition and Intentionality: An Introduction to Artificial Intelligence, 1986–87
Philosophy of Science, 1988–89
Advanced Philosophy of Science, 1988–89
Metaphysics, 1988–89

University of Erlangen (jointly with H. Burkhardt)
Franz Brentano und die deskriptive Psychologie, Proseminar, SS 1984
Einführung in die analytische Philosophie. Intentionalität, Referenz, Wahrnehmung, Proseminar, WS 1984–85
Die Philosophie Ludwig Wittgensteins, Proseminar, SS1985

Internationale Akademie für Philosophie im Fürstentum Liechtenstein
Truth, Correspondence and Ontology, Block–Seminar, May–June 1987
Bewusstsein, Bedeutung und Metaphysik. Aspekte der Philosophie des 20. Jahrhunderts, Block-Seminar, September 1987
History of Phenomenology, Block-Seminar, June–July 1988, WS 1991/92
Introduction to Formal Logic, Block-Seminar, October–November 1988
Sprachphilosophie, Seminar, WS 1989/90
On Commentaries: From Averroes to the Bürgerliches Gesetzbuch, Seminar, WS 1989/90
Formal Logic, Lecture with Seminar, WS 1989/90
Pascal, Graduate Seminar, WS 1989/90
Introduction to Philosophy, Lecture with Seminar, SS 1990, WS 1991/92
Philosophie und Literatur, Lecture, SS 1990
Aristotle's Poetics, Graduate Seminar, SS 1990
Die Österreichische Schule der Nationalökonomie, Seminar, WS 1990/91
Introduction to Philosophical Logic, Lecture with Seminar, WS 1990/91
Methods of Research in Philosophy, Seminar, WS 1990/91
Natural Law, Human Rights and Legal Positivism, Graduate Seminar, WS 1990/91
Introduction to Formal Logic and Set Theory, Lecture with Seminar, SS 1991
Analytic Metaphysics, Seminar, SS 1991
Europäische Philosophie der Gegenwart, Lecture, SS 1991
Die Philosophie Franz Brentanos, Seminar, WS 1991/92
Philosophy of Mathematics and the Natural Sciences, Lecture, SS 1992
Formal Ontology, Research Seminar, SS 1992

Einführung in die Phänomenologie, Lecture, WS 1992/93
Philosophy of Music, Seminar (jointly with R. Casati), WS 1992/93
Apriorism, Research Seminar, WS 1992/93
History and Philosophy of Logic, Seminar (jointly with G. White), SS 1993
Truth, Research Seminar, SS 1993
Philosophie und die Kognitionswissenschaften, Lecture (jointly with R. Casati), SS 1993

University of Graz
Formale Ontologie, Vorlesung, WS 1987
Grundlagenprobleme der Ästhetik, Privatissimum, WS 1987
Phänomenologie, Vorlesung mit Konversatorium, WS 1987
Topologie für Philosophen, Privatissimum, SS 1988
Metaphysik: Eine Einführung in die Philosophie, Proseminar, SS 1988
Was ist Wahrheit? Vorlesung, SS 1988 (jointly with R. Haller)

International Summer School for Philosophy and Artificial Intelligence, Bolzano, Italy
Cognition and Intentionality, July 1988
Formal Ontology, July 1991
Cognitive Metaphysics, October 1994

University of California at Irvine
Metaphysics, Winter Quarter 1990

University of Turku, Finland
The Physics of the Common-Sense World, Block-Seminar, September 1990

University at Buffalo
Cognition and Intentionality: Perspectives on Phenomenology and Cognitive Science, Graduate Seminar, Spring Semester 1991
Continental Drift: A Conspectus of 20th Century European Philosophy, Marvin Farber Lectures, Spring Semester 1991
Introduction to Philosophy, Autumn Semester 1991 (block seminar, with P. Hare and N. Garver)
Formal Ontology (graduate block seminar), 1991–92
Social Philosophy, Spring Semester 1991, Spring Semester 1992, Fall Semester 1993 (block seminars with P. Hare and N. Garver)
Metaphysics, Fall Semester 1992 (block seminar, with P. Hare and N. Garver)
Topics in European Intellectual History, Fall Semester 1992 (block seminar, with G. Iggers and others)
Methodological Problems of the Social and Cognitive Sciences (one-year graduate block seminar), 1992–93
Phenomenology and Existentialism, Spring Semester 1993 (block seminar, with P. Hare and N. Garver).
Writing Philosophy (graduate block seminar), 1993–94
Epistemology, Spring Semester 1994 (block seminar, with P. Hare)
Foundations of Cognitive Science (graduate lecture course, First International Summer Institute in Cognitive Science), July 1994.
Introduction to Philosophy, Fall Semester 1994, Summer Semester 1995, Fall Semester 1995, Fall Semester 1996 (Enrolment: 217)
Twentieth-Century Philosophy, Fall Semester 1994
Ethics, Spring Semester 1995, Fall Semester 1995, Spring Semester 1996, Spring Semester 1997
Cognitive Metaphysics (graduate seminar), Spring Semester 1995
Austrian Philosophy, Fall Semester 1995
American Pluralism: Issues of Race, Class, Sex and Gender, Spring Semester 1996, Spring Semester 1997;

Spring Semester 1998; Spring Semester 1999
Husserl (graduate seminar), Spring Semester 1996, Spring Semester 1998, Spring Semester 2003
Groundwork for the Social Sciences, Fall Semester 1996 (jointly with M. Thalos)
Critical Thinking for Lawyers, Spring Semester 1997
Law and Ontology (graduate seminar), Fall Semester 1997
Research Ethics (graduate seminar), Spring Semester 1998
Philosophy and Economics (graduate seminar), Fall Semester 1998.
Research Ethics (graduate seminar), Spring Semester 1999.
Ethics and Politics of Cross-Cultural Communication (graduate seminar, with J. C. Nyiri, Budapest), Spring Semester 1999
Merleau-Ponty's *Phenomenology of Perception* (graduate seminar), Spring Semester 1999
Clinton: A Philosophical Exploration, Spring Semester 1999
Introduction to Cognitive Science (graduate seminar, with Roberto Casati), Fall Semester 1999
Problems in Ontology: The Metaphysics of Spatial Entities (graduate seminar, with Roberto Casati), Fall Semester 1999
Husserl's *Logical Investigations* (graduate seminar), Spring Semester 2001
Geographic Ontology (graduate seminar, with David Mark), Spring Semester 2001
Philosophy of Social Reality (undergraduate honors seminar, with Rudolf Lüthe), Fall Semester 2001
Geospatial Ontology (graduate seminar, with Roberto Casati), Fall Semester 2001
Religion, Revolution, War and Terrorism (graduate seminar), Spring Semester 2002
Formal Ontology (graduate seminar), Fall Semester 2002
The Meaning of Life (undergraduate honors seminar), Spring Semester 2003
Husserl (graduate seminar), Spring Semester 2003
Topics in Ontology (graduate seminar), Spring Semester 2003
Types and Tokens (graduate seminar with Boris Hennig and Fabian Neuhaus), Fall Semester 2005
Ontology, Bioinformatics and Life Sciences (public lecture series), Fall Semester 2006
An Introduction to Biomedical Ontology (tutorial), Spring Semester 2008
CAS 101: Trends in Arts and Sciences (Philosophy), Fall Semester 2009
Basic Formal Ontology (tutorial), Fall Semester 2009
From Aristotle to the Universal Core (tutorial), Fall Semester 2009
Philosophical Aspects of Health and Disease, Fall Semester, 2010 (with Mathias Brochhausen)
CAS 101: Trends in Arts and Sciences (Philosophy), Fall Semester 2011
Four Seminars on Biomedical Informatics. Core Curriculum in Clinical and Translational Research Seminar Series (School of Medicine), Spring Semester 2012
Basic Formal Ontology 2.0 (tutorial), Summer Semester 2012
Protégé 2000 (tutorial), Summer Semester 2012 (with Ron Rudnicki)
Problems in Ontology (graduate seminar), Fall Semester 2012
Ontological Engineering (graduate seminar), Fall Semester 2013, Fall Semester 2014
Tutorial and Hackathon: Ontology and Imaging Informatics, Third Clinical and Translational Science Ontology Workshop, June 23-25, 2014
CE 630: Research Methods in Chemical and Biological Engineering (Research Ethics), Spring Semester 2015
CAS 101: Trends in Arts and Sciences (Philosophy), Fall Semester 2015
Analytic Metaphysics, Spring Semester 2016
Biomedical Ontology, Fall Semester 2016 (with Werner Ceusters)
Applied Ontology, Spring Semester 2017 (online course)
PHI 579 Social Norms and Informal Institutions, Spring Semester 2017 (guest lecture)
Advanced Biomedical Ontology, Fall Semester 2017 (with Werner Ceusters)
Clinical and Translational Science Institute (CTSI) Workforce Development Core, Biomedical Informatics Workshop Series, Lectures on: How to write grants. How to get published. Data ethics and responsible data sharing. October 3 and October 15, 2017
Ontology for Systems Engineering (Slides), Center for Multi-Source Information Fusion, January 26, 2018

Ontological Engineering, Spring Semester 2018 (online course)
Applied Ontology, Fall Semester 2018
Intelligence Analysis: A Crash Course, Fall Semester 2019
Clinical and Translational Science Institute (CTSI) Workforce Development Core, Biomedical Informatics Workshop Series, Lectures on:

The Reproducibility Crisis in Biomedical Research. October 31, 2019; October 21, 2021
Philosophy on Rails: An Introduction to Ontology, Fall Semester 2020

The Metaphysics and Ethics of Transhumanism, Guest Lecture: Transhumanism and the Turing Test, September 30, 2020.
American Philosophy and Its Contemporary Relevance, Fall Semester 2021, Department of Philosophy (with Jobst Landgrebe)
Philosophy and Artificial Intelligence (Crash Course), October 3-4, 2021, Department of Philosophy and Department of Computer Science (with Jobst Landgrebe)
Applied Ontology (online course), Spring Semester 2022, Department of Philosophy
Philosophy of Science, Fall Semester 2022, Department of Philosophy
Lecture in John Beverley's Logic of Ontology class (PHI 637), May 1, 2023 ("BFO-2020-2023", Video)
Clinical and Translational Science Institute (CTSI) Biomedical Informatics Bootcamp, August 15, 2023 ("Use of AI in medical teaching, medical care, and medical research", Video)

Catholic University of Lublin
Truth and Truthmakers, Block-Seminar, March-April 2000
Applied Ontology, Block-Seminar, May 2002
Applied Ontology: An Introduction, Block-Seminar, May 2018

Universität Koblenz-Landau
Werkzeuge des systematischen Denkens. Eine Einführung in die systematische Philosophie, Summer Semester 2000
Von Platon bis Nozick: Eine Einführung in die politische Philosophie (with Ruth Hagengruber), Summer Semester 2000
Probleme der angewandten Ethik (seminar, with Rudolf Lüthe), Summer Semester 2000
Kognition, Information, Repräsentation (seminar)

Universidad Autónoma del Estado de Morelos, Cuernavaca, Mexico
Categorization: An Introduction to the Theory of Granular Partitions, June 2001 (block seminar)

Copenhagen Business School, Copenhagen, Denmark
Language and Ontology (block seminar), May 2003

Universidad Francisco Marroquin, Guatemala City, Guatemala
The Meaning of Social Life (block seminar), July 2003
Video presentations

International Spatial Cognition Summer Institute, Bad Zwischenahn, Germany
Ontology, Space and Language (block seminar, with John Bateman), August 24 - September 6 2003

Intelligent Systems for Molecular Biology (ISMB)
Principles of Ontology Construction (Tutorial with Suzanna Lewis and Michael Ashburner), Detroit, June 25, 2005
How to Build Ontologies and How to Use Them (Tutorial with Nigam Shah), Vienna, Austria, July 19, 2007

Bio-Ontologies: How to Make and Use Them (Tutorial with Nigam Shah), Toronto, Canada, July 18, 2008

Medical Informatics Europe (MIE)
MIE 2005: Principles of Ontology Design (Tutorial, with Werner Ceusters), Geneva, August 28, 2005
MIE 2006: Standards and Ontology (Tutorial, with Werner Ceusters), Maastricht, August 27, 2006
MIE 2009: Biomedical Ontologies: The State of the Art (Tutorial, with Werner Ceusters), Sarajevo, August 30, 2009

International Conference and Research Center for Computer Science, Schloss Dagstuhl, Germany
Training Course in Biomedical Ontology (Tutorial), May 21-24, 2006
Reasoning with Biomedical Information: Training Course in Logic for Biomedical Research (Tutorial), June 20-22, 2007

Universität des Saarlandes
Problems in Ontology (with Pierre Grenon and Ingvar Johansson), Fall Semester, 2004
Spezies (graduate seminar, with Ulrich Nortmann and Mathias Brochhausen), Summer Semester 2006
Sprachtechnologie, Ontologien und Rechtswissenschaft (research seminar, with Manfred Pinkal, Max Herberger, and Stephan Walter), Summer Semester 2006
Die Grundkategorien der Ontologie (Blockveranstaltung), Summer Semester 2014

Duke University, Durham, NC
The Foundations of Biomedical Ontology (Tutorial), October 31, 2006

Massachusetts Institute of Technology, *Cambridge, MA*
Connecting BioPAX to Other Biomedical Ontologies (Tutorial), November 20-21, 2006

Protégé 2007, Budapest, Hungary
How to Build and Maintain Useful Ontologies (Tutorial), July 15, 2007

Universidade Federal Fluminense, Rio de Janeiro, Brazil
An Introduction to Biomedical Ontology (Tutorial), August 14, 2008

Northwestern University, Chicago, IL
Tutorial on Ontology Development, Disease Ontology Workshop, Northwestern University, Chicago, January 16-17, 2010

European Bioinformatics Institute, Hinxton, Cambridge, UK
Ontologies for the Virtual Physiological Human (Tutorial, with Alan Ruttenberg), February 14, 2010
Introduction to Ontology Best Practices (Tutorial), Ontology Development and Engineering: Tutorial & Training Workshop (EMBL-EBI Industry Programme), October 11, 2010

US Army Net-Centric Data Strategy Center of Excellence, ANSER Center, Arlington, VA
Universal Core Semantic Layer (Tutorial, with Lowell Vizenor), March 17, 2010

Pre-Conference of the 2nd Summer School in Affective Sciences (ISSAS 2010), University of Geneva
Groundrules for an Ontology of Emotion (Tutorial), August 22, 2010

Department of Human Genetics, Emory University, Atlanta GA
Building Ontologies for Clinical and Translational Research, June 29, 2011

Presentations on Youtube

Space and Naval Warfare (SPAWAR) Systems Command, Systems Center Atlantic, Charleston SC
SPAWAR Semantic Boot Camp, September 21-23, 2011

US Army Intelligence and Information Warfare Directorate (I2WD). Washington DC
Semantic Enhancement Training, January 12-13, 2012
Ontology for the Intelligence Community: Training and Coordination Event, April 19-20, 2012
Distributed Common Ground System Ontology Training Event, March 27, 2013

New York Botanical Garden, Bronx, NY
Introduction to Bio-Ontologies, Tutorial, Feb 5, 2012

National Center for Biomedical Ontology, Baltimore, MD
Introduction to Biomedical Ontology for Clinical and Translational Research Tutorial, April 24, 2012

Genomic Standards Consortium, University of Kansas Biodiversity Institute, *Lawrence, KS*
Semantics of Biodiversity Workshop and Tutorial, May 16 -18, 2012
Presentations on Youtube

International Conference on Biomedical Ontology (ICBO)
How to Develop and Use OBO Foundry Ontologies, Tutorial, Medical University of Graz, Austria
July 21, 2012
Basic Formal Ontology 2.0, Tutorial, Medical University of Graz, Austria, July 25, 2012
OBO Foundry 101: Tutorial on Collaborative Ontology Development (with Melanie Courtot, Melissa Haendel, Chris Mungall, Bjoern Peters, Alan Ruttenberg, Carlo Torniai and Jie Zheng), Concordia University, Montreal, Canada, July 7, 2013
Information Artifact Ontologies Workshop, Rio de Janeiro, Tutorial on the Information Artifact Ontology, September 22, 2014
Tutorial: Introduction to Basic Formal Ontology, Lisbon, Portugal, July 28, 2015
Tutorial: The Ontology for Biomedical Investigations, Lisbon, Portugal, July 28, 2015
Tutorial: Open Biomedical Ontologies, Corvallis, OR, August 1, 2016
Tutorial: Building Ontologies with Basic Formal Ontology, Corvallis, OR, August 7, 2018 (Video)
BFO Tutorial (2019) (with Alan Ruttenberg), July 30, 2019 (Video)

European Conference on Computational Biology (ECCB), Basel, Switzerland
Applications of Bio-Ontologies in Large-Scale Data-Driven Science, Tutorial, September 9, 2012

Semantic Technology for Intelligence, Defense and Security (STIDS), George Mason University, Fairfax, VA
Ontology for Intelligence, Defense and Security, Tutorial, October 23, 2012
Information Ontologies for the Intelligence Community, Tutorial, November 12, 2013
Ontology of Military Planning and Operations Assessment, Tutorial, November 18, 2014

Quantitative Systems Immunology Summer School, Boston University, Boston, MA
Immunology Ontology, Tutorial (with Lindsay Cowell), June 10-14, 2013. Video

Milan Polytechnic, Milan, Italy
Tutorial: An Introduction to Ontology for Mechanical Engineers, April 28-30, 2015

Air Force Research Laboratory, Rome, NY
Ontology Bootcamp, July 7, 2015

Air Force Research Laboratory, Wright-Patterson Air Force Base, Dayton, OH
Ontology Bootcamp, February 25-26, 2016

Aircraft Airworthiness & Sustainment (AA&S) Conference

Digital Thread Training: Ontology Bootcamp, Grapevine, TX, March 24, 2016

Unlocking Digital Thread (DT) Data for More Effective and Economical Systems Health Monitoring, Phoenix, AZ, May 21, 2017

Web Science and Technology (WebST) 2016, *Bilbao, Spain*
Towards Ontological Foundations for Web Science, July 18-19, 2016

ASME 2017 International Design Engineering Technical Conferences (IDETC) and Computers & Information in Engineering Conference (CIE) (IDETC/CIE), Cleveland, OH
A Strategy for Promoting Data Interoperability Across the Enterprise. Introduction to BFO for Engineers, August 6, 2017

Systems Engineering Research Center (SERC), Washington, DC
Systems Engineering Ontology Bootcamp, December 5, 2017, (Video)

University of Italian Switzerland (USI) and Swiss Artificial Intelligence Laboratory (IDSIA), Lugano, Switzerland
Ontology and Artificial Intelligence, April 8-12, 2019
Philosophy and Artificial Intelligence, February 19-21, May 14-27, 2020
Philosophy and Artificial Intelligence, February 22-26, May 17-21, 2021
Philosophy and Artificial Intelligence, March 1-3, May 17-25, 2022
Philosophy and Artificial Intelligence, February 28, March 1-3, May 9-11, 16, 17, 2023

Propulsion Directorate, Tinker Air Force Base, Oklahoma City, OK
Propulsion Ontology Tutorial, June 27, 2019

Joint Ontologies Workshop (JOWO), Graz, Austria
TLO: Top Level Ontologies (ISO/IEC 21838), September 24, 2019 (Video: Part 1, Part 2)

Ground System Architectures Workshop (GSAW), Los Angeles, CA
Ontologies for Space and Ground Systems, March 1, 2020 (Video)
Ontologies for Space and Ground System Cybersecurity, March 11, 2021

US Customs and Border Protection, Tucson, AZ
Ontology Bootcamp for Border Security Professionals, August 23-24, 2022

US Cybersecurity and Infrastructure Security Agency, Washington, DC
2023 CISA Ontology Bootcamp, June 26-27, 2023

Ontology Driven Data Interoperability for Materials and Manufacturing
ENIT, Tarbes, France, 19-20 September 2023
Tutorial on Basic Formal Ontology and Industrial Ontologies Foundry, September 19-20, 2023

POSTDOCTORAL AND OTHER RESEARCH SUPERVISED

1. Graham White, IAP Liechtenstein, Fonds Nationale (Bern, Switzerland), 1991–1994
2. Roberto Casati, IAP Liechtenstein, Fonds Nationale (Bern, Switzerland), 1991–1994
3. Wojciech Zelaniec, IAP Liechtenstein and SUNY Buffalo, Fonds zur Förderung der wissenschaftlichen Forschung (Vienna, Austria), 1992–1996
4. Dieter Münch, University of Manchester, Deutsche Forschungsgemeinschaft, 1986–1988
5. Artur Rojszczak, University at Buffalo, Foundation for Polish Science, 1998–1999
6. Guido Hülsmann, University at Buffalo, Alexander von Humboldt-Stiftung, 1998–1999
7. Berit Brogaard, University at Buffalo, College of Arts and Sciences, 1999–2000

8. Alan Clune, University at Buffalo, College of Arts and Sciences, 2001
9. Daniel von Wachter IFOMIS, Leipzig, 2002
10. Igor Papakin, IFOMIS Leipzig, 2002–2003
11. Martin Trautwein, IFOMIS Leipzig, 2002–2004
12. Thomas Bittner, IFOMIS, Leipzig/Saarbrücken, 2002–2005
13. Maureen Donnelly, IFOMIS, Leipzig/Saarbrücken, 2002–2005
14. Pierre Grenon, IFOMIS, Leipzig/Saarbrücken, 2002–2007
15. Luc Schneider, IFOMIS, Leipzig, 2003–2004
16. Anand Kumar, IFOMIS, Leipzig, 2003–2006
17. Fabian Neuhaus, IFOMIS Saarbrücken / University at Buffalo / National Center for Biomedical Ontology, 2004–2007
18. Katherine Dormandy (née Munn), IFOMIS, Leipzig/Saarbrücken, 2002–2005
19. Dirk Marwede, IFOMIS, Leipzig/Saarbrücken, 2004–2006
20. Boris Hennig, IFOMIS, Leipzig/Saarbrücken, 2004–2006
21. Mathias Brochhausen, IFOMIS, Saarbrücken, 2005–2006, University at Buffalo, 2010-2011
22. Ludger Jansen, IFOMIS Saarbrücken, 2005–2006
23. Christian Cocos, IFOMIS Saarbrücken, 2006
24. Jose L. E. Mejino, Jr. University at Buffalo / National Center for Biomedical Ontology, 2006
25. Robert Arp, University at Buffalo / National Center for Biomedical Ontology, 2007–2009
26. Albert Goldfain, Immune System Biological Networks: A Case Study in Improved Data Integration and Analysis (NIH / NIAID), University at Buffalo, 2008–2010
27. Leonard Jacuzzo, University at Buffalo / National Center for Biomedical Ontology, 2009
28. Kerry Trentelman, University at Buffalo / National Center for Biomedical Ontology, 2009–2010
29. Gian Paolo Terravechia, University at Buffalo, 2009
30. Mauricio B. Almeida, University at Buffalo, 2010–2011
31. William H. Mandrick, University at Buffalo, 2011
32. Selja Seppälä, University at Buffalo, 2012–2016
33. Fumiaki Toyoshima, Japanese Institute for Advanced Scientific Research (JAIST), 2014-2016
34. Fernanda Farinelli, Federal University of Minas Gerais, Brazil, 2015-2017
35. Hedi Karray, National School of Engineering, Tarbes, France, 2016
36. Jose Parente de Oliveira, University at Buffalo, 2016
37. David Kasmier, AFSOR and EWI, University at Buffalo, 2018–
38. David Limbaugh, ICPostdoc, University at Buffalo, 2018–2020
39. Shane Babcock, IDO-COVID-19, University Buffalo, 2020
40. Amelia Kahn, ICPostdoc, University at Buffalo, 2021–
41. Giorgio Alberto Ubbiali, University of Milan, 2023.

CURRENT PH.D. STUDENTS

1. Scott Luan
2. Eric Merrell
3. Gloria Sanso
4. Emanuele Martinelli (external supervisor, Department of Philosophy, University of Zurich).

PH.D. DISSERTATIONS DIRECTED

1. Catherine J. Pearce, Phenomenology of Time and Space, University of Manchester, October 1991. Current employment: Her Majesty's Treasury, UK.
2. James DuBois, Reinach's Theory of Judgment, International Academy of Philosophy, Liechtenstein, June 1992. Published as Judgment and Sachverhalt. An Introduction to Adolf Reinach's Phenomenological Realism, Dordrecht/Boston/London: Kluwer Academic Publishers, 1995. Current employment: Steven J. Bander Professor of Medical Ethics, Washington University, St. Louis.
3. Balász Mezei, World and Life-World. Aspects of the Philosophy of Edmund Husserl, International Academy of Philosophy, Liechtenstein, June 1992. Published as World and Life-World, Frankfurt: Peter Lang, 1995. Current employment: Department of Philosophy, Eötvös Loránd University, Budapest
4. Paul Chu, A Small Gray Book about the Present, International Academy of Philosophy, Liechtenstein, November 1992

5. Agnieszka Lekka-Kowalik, The Concept of Rationality in Natural Science, International Academy of Philosophy, Liechtenstein, January 1993. Current employment: Director and Vice-Dean, John Paul II Institute, Catholic University of Lublin, Poland
6. Aage Holter, The Horizon of Choice: A Contribution to the Austrian Theory of Economics, International Academy of Philosophy, Liechtenstein, May 1993; Current Employment: Kreative Norge, Norway
7. Michael Gorman, Ontological Priority, University at Buffalo, August 1993. Current employment: Department of Philosophy Catholic University of America
8. David Koepsell, The Ontology of Cyberspace, University at Buffalo, February 1997 (published as The Ontology of Cyberspace: Law, Philosophy, and the Future of Intellectual Property, Chicago: Open Court, 2000). Director of Research and Strategic Initiatives, Comisión Nacional de Bioética, Mexico, D.F.
9. Daniel Barwick, On the Nature of Concepts: An Essay in Metaphysics, University at Buffalo, April 1997. Current employment: Department of Philosophy SUNY Alfred
10. Leo Zaibert, Intentionality and Blame: A Study in the Foundations of Culpability (member of Ph.D. Committee), University at Buffalo, June 1997. Current employment: Chair, Department of Philosophy, Union College, Schenectady
11. Berit Brogaard, Temporal Mereology, University at Buffalo, November 1999. Current employment: Department of Philosophy, University of Miami
12. Gerold Erion, Common Sense: An Investigation in the Theory of Ontology, Epistemology, and Moral Philosophy, University at Buffalo, November 1999. Current employment: Professor of Philosophy, Medaille College, Buffalo
13. Ivonne Palares, Foundations of the Theory of Categories, University at Buffalo, November 1999. Current employment: Department of Philosophy, Universidad Autónoma del Estado de Morelos, Mexico
14. Alan Clune, Using the World to Understand the Mind: Evolutionary Foundations for Ecological Psychology, University at Buffalo, April 2000. Current employment: Department of Philosophy, Sam Houston State University
15. Gloria Zuniga, A General Theory of Value: Axiology in the Central European Philosophical Tradition, University at Buffalo, April 2000. Department of Philosophy, Ashford University
16. Michael Happold, Information, Computation, and the Nature of Cognition: A Critique of Computational Approaches to Understanding and Creating Minds, August 2000. Current employment: Senior Robotics Research Scientist at Neya Systems, LLC in Pittsburgh, PA
17. David Garren, Whose Life Is It Anyway: The Case Against Paternalism, March 2002. Current employment: Professor, US Naval Academy, Annapolis
18. David Kaspar, Wise Action: A Dissertation on Prudence and Morality, October 2002. Current employment: St John's University, Staten Island Campus
19. Eric Little, Moderate Materialism: Toward a Unified Ontology of Consciousness, October 2002. Current employment: VP Data Sciences, Osthus
20. Adrienne McEvoy, The Role of Empathy in Pain Management Decisions, University at Buffalo, August 2002. Current employment: Mansfield University of Pennsylvania, Mansfield, PA
21. William Mandrick, The Ontology of War, University at Buffalo, April 2003. US Army Colonel (Retd.), Current employment: Chief Ontologist, Raytheon.
22. Youngjin Kiem, Prolegomena to a New Theory of Intentionality, University at Buffalo, September 2004. Current employment: Assistant Professor, Kyonggi University, Suwon, Korea
23. Lowell Vizenor, Corporate Being: A Study in Realist Ontology, University at Buffalo, February 2006 Current employment: Chief Technology Officer at Securboration, Washington, DC.
24. Douglas Mayhew, An Ontology of Natural Cognition. The Substance and Structure of Everyday Thought, University at Buffalo, May 2007 (deceased)
25. Pierre Grenon, On Relations, University of Geneva, October 2007 (co-supervisor: Kevin Mulligan). Current Employment: Centre for Health Informatics, University College, London
26. Luc Schneider, Kinds of Instances: A Logical and Metaphysical Inquiry into the Ontological Square, University of Geneva, October 2007 (co-supervisor, Kevin Mulligan). Current Employment: Digital Curator National Library of Luxemburg
27. Nikoloz Tsikolia, Mechanisms of carcinogenesis: A consideration of causality in the development and pathology of the living organism based on realistic ontology, University of Leipzig, November 2007 (co-supervisor). Current employment: Department of Anatomy and Embryology, University Medical Center, Göttingen, Germany

28. Mark Niswonger, Life at Its Edges: A New Look at the Persistence Conditions for Organisms, University at Buffalo, November 2010. Current employment: Brown Mackie College, Cincinnati
29. A. Patrice Seyed, A Method for Evaluating and Standardizing Ontologies, University at Buffalo, December 2011 (co-supervisor). Current employment: Biomedical Ontology Engineer at 3M Health Information Systems, Troy, NY
30. Frédéric Tremblay, Resemblance Realism: A Theory of Universals, University at Buffalo, May 2014. Current employment, Immanuel Kant Baltic Federal University, Kaliningrad, Senior Research Fellow
31. William Duncan, The Ontology of Computational Artifacts, University at Buffalo, June 2014. Current employment: Ontologist, Lawrence Berkeley National Lab
32. Peter Koch, A Theory of Patient Welfare, University at Buffalo, 2016. Current employment: Assistant Professor, Villanova University, Villanova, PA
33. J. Neil Otte, Moral Psychology: An Ontological Approach, University at Buffalo, 2019. Current employment: Senior Ontologist, Applied Physics Lab, Johns Hopkins University
34. Brian Donohue, Social Ontology and Social Normativity, University at Buffalo, 2020. Current employment: Senior Ontologist, Johns Hopkins University Applied Physics Lab
35. Harjeet Parmar, Memory, Speak! An Essay on the Computational Theory Mind, Declarative Memory, and the Problem(s) of Relevance, University at Buffalo, 2021, Senior Solutions Architect at Aleph One Consulting, Washington DC
36. Eric Merrell, The Ontology of Relevance, University at Buffalo, 2022, Ontologist, Johns Hopkins University Applied Physics Lab

PH.D. COMMITTEES (SELECTED)

Michael Gorman, Ontological Priority, SUNY Buffalo, August 1993. Current employment: Professor of Philosophy Catholic University of America.

Jonathan Sanford, Aristotle, Scheler, MacIntyre: The Metaphysical Foundations of Ethics, 2001. Current employment: Provost, Professor of Philosophy, University of Dallas

Rasmus Rosenberg Larsen, Pathologizing Evil: A Critique of Modern Psychopathy Research, University at Buffalo, 2017. Current employment: Assistant Professor, University of Toronto, Mississauga

Catherine Ann Nolan, The Metaphysics and Ethics of Vital Organ Donation, University at Buffalo, 2015. Current employment: University of Dallas

David Limbaugh, The Flexibility of Reality: An Essay on Modality, Representation, and Powers, University at Buffalo, 2018. Current employment: Ontologist, CUBRC, Buffalo

Francesco Franda, Social Kinds: A User's Manual, University at Buffalo, 2022

Alexander Anderson

M.A. THESES DIRECTED

Jeremy Van Ek, SUNY Buffalo, *Chance, Free Will, Quantum Mechanics,* May 1998.

Eric Little, SUNY Buffalo, *The New Phenomenology of Hermann Schmitz: A Refutation of the Inner World of the Conscious Self,* January 1999.

Kristl Nowell, SUNY Buffalo, *A Formal Ontology of Constitution*, August 2011.

Alexander Cox, SUNY Buffalo, *Defining Disease*, June 2015.

Mark Jensen, SUNY Buffalo, *Mental Disorder, Nature and Ontology*, July 2015

Travis Allen, SUNY Buffalo, *The ImmPort Antibody Registry and Ontology*, July 2015

Giacomo De Colle, USI, *Why AI Cannot Develop Intelligent Functions*, September 2022.

STUDENTS/SUPERVISEES WITH WHOM I HAVE CO-AUTHORED PAPERS

Munira	Mohd Ali	2	PhD*
Travis	Allen	1	PhD
Mauricio B.	Almeida	7	PD
Anthony	Andersen	1	PhD
Robert	Arp	15	PD
Shane	Babcock	3	PhD, PD
John	Beverley	5	PhD
Thomas	Bittner	16	PD
Jonathan	Bona	6	PhD*
Matheus	Brochhausen	9	PD
Berit	Brogaard	11	PhD
Jeremy	Chapman	4	PhD*
Christian	Cocos	1	PD
Alexander	Cox	7	PhD
Maureen	Donnelly	5	PD
William	Duncan	11	PhD
Gerald J.	Erion	3	PhD
Fernanda	Farinelli	4	PD
Francesco	Furini	2	PD
Albert	Goldfain	8	PD
Pierre	Grenon	12	PD
Janna	Hastings	9	PD
Ludger	Jansen	5	PD
Hedi	Karray	6	PD
David	Kasmier	8	PD
Robert M.	Kelly	3	PhD
Peter	Koch	2	PhD
David	Koepsell	3	PhD
Anand	Kumar	32	PD
David	Limbaugh	9	PhD
William H.	Mandrick	7	PhD, PD
Shahid	Manzoor	2	PhD*
Jensen	Mark	8	PhD
Dirk	Marwede	1	PD
Jose L. E.	Mejino	4	PD
Eric	Merrell	7	PhD
Katherine	Munn	6	PD
Christopher	Nebelecky	2	PhD*
Fabian	Neuhaus	8	PD
Neil	Otte	12	PhD
Igor	Papakin	2	PD
José M	Parente	2	PD
Patrick	Ray	1	PhD
Artur	Rojszczak	3	PhD, PD
Gloria	Sanso	1	PhD
YonatanG	Schreiber	1	PhD
Selja	Seppälä	5	PD
Jonathan	Simon	2	PD
Andrew D.	Spear	12	PhD
Kerry	Trentelman	1	PD
Jonathan	Vajda	1	PhD
Lowell	Vizenor	5	PhD
Graham	White	1	PD
Leo	Zaibert	8	PhD
Wojciech	Zelaniec	1	PD

*= PhD co-supervision of UB student in Faculty of Engineering and Applied Sciences

PH.D. AND HABILITATION DISSERTATIONS EXTERNALLY EXAMINED

Neils Bokhove, *Phänomenologie: eine begriffsgeschichtliche Untersuchung,* University of Utrecht, Holland (Ph. D., November 1991)

Maria van der Schaar, *G. F. Stout's Theory of Judgment and Proposition*, University of Leiden, Holland (Ph. D., November 1991)

Panu Turunen, *Der unbefangene Blick. Mach, Husserl und die ursprüngliche Anschauung*, University of Joensuu, Finland (Ph.D., June 1992).

H. G. Zilian, *Wissenschaftstheorie von Felix Kaufmann,* Habilitation, University of Graz, Austria (January 1991–September 1992).

Ján Pavlík, Docent degree, Katedra filosofie, Vysoká Skola Ekonomická, Prague (1992–1995).

Karl Milford, *Geschichte der politischen Ökonomie,* Habilitation, University of Vienna, Austria, December 1995–March 1996.

Robin D. Rollinger, *Husserl's Position in the School of Brentano,* University of Utrecht, Holland (Ph. D., June 1996)

Artur Rojzsczak, Department of Philosophy, Jagiellonian University, Cracow, Poland (Ph. D., December 1996).

Lars Lundsten, *Communication as Experience: A Reinachian Inquiry,* Department of Philosophy, University of Helsinki, Finland (Ph. D., 1997)

Markus Haller, *Justification, Property, and Perceived Injustice: Implications for Economic Freedom and Social Security,* University of Geneva (Ph.D., June 1999).

Wolfgang Andreas Huemer, *The Constitution of Consciousness. A Study in Analytic Phenomenology*,

University of Toronto (Ph.D., October 1999).

Fabrice Correia, *Existential Dependence and Cognate Notions,* University of Geneva (Ph.D., November 2002)

Frank Hindriks, *Rules and Institutions*, PhD Dissertation University of Rotterdam, Netherlands, 2004.

Andries van Renssenz, *A Generic Extensible Ontological Language*, PhD Dissertation, University of Delft, Netherlands, 2004.

Hsing-Chien Tsai, *The Logic and Ontology of Part-Whole Relations*, PhD Dissertation, Columbia University, New York, 2004.

External member, PhD Committee, University of Melbourne, Australia, 2007-2009.

External member, PhD Committee, Monash University, Melbourne, Australia, 2010.

External member, PhD Committee, Jens Orthmann, *Semantic Integration of Human and Technical Observations*, University of Münster, 2013. External member, PhD Committee, David Zarebski, *Naturalized Ontology and Knowledge Engineering,* Université Paris 1 - Panthéon-Sorbonne, 2018.

External member, PhD Committee, Tom Poljansek, *Simulation und geteilte Wirklichkeit*, University of Stuttgart, February 2018.

External member, PhD Committee, Damiano Arena Nuncio, *Towards Semantics-Driven Modelling and Simulation of Context-Aware Manufacturing Systems,* Institute of Mechanical Engineering, École Polytechnique Fédérale de Lausanne (EPFL), May 6, 2019.

External member, PhD Committee, Luan Fonseca Garcia, *GeoCore Ontology: A Core Ontology for Interoperability in Petroleum Geology*, Instituto De Informática, Universidade Federal Do Rio Grande Do Sul, Brasil, June 30, 2021.

External member, PhD Committee, Martijn Nico Roelofs, A Graph-Based, Probabilistic Framework for Novel Aerospace Technology Evaluation and Selection, Department of Aerospace Engineering, Delft University of Technology, November 29, 2021

External supervisor, Emanuele Martinelli, Department of Philosophy, University of Zurich, 2020–.

LEARNED SOCIETIES

British Society for Phenomenology (1974–1990, as Member of Council 1977–1990)

Seminar for Austro-Glaerman Philosophy (Founder Member, with Kevin Mulligan and Peter Simons, 1977–1986)

American Philosophical Association (1987–)

European Society for Analytic Philosophy (Founder Member as of 1991; National Representative 1991–1994)

Society for the Study of Husserl's Philosophy (1991–1998; Member of Board of Directors 1991–1994)

Schweizerische Gesellschaft für Philosophie (1991–1993)

Internationale Bernard Bolzano Gesellschaft (Founder Member and Member of Council, 1991–1997)

Österreichische Ludwig–Wittgenstein Gesellschaft (1992–2005)

New York Association of Scholars (1992–; Board of Directors 1994–96)

Association of Philosophy Journal Editors (1993–2015)

The Creighton Club. New York State Philosophical Association (1994–1998)

Council of Editors of Learned Journals (1994–2015)

Society for Philosophy and Geography (1996–2001)

Center for Advanced Research in Phenomenology (member of International Board of Advisers, 1996–2001)

Alexander von Humboldt Association of America (1996–)

Franz Brentano Gesellschaft (1998–)

Association des Historiens de la Tradition Economique Autrichienne (Academic Council, 1999–2005)

American Medical Informatics Association (2003–)

International Association for Ontology and Its Applications (2009–, Advisory Board Member since 2010)

Inbegriff – Geneva Seminar for Austro-German Philosophy (2015–)

EXTERNAL REVIEWING (UNIVERSITIES)

University of California at Irvine, 1987
University of Wisconsin at Green Bay, 1988
University of California at Irvine, 1990, 1996
Institute of Economics, University of Vienna, 1992.
Department of Philosophy, University of North Florida (external reviewing, August 1996).
Department of Philosophy, University of Guelph (external reviewing, August 1998).
Department of History, University of Louisville (external reviewing, July 1999).
Department of Philosophy, CUNY Graduate School and University Center (external reviewing, October 1999).
Department of Philosophy, Tel Aviv University (external reviewing, April 2001).
Department of Cognitive Science, University of Helsinki (external evaluation of candidates for head of department, June 2001).
Department of Philosophy, Hunter College, CUNY (external reviewing, October 2002)
Office of Research Services, Carleton University, 2006.
Member, Appointments Committee, Chair in Ethics, Graz University, Austria, 2007
Member, Appointments Committee, Professorship in Analytic Philosophy, Saarland University, Saarbrücken, Germany, 2007
University of Texas School of Biomedical Informatics, Houston, August 2013
Stanford University School of Medicine, Department of Pediatrics, October 2013
Harvard University Medical School, Department of Neurology, December 2013
University of Texas Southwestern Medical Center, Department of Clinical Sciences, February 2014
Yale University School of Medicine, January 2016
University of Prince Edward Island, September 2018
J. Craig Venter Institute, La Jolla, CA, February 2019

PROFESSIONAL AND UNIVERSITY SERVICE (SELECTIONS)

1977–1986	Co-founder and secretary of the Seminar for Austro-German Philosophy. In this capacity responsible for the organization of some 36 academic colloquia in Austria, Belgium, France, Germany, Great Britain, Holland, and Switzerland, ranging from small informal workshops to large international conferences
1979–1988	Organization (in conjunction with the Goethe Institute, Manchester) of a series of over 70 talks and seminars in British universities given by philosophers from the German Federal Republic
1980–1989	Member, Scientific Advisory Board of the Internationale Bibliographie der Österreich-ischen Philosophie (Graz)
1984–	Member, Scientific Council of the Forschungsstelle und Dokumentationszentrum für Österreichische Philosophie, Graz
1986–1990	Member of the Scientific Council of the Centro Studi per la Filosofia Mitteleuropea, University of Trento, Italy
1988–1990	Director of the International Summer Schools on Philosophy and Artificial Intelligence, Bolzano, Italy
1991–1994	Co-Director of the First International Summer Institute in Cognitive Science, University at Buffalo (held July 1994)
1994–1999	Trustee of the Hegeler–Carus Foundation, La Salle, Illinois
1994–1996	Member, Board of Directors of the New York State Association of Scholars
1996–2002	President, New York Association of Scholars

1996	Consulting editor, *Fachwörterbuch Philosophie* (University of Innsbruck)
1996–2006	Member, International Board of Advisors, Center for Advanced Research in Phenomenology (CARP)
1997–1999	Member, Faculty Senate, University at Buffalo
1997–1999	Member, Committee on International Cooperation, American Philosophical Association
1997–1999	Chair, University at Buffalo Graduate Group for German and Austrian Studies
1998	Co-Director,NSF Study Group on Ontology of Fields (Project Varenius Initiative), Bar Harbor, Maine.
1999–	Member of Advisory Board of the Hegeler–Carus Foundation, La Salle, Illinois
1999–2011	Member of Scientific Council, Centre de Recherches en Philosophie politique, économique et sociale, Paris
2000–	Board Member, Hegeler Institute
2004–2009	State University of New York Chancellor's Advisory Committee
2007–2010	University at Buffalo Distinguished Ranks Committee
2008–2010	University at Buffalo Research Advisory Council, Vice-President for Research
2009–	University at Buffalo Clinical and Translational Science Award (CTSA) Bioinformatics Committee
2009–2012	Co-Chair, University at Buffalo Clinical and Translational Science Award (CTSA) Data Warehouse Committee
2009–2017	University at Buffalo Clinical and Translational Science Award (CTSA) Steering Committee
2009–2012	Director, University at Buffalo Center for Brain and Behavior Informatics (CBBI)
2013–2014	UB Department of Philosophy: Graduate Affairs Committee, Logic Colloquium Commitee
2013–2018	UB Department of Biomedical Informatics, Appointments Committees for PhD Program Director Chief, Division of Biomedical Ontology Chief, Division of Sociotechnical Influences and Human Centered Design Chief, Division of Bioinformatics
2013	UB Department of Biomedical Informatics Steering Committee MA and PhD Programs
2014–15	Chair, UB Department of Philosophy Undergraduate Affairs Committee
2015	UB Health Science Schools Committee to Evaluate Clinical Trials Management Systems
2015–	UB Department of Philosophy Website/Media/Library Committee (Chair)
2015–17	UB Department of Philosophy Colloquium Committee (Chair)
2015–16	Committee on Publication Ethics (COPE)
2016–19	UB Manufacturing Council
2017	Interim Director of Graduate Studies and ex Officio member of Admissions, Curriculum, Graduate Affairs, and Progress and Evaluation Committees
2017–18	UB Department of Philosophy, Chair, Graduate Affairs Committee
2018–19	UB Department of Philosophy, Chair, Teaching Quality Committee
2019–20	UB Department of Philosophy, Chair, Graduate Affairs Committee
2020–23	UB Department of Philosophy, Admissions and Financial Aid Committee

CONFERENCE PROGRAM COMMITTEES

1994	Workshop on Mereology, European Conference on Artificial Intelligence, Amsterdam, August 1994
1994–95	International Joint Conference on Artificial Intelligence, Montreal, 1995
1997	Conference on Spatial Information Theory, Pittsburgh (COSIT 1997).
1998	International Conference on Formal Ontology in Information Systems (FOIS 1998)
	Director, Section on Philosophy and Cognitive Science, World Congress of Philosophy,

	Boston, September 1998
1999	Conference on Spatial Information Theory, Stade, Hamburg (COSIT 1999).
2000	Workshop on Semantic Approximation, Granularity and Vagueness, Breckenridge, CO, April 11, 2000 (KR 2000)
2000	International Conference on Ontology and Epistemology for Spatial Data Standards European Science Foundation, Sept. 22–27, 2000, Agelonde, France.
	Interdisciplinary Conference on Geographic Information Science, Savannah, Georgia, October 28 31 (GIScience 2000)
2002	Workshop on Action-Oriented Approaches in Geographic Information Science, University of Maine, November 2-4, 2002
	Interdisciplinary Conference on Geographic Information Science, Boulder, Colorado (GIScience 2002)
2003	Wissenschaftstheorie in Ökonomie und Wirtschaftsinformatik, Koblenz, Germany, June 5-6, 2003
	Conference on Spatial Information Theory (COSIT 2003), Ittingen, Switzerland.
2004	Pacific Symposium on Biocomputing, Hawaii, January (PSB 2004)
	Minor Entities: Philosophical Workshop in Geneva, July 8-11, 2004
	Formal Ontology in Information Systems (FOIS 2004)
	Third International Conference on Geographic Information Science Adelphi, MD, USA, October 20-23, 2004
	Spatial Cognition 2004, Frauenchiemsee Island, Germany, October 2004.
2005	Pacific Symposium on Biocomputing, Hawaii, January (PSB 2005)
	First Conference on Geospatial Semantics (GeoS 2005)
	Cognitive Science 2005. 27th Annual Meeting of the Cognitive Science Society, Turin, Italy
	Conference on Spatial Information Theory, Ellicottville, NY (COSIT 2005)
	Conference on Philosophy and Informatics, Koblenz, September 11, 2005 (WSPI 2005),
	First International Workshop on Formal Biomedical Knowledge Representation, Whistler, BC, Canada (KR-MED 2004)
	Working Group 6, Conference of the International Medical Informatics Association, Rome, May 2005.
2006	Third International Workshop on Philosophy and Informatics, Saarbrücken, Germany) (WSPI 2006)
	Australasian Ontology Workshop (AOW 2006)
	First International Workshop on Ontology Content and Evaluation (OntoContent 2006)
	3rd Integrative Bioinformatics Workshop (IBW 2006)
	Formal Ontology in Information Systems (FOIS 2006)
	GMDS/EFMI Workshop on the Formal Foundations of Health Terminology, Timisoara Romania, August 2006.
	EFMI Conference on Foundations of Clinical Terminologies and Classifications, Timisoara, Romania, April 2006 (FCTC 2006)
	Fourth International Conference on Spatial Information Science, Münster, Germany (COSIT 2006)
	Pacific Symposium in Biocomputing, Hawaii, 2006.
2007	Workshop on Cyberinfrastructure for e-Science (CyIneS 2007)
	Conference on Spatial Information Theory (COSIT 2007)
	Australasian Ontology Workshop (AOW07), 2-6 December, Gold Coast, Queensland. http://www.comp.mq.edu.au/conferences/aow/
	International Workshop on Integrative Bioinformatics, 4th Annual Meeting, September 10-12, 2007, University of Ghent, Belgium
	WWW2007 Workshops
2008	Ontology for the Intelligence Community, Columbia, MD (2008)
	Special Interest Group of the Association for Information Systems (AIS) on Ontology-

	Driven Information Systems (SIG-ODIS)
	International Conference on Spatial Cognition (COSIT) 2008
	Ontolog Forum/NCOR/NIST Ontology Summit, Gaithersburg, MD, April 28-29.
	Knowledge Representation Ontology Workshop, Sydney, Australia (KROW 2008)
	Conference on Representing and Sharing Knowledge Using SNOMED (KR-MED 2008)
	Spatial Cognition 2008, September 15-19, Freiburg, Germany (SC 2008)
	Fifth International Conference on Formal Ontology in Information Systems (FOIS 2008)
	Fifth International Workshop on Philosophy and Informatics (WSPI 2008).
	Bio-Ontologies: Semantic Applications In Life Sciences (Bio-Ontologies 208)
2009	9th International Conference on Spatial Information Theory (COSIT 2009)
	InterOntology 2009, Tokyo
	1st Conference on Ontology for the Intelligence Community, Columbia, MD (OIC 2009)
	2nd International Joint Conference on Biomedical Engineering Systems and Technologies (BIOSTEC-2009)
	Workshop on Legal Ontologies and Artificial Intelligence Techniques, Barcelona, Spain (LOAIT 2009)
	5th Australasian Ontology Workshop, Melbourne, Australia (AOW 2009)
	Knowledge Representation Ontology Workshop, Melbourne, Australia (KROW-SI 2009)
	32nd Annual Conference on Artificial Intelligence (KI 2009)
	Conference on Ontology for the Intelligence Community (OIC 2009)
	3rd InterOntology Conference, Keio University, Tokyo
2010	International Conference on Health Informatics (HEALTHINF 2010)
	Sixth International Conference on Formal Ontology in Information Systems (FOIS 2010)
	World Conference on Legal Theory and Social Philosophy, Beijing (IVR-09)
	IARPA-BAA-09-10: Knowledge Discovery and Dissemination (KDD)
	5th International Workshop on Ontology Content (OnToContent2010), Crete, Greece
	Conference on Semantic Technology for Intelligence, Defense, and Security, Fairfax, VA (STIDS 2010)
	6th Australasian Ontology Workshop (AOW 2010)
	4th InterOntology Conference, Keio University, Tokyo
	Bio-Ontologies: Semantic Applications In Life Sciences (Bio-Ontologies 2010)
2011	Conference on Semantic Technology for Intelligence, Defense, and Security, Fairfax, VA (STIDS 2011)
	Conference on AI Approaches to the Complexity of Legal Systems, Frankfurt, Germany (AICOL 2011)
	7th International and Interdisciplinary Conference on Modeling and Using Context 2011
	International Conference on Biomedical Ontology, Buffalo (ICBO 2011)
2012	Formal Ontology in Information Systems, Graz, Austria (FOIS 2012)
	International Conference on Biomedical Ontology, Graz, Austria (ICBO 2012)
	5th InterOntology, Keio University, Tokyo
	8th International Workshop on Ontology Content (OnToContent 2012)
	Conference on Semantic Technology for Intelligence, Defense, and Security (STIDS 2012)
	European Conference on Computational Biology, Basel, Swizerland (ECCB 2012)
	Eighth Australasian Ontology Workshop (AOW 2012)
2013	Conference on Semantic Technology for Intelligence, Defense, and Security Security (STIDS 2013)
	International Conference on Biomedical Ontology, Montreal, Canada (ICBO 2013)
	9th International Workshop on Ontology Content (OnToContent 2013)
2014	Conference on Semantic Technology for Intelligence, Defense, and Security Security (STIDS 2014)
	International Conference on Formal Ontology in Information Systems, Rio de Janeiro, Brazil (FOIS 2014)

	7th International Biocuration Conference (ISB2014)
	FOIS Ontology Competition, Rio de Janeiro, Brazil
	Information Artifact Ontologies Workshop, Rio de Janeiro, Brazil (IAOW 2014)
	European Conference on Computational Biology, Basel, Swizerland (ECCB 2014)
	International Conference on Biomedical Ontology, Houston, Texas (ICBO 2014)
2015	Conference on Semantic Technologies for Intelligence, Defense, and Security (STIDS 2015)
	11th OntoContent Workshop, Rhodes, Greece
	Conference on Spatial Information Theory (COSIT 2015)
	International Conference on Biomedical Ontology, Lisbon, Portugal (ICBO)
	International Workshop on Definitions in Ontologies (IWOOD 2015)
	International Conference on Spatial Information Science (COSIT 2015)
	Joint Ontologies Workshop on Modular Ontologies (JOWO/WOMO 2015)
	Conference on AI Approaches to the Complexity of Legal Systems (AICOL 2015)
2016	International Conference on Biomedical Ontology, Corvallis, OR, USA (ICBO)
	Conference on Semantic Technologies for Intelligence, Defense, and Security, Fairfax, VA (STIDS 2016)
	International Conference on Formal Ontology in Information Systems, Annecy, France (FOIS 2016)
	International Workshop on Definitions in Ontologies (IWOOD 2016)
	11th OntoContent Workshop, Rhodes, Greece
	15th International Conference on Artificial Intelligence and Law (AICOL2016)
	Biocuration 2016: 9th International Biocuration Conference
2017	International Conference on Biomedical Ontology (Corvallis, OR, USA) (ICBO)
	Workshop on Foundational Ontologies and Semantic Interoperability (FOUST), Bolzano, Italy
	Visual Learning: CONTENT – CULTURE – CONSCIOUSNESS, Budapest, Hungary
	2nd Workshop on Representing Social and Legal Entities in the Biomedical Domain (SoLe-BD), Newcastle, UK
	1st International Oncology Ontology (ONCONTO) Workshop 2017
	13th International Conference on Spatial Information Theory (COSIT 2017), L'Aquila, Italy
	16th International Conference on Artificial Intelligence and Law (AICOL2017), London, UK
	Second International Conference on Informatics and Assistive Technologies for Health-Care, Medical Support and Wellbeing (HEALTHINFO 2017), Athens, Greece
	OntoBrAS 2017
	Joint Ontology Workshops (JOWO 2017)
2018	International Conference on Biomedical Ontology (Newcastle, UK) (ICBO 2018) Acronym:
	Roman Ingarden and His Times: An International Phenomenological Conference', Jagiellonian University, Cracow, 25-27 October 2018
	Ontology of Social, Legal and Economic Entities (SoLEE 2018)
	(HEALTHINFO), Nice, France, October 14-18, 2018
	10th International Conference on Formal Ontology in Information Systems (FOIS), Cape Town, South Africa, 2018
	Biocuration 2018: 11th International Biocuration Conference
2019	International Conference on Biomedical Ontology, Buffalo, NY, USA (ICBO 2019)
	Joint Ontology Workshops: The Styrian Autumn of Ontology (JOWO 2019)
	14th International Conference on Spatial Information Theory (COSIT 2019)
	Ontology of Social, Legal and Economic Entities (SoLEE 2019)

	32nd International Conference on Legal Knowledge and Information Systems organised by the Foundation for Legal Knowledge Based Systems (JURIX 2019)
2020	International Conference on IOT, Smart City & Applications (ICISCA 2020)
	International Conference on Formal Ontology in Information Systems (FOIS 2020)
	33rd International Conference on Legal Knowledge and Information Systems organised by the Foundation for Legal Knowledge Based Systems (JURIX 2020)
	AI Approaches to the Complexity of Legal Systems (AICOL 2020)
	6th Joint Ontology Workshops (JOWO)
	10th International Conference On Interoperability For Enterprise Systems And Applications (I-ESA2020)
	International Conference on Formal Ontology in Information Systems (FOIS 2020)
2021	International Conference on Biomedical Ontology (ICBO 2021)
	The Joint Ontology Workshops (JOWO 2021)
	12th International Conference on Formal Ontology in Information Systems (FOIS 2021)
2022	FOUST VI: Workshop on Foundational Ontologies, 2022
	15th Conference on Artificial General Intelligence (AGI-22), St Petersburg
	8th Joint Ontology Workshops (JOWO 2022), Sweden

STUDIES OF MY WORK

Videos

https://www.youtube.com/watch?v=YMpANjJOYbg

Festschrifts

Leo Zaibert (ed.), The Theory and Practice of Ontology, London and New York: Palgrave/MacMillan, December 2016

> This book provides close examination of ontology and the work of Professor Barry Smith, one of the most prolific philosophers of the modern day. In this book numerous scholars who have collaborated with Smith explore the various disciplines in which the impact of his work has been felt over the breadth of his career, including biology, computer science and informatics, cognitive science, economics, genetics, geography, law, neurology, and philosophy itself. While offering in-depth perspectives on ontology, the book also expands upon the breadth of Smith's influence. With insights from renowned and influential scholars from many different countries, this book is an informative and enlightening celebration of all Smith has contributed to numerous academic schools of thought.

Including contributions by Jonathan P. Bona, Berit Brogaard, Roberto Casati, Werner Ceusters, Maurizio Ferraris, Ingvar Johansson, David Koepsell, Kevin Mulligan, Alessandro Salice, Peter Simons, Mariam Thalos. Achille Varzi

Gloria Zúñiga y Postigo and Gerald J. Erion (eds.), Barry Smith an sich (*Cosmos + Taxis. Studies in Emergent Order and Organization*, 4 (4), June 2017).

Including contributions by Wolfgang Grassl, Nicola Guarino, John T. Kearns, Rudolf Lüthe, Luc Schneider, Peter Simons, Jan Woleński, Wojciech Żełaniec

Conference sessions

A session on my work was organized at the Conference on Formal Ontology of the Japanese Phenomenological Society, 12 November 2006.

Perspectives on Deontology from Early Phenomenology and Contemporary Philosophy. Workshop with Barry Smith, University of Geneva, July 6, 2016

Metaphysics and Formal Ontology, Dynamis: Finnish Network of Metaphysics, Tampere, April 27, 2018

Special issues

Oggeti Fiat, special issue of the journal *Rivista di Estetica*, 42 (2002), 90 pp.

Human Behaviour Change Project, Wellcome Trust, 2020.

Monographs and dissertations

Nicolas F. Gier, 1981 *Wittgenstein and Phenomenology. A Comparative Study of the Later Wittgenstein, Husserl, Heidegger, and Merleau-Monty*, Albany: State University of New York Press.

Armin Burkhardt, 1986 *Soziale Akte, Sprechakte und Textillokutionen. A. Reinachs Rechtsphilosophie und die moderne Linguistik*, Tübingen: Niemeyer.

Peter M. Simons, 1987 *Parts. A Study in Ontology*, Oxford: Clarendon Press.

Schuhmann, Karl 1988 "Die Entwicklung der Sprachakttheorie in der Münchener Phänomenologie", *Phänomenologische Forschungen*, 21, 133-166

Massimo Libardi, 1990 *Teorie delle parti e dell'intero. Mereologie estensionali*, Trento: Centro Studi per la Filosofia Mitteleuropea.

Raynaud, Savina 1990 *Il Circolo Linguistico di Praga (1926-1939). Radici storiche e apporti teorici*, Milan: Vita e Pensiero.

Peter M. Simons, 1992 *Philosophy and Logic in Central Europe from Bolzano to Tarski*, Dordrecht/Boston/London: Kluwer

Maria van der Schaar, 1991 *G. F. Stout's Theory of Judgment and Proposition*, Leiden: NWO

Roberto Brigati, 1992 *Il linguaggio dell'oggettività. Saggio su Meinong*, Bologna: Thema.

Raimondo Cubeddu, 1992 *Il liberalismo della scuola austriaca: Menger, Mises, Hayek*, Naples: Morano

Petitot, Jean 1992 *Physique du Sens. De la théorie des singularités aux structures sémio-narratives*, Paris: Editions du CNRS.

Roberto Poli, 1992 *Ontologia formale*, Genova: Marietti.

Alberto Voltolini, 1992 *Riferimento e intenzionalità. Per un'ontologia del discorso*, Pisa: Edizioni ETS

Vincenzo Fano, 1993 *La filosofia dell'evidenzia. Saggio sull'epistemologia di Franz Brentano*, Bologna: CLUEB.

R. D. Rollinger, 1993 *Meinong and Husserl on Abstraction and Universals. From Hume Studies I to Logical Investigations II* (Studien zur Österreichischen Philosophie XX), Amsterdam/Atlanta: Rodopi

Raimondo Cubeddu, 1993 *The Philosophy of the Austrian School*, London and New York: Routledge.

Michael Dummett, 1993 *Origins of Analytic Philosophy*, London: Duckworth and Cambridge, Mass.: Harvard University Press.

Gregor Haefliger, 1994 *Über Existenz: Die Ontologie Roman Ingardens*, Dordrecht/Boston/Lancaster: Kluwer Academic Publishers.

Philippe Mach, 1995 *L'ordre sensoriel selon Hayek. Une analyse et une évaluation*, Département de Philosophie, Université de Genève.

James M. DuBois, 1995 *Judgment and Sachverhalt. An Introduction to Adolf Reinach's Phenomenological Realism* (Phaenomenologica 132), Dordrecht/Boston/London: Kluwer.

Zelaniec, Wojciech 1996 *The Recalcitrant Synthetic A Priori*, Lublin: ArTom

Jens Cavallin, 1997 *Content and Object. Husserl, Twardowski and Psychologism*, Dordrecht/Boston/London: Kluwer.

Marianne Sawicki, 1997 *Body, Text, and Science: The Literacy of Investigative Practices and the Phenomenology of Edith Stein*, Dordrecht/Boston/London: Kluwer Academic Publishers.

Allen Oakley, 1998 *The Foundations of Austrian Economics. From Menger to Mises*, Cheltenham: Edward Elgar.

Nef, F. 1998 *L'ojet quelconque. Recherches sur l'ontologie de l'objet*, Paris: Libraire Philosophique J. Vrin

Alain de Libera, 1999 *L'Art des généralités. Théories de l'abstraction*, Paris: Aubier

Jocelyn 1999 *L'A Priori Conceptuel: Bolzano, Husserl, Schlick*, Paris: Vrin.

Giuseppe Lorini, 2000 *Dimensioni Giuridiche dell'Istituzionale*, Padova: Cedam.

Lothar Ridder 2002 *Mereologie: ein Beitrag zur Ontologie und Erkenntnistheorie.* Frankfurt Am Main : V. Klostermann

Matthew E. Roberts 2006 *A Historical Survey and Conceptual Account of States of Affairs,* Dissertation, University of Colorado

Stjernfelt, Frederik. *Diagrammatology: An investigation on the borderlines of phenomenology, ontology, and semiotics*. Vol. 336. Springer science & business media, 2007.

Martin Berzell, *Electronic Healthcare Ontologies: Philosophy, the Real World and IT Structures*, Linköping Studies in Arts and Science, 2010, No. 517

John William Lamp, *Information Categorisation: An Emergent Approach*, PhD Dissertation, University of Melbourne, March 2011.

Marco Romano, *Ontologies, Logic and Interaction*, PhD Dissertation, Università degli Studi di Roma Tre, 2011

Eric S. Chelstrom, *Social Phenomenology : Husserl, Intersubjectivity, and Collective Intentionality*, Lexington Books, 2012.

Daniel Parrochia and Pierre Neuville, *Towards a General Theory of Classifications*, New York: Springer, 2013.

Ian Verstegen, *A Realist Theory of Art History*, London and New York: Routledge 2013.

Robert Massesich, *Reality and Accounting. Ontological Explorations in the Economic and Social Sciences*, London: Taylor and Francis, 2013.

Sabina Leonelli, *Data-Centric Biology: A Philosophical Study,* University of Chicago Press, 2016:

> the term "ontology" is used in computer science to indicate a set of representational primitives with which to model a domain of knowledge or discourse. It was originally picked up from philosophy, but it quickly acquired a technical meaning that had everything to do with the structure of "object- directed" programming languages and little to do with the intricacies of metaphysics (Gruber, "A Translation Approach to Portable Ontology Specifications"). Some philosophers, most notably Barry Smith, have exploited the overlap in terminology so as to position metaphysics as an important source of inspiration and guidance in the construction of bio-ontologies (e.g., Smith and Ceusters, "Ontological Realism"). Smith effectively brought his own philosophical viewpoint to bear on the non-philosophical meaning assigned to the term by bioinformaticians, and his work is partly responsible for the interdisciplinary mingling that underpins the "mixed status" of the term "ontology."

Umberto Eco 2014, *From the Tree to the Labyrinth*. Harvard University Press, 2014, pp. 57, 507.

> The aspects that make ontologies interesting are highlighted by Smith (2003): (i) they do not pretend to be representations of the world but of our modes of conceptualization in given domains—sometimes representing also commonsense knowledge; (ii) therefore an ontology has nothing to do with questions of ontological realism and is a purely pragmatic undertaking; (iii) the entities present in an ontology possess only the properties represented in that structure (we would add that the others are narcotized because they are irrelevant to the

specific universe of discourse). As Smith remarks, it is as if Hamlet, whose hair is not mentioned in Shakespeare's tragedy, was neither bald nor nonbald, but instead was a man without properties as far as his hair was concerned.

Robin Stenwall, *Truth, Grounding and Dependence*, Doctoral Dissertation, Lund University, Sweden. 2015

> The seminal paper "Truth-Makers" (1984) by Kevin Mulligan, Peter Simons and Barry Smith started what can only be described as an industry of modern metaphysics, Truthmaker Theory—an industry that does not appear to have slowed down since the time of the papers' original publication, but on the contrary seems to gain increasing momentum as time passes.

Bojanić, P. (2014). How to incorporate (with) documents, *Metaphysics and Ontology Without Myths*, 139.

Andrew J Iliadis, A black art: Ontology, data, and the Tower of Babel problem, Dissertation, Purdue University, 2016.

Lukas Benedikt Kraus, *Ontologie der Grenzen ausgedehnter Gegenstände*, Bonn: W. de Gruyter, 2016.

Christian Damböck, *Deutscher Empirismus: Studien zur Philosophie im deutschsprachigen Raum 1830-1930*, Vienna: Springer, 2017.

Michaël Bauwens, *The Metaphysics of Institutions: Powers, Contingency and Freedom*, Dissertation, University of Leuven, 2018.

Thomas Hagedorn, Supporting Engineering Design of Additively Manufactured Medical Devices with Knowledge Management Through Ontologies, Doctoral Dissertation, University of Massachusetts Amherst, 2018.

Simon Josias Graf, Building Formal Ontologies for Theology and Systems of Belief, Thesis, Aalborg University, 2018.

Ulrich J. Behnen, Ontologie komplexer IoX-Systeme. Zur Metaphysik der Informatik im Internet of Everything, Dissertation, Technical University of Munich, 2018.

David R. L. Zarebski, Ontologie naturalisée et Ingénierie des Connaissances, Doctoral Dissertation, Université Paris I Panthéon, Sorbonne, 2018.

Allen J. Flynn, The Knowledge Grid: A Platform to Increase the Interoperability of Computable Knowledge and Produce Advice for Health, Doctoral Dissertation, University of Michigan, 2018.

Eva Seidlmayer, An ontology of digital objects in philosophy. An approach for practical use in research, Thesis, Technische Hochschule Köln, 2018.

Timothy Tambassi, The Philosophy of Geo-Ontologies. Applied Ontology of Geography, Springer, 2018.

Richard Davies (ed.), *Natural and Artifactual Objects in Contemporary Metaphysics. Exercises in Analytic Ontology*, London: Bloomsbury, 2019.

Kumar Abhishek, An Ontology Based Decision Support System for Tuberculosis Control and Management in India, Doctoral Dissertation, National Institute of Technology, Patna, 2018.

Roberto Pusceddu, L'immagine nel contratto: uno studio filosofico-giuridico delle rappresentazioni grafiche nei documenti contrattuali. Doctoral Dissertation, University of Cagliari, 2020.

Nicola Piras, Boundaries: A Study in the Metaphysics of Space, Doctoral Dissertation, Università degli Studi di Sassari, 2017.

Arthur Heller Britto, Brentanian continua and their boundaries, Doctoral Dissertation, Columbia University, 2020.

Christian Damböck, "(Dis-) Similarities: Remarks on 'Austrian' and 'German' Philosophy in the Nineteenth Century", in *Franz Brentano and Austrian Philosophy*. New York: Springer, 2020, 169-180.

Janna Hastings, *Mental Health Ontologies*, University of Exeter Press, 2020.

I have also benefited enormously from years of conversations on various topics related to the ontology of mental phenomena with collaborators and members of the wider ontology community including, but not limited to, Rasmus Rosenberg Larsen Stefan Schulz, Werner Ceusters, Neil Otte, Nicolas le Novère, Jeanette Chacón, Mark Jensen and, most of all, Barry Smith. Smith s paradigm of applied ontology as a scientific tool, and his practical methodology of realism-based ontology development, have profoundly influenced my work for more than a decade since I first encountered these ideas. Although he is fond of saying that when he became an ontologist he ceased to be a philosopher, in my opinion, Smith's work continues to exemplify the best in philosophy, by offering a philosophy that stubbornly refuses to be insular but rather applies itself directly to real-world problems, and accepts the practical constraints that arise when trying to create solutions that genuinely have the power to change the world. It is a philosophy that cuts across all the traditional divisions between the domains of the humanities, the sciences and engineering, and thereby exemplifies the continued relevance of philosophy for the world we live in today.

Bartłomiej Skowron, *Część i Całość: W Stronę Topoontologii* (*Part and Whole: Towards Topoontology*), Warszawa: Oficyna Wydawnicza Politechniki Warszawskiej, 2021.

Caterina Pietra, Healthy city: An ontological understanding, PhD Thesis, Program in Design, Modeling and Simulation in Engineering, Civil Engineering and Architecture Curriculum, Faculty of Engineering, University of Pavia, May 2022**.**

National Academies of Sciences, Engineering, and Medicine Committee on Accelerating Behavioral Science through Ontology Development and Use, *Ontologies in the Behavioral Sciences: Accelerating Research and the Spread of Knowledge.* Washington, DC: The National Academies Press. 2022. https://doi.org/10.17226/26464.

Hakkarainen, J., & Keinänen, M. (2023). *Formal Ontology (Elements in Metaphysics).* Cambridge: Cambridge University Press. doi:10.1017/9781009070126

Sun, Y. Multi-dimensional Mereotopology based on Algebraic Topology, Dissertation, University of Toronto, 2003

Articles and Chapters in Books

Kevin Mulligan 1987 “Promisings and Other Social Acts: Their Constituents and Structure” in K. Mulligan, ed., *Speech Act and Sachverhalt*, Dordrecht/Boston/Lancaster, Kluwer, 29-90.

Stanley L. Paulson, 1987 “Demystifying Reinach’s Legal Theory”, in K. Mulligan, ed., *Speech Act and Sachverhalt*, Dordrecht: Reidel, 133-154.

Michael Losonsky,1988 “An Ontological Argument for Modal Realism”, *Grazer Philosophische Studien*, 31, 165-177.

Fiorenza Toccafondi, “Christian von Ehrenfels: qualita gestaltiche, cosmogonia ed eugenetica”, *Intersezione,* 9:3, 1989, 541-552.

Claudia Casadio, 1990 “Husserl e il paradigma mereologico”, *Lingua e Stile*, 25, 405-423, p. 408, 409, 411, 418, 419, 420, 422.

Neil Duxbury, “Apriori Philosophy and Legal Ontology”, *Archiv für Rechts- und Sozialphilosophie*, 77 (1991), 262–266.

Stefano Besoli, 1991 “La verità del contenuto. Riflessioni intorno alla problematica del giudizio in Twardowski”, *Discipline Filosofiche*, 2, 49-94.

Falconi, Daniela 1991 “Gli atti sociali nella fenomenologia del diritto di Adolf Reinach”, in B. Romano, ed., *Relazione Giuridica riconoscimento e atti sociali*, Rome: Bulzoni, 395-455.

Schuhmann, Karl 1993 “Husserl and Twardowski”, in F. Coniglione, R. Poli and J. Wolenski (eds.), 1993 *Polish Scientific Philosophy: The Lvov-Warsaw School* (Poznan Studies in the Philosophy of the Sciences and the Humanities, 28), Amsterdam/Atlanta: Rodopi

Wilhelm Baumgartner and Peter M. Simons 1993 “Brentanos Mereologie”, *Brentano Studien*, 4, 53-77.

Wilhelm Baumgartner and Peter M. Simons 1994 “Brentano’s Mereology”, *Axiomathes*, 5, 55–76.

David Gordon, 1994 “Second Thoughts on *The Philosophical Origins of Austrian Economics*”, *The Review of Austrian Economics*, 7 (1994), 133-136.

Winfried Löffler, *“Austrian Philosophy”*, *Kontroversen in der Philosophie,* 8 (1995), 99–107.

Natale Stucchi, 1996 “Seeing and Thinking: Vittorio Benussi and the Graz School”, *Axiomathes* VII, no. 1-2, 137–172

Michel Bourdeau, “Les nouveaux habits du Professeur Husserl”, *Critique*, 593 (1996), 893–907.

Helmut Seiffert, 1994 “Autoren Nachreden”, *Information Philosophie*, 4/94, 48-50.

Massimo Libardi, 1994 “Applications and Limits of Mereology. From the Theory of Parts to the Theory of Wholes”, *Axiomathes*, 5, 13–54.

Brigitte Nerlich and Clarke David D. 1994 “Language, Action and Context Linguistic Pragmatics in Europe and America (1800-1950)”, *Journal of Pragmatics*, 22, 439-463

Artur Rojszczak, 1994 “Über die Korrepondenz von Tarskis Definition der Wahrheit”, *Analyomen* 1, G. Meggle and U. Wessels, eds., Berlin/New York: Walter de Gruyter, 539–543.

Achille C. Varzi, 1994 “On the Boundary between Mereology and Topology”, in R. Casati, B. Smith and G. White (eds.), *Philosophy and the Cognitive Sciences*, Vienna: Hölder-Pichler-Tempsky, 423-442

Brigitte Nerlich, 1995 “The Notion of ‘Speech Act’ in German Linguistics, Philosophy and Psychology between 1880 and 1970", in Elisabetta Fava, *Speech Acts and Linguistic Research*, Padova: Nemo, 1–20, pp. 9, 13, 14, 20.

Rosa Braidotti, 1995. “The Nostalgic Trip”, *Free Inquiry*, Fall 1995, 63-64.

Bateman, John A. 1995, “On the Relatioship between Ontology Construction and Natural Language: A Socio-Semiotic View”, *International Journal of Human-Computer Studies*, 43, 929-44.

Robin.Rollinger, 1996, “Meinong on Husserl on Assumptions”, *Axiomathes* VII, 1-2, 89–102.

Luigi Dappiano, 1996 “Theories of Values”, in L. Albertazzi, et al. (eds.), *The School of Franz Brentano,* Dordrecht/Boston/London: Kluwer.

Massimo Libardi, 1996 “Franz Brentano (1838–1917), in L. Albertazzi, et al. (eds.), *The School of Franz Brentano*, Dordrecht/Boston/London: Kluwer

Jan Wolenski, 1996 “Reism in the Brentanist Tradition”, in L. Albertazzi, et al. (eds.), *The School of Franz Brentano*, Dordrecht/Boston/London: Kluwer, 357–375.

Leonardo A. Zaibert, 1996 “On Deference and the Spirit of the Laws”, *Archiv für Rechts- und Sozialphilosophie*, 82, 460–471.

David Mark, Egenhofer, Max and Hornsby, Kathleen 1997 "Formal Models of Commonsense Geographic Worlds", *National Center for Geographic Information and Analysis Technical Report 97-2*, Santa Barbara/Buffalo/Maine: NCGIA.

Richard Sylvan, 1997 “Issues in Regional Philosophy: Austrian Philosophy? And its Austral Image?”, in K. Lehrer and J. C. Marek (eds.), *Austrian Philosophy Past and Present*, Dordrecht/Boston/London: Kluwer, 147–166.

Achille C. Varzi, 1997 “Boundaries, Continuity, and Contact”, *Noûs*, 31:1, 26-58

D. A. Reisman, 1997 “Comment: The Connectionist as a Conservative”, in S. F. Frowen (ed.), *Hayek: Economist and Social Philosopher: A Critical Retrospect*, London: Macmillan, 1997, 31–36.

Nebojsa Kujundzic 1997 “Reinach, Material Necessity, and Free Variation”, *Dialogue*, 36.

Chisholm, Roderick M. 1997 “My Philosophical Development”, L. E. Hahn, ed., *The Philosophy of Roderick Chisholm*, Chicago: Open Court, 3–41, pp. 17f:

> Still another institution should be mentioned, one that has played a significant role in contemporary philosophy. This is the Society for Austro-German Philosophy which came into existence in England in the latter half of the 1970s. The society consisted of three young English students of philosophy, each of them very competent in philosophy and filled with boundless energy and enthusiasm. Later known to many as “the Triumvirate,” they are Kevin Mulligan, Peter Simons, and Barry Smith. They were concerned, as I had been, with the fact that a large part of the philosophical world was unaware of the great philosophical riches to be found in the Austro-German philosophy of the previous one hundred years. I was invited to become a member of the society and accepted at once. I first met the trio when, in 1979, I presented “The Benefactors Lectures” (later to be published as The First Person) before the Royal Institute of Philosophy in London.
>
> The Austro-German Society had great success, organizing countless meetings throughout Europe, both east and west. I have attended many of these meetings. One that I especially recall, naturally, was a meeting on my philosophy at the University of Salzburg. One memorable meeting, in which both the society and the University of Graz were involved, was devoted to “The Philosophy of Christian von Ehrenfels” and took place at the Ehrenfels Schloss in Upper Austria.

Ingvar Johansson, 1998. “Pattern as an Ontological Category”, *Formal Ontology in Information Systems*, N. Guarino (ed.), Amsterdam: IOS Press, 86-94.

Wolfgand Grassl. 1999 “The Reality of Brands: Towards an Ontology of Marketing”, *American Journal of Economics and Sociology*, 58, 313–359.

Kevin Mulligan, 2000 “Métaphysique et Ontologie”, in Pascal Engel, ed., *Précis de philosophie analytique*, Paris: Presses Universitaires de France, 5–33, pp. 5, 6, 12, 14, 16, 19, 20, 25, 27, 31, 33.

Hastings J, Cox S, West R, Notley C. Addiction Ontology: Applying Basic Formal Ontology in the Addiction domain. *Qeios* . 2020 Dec 7.

Available from: https://www.qeios.com/read/HZHJIP

William Lane Craig, 2001. “Middle Knowledge, Truth-Makers, and the ‘Grounding Objection’”, *Faith and Philosophy*, 18(3), 337-352.

Gregory, Dominic 2001 “Smith on Truthmakers”, *Australasian Journal of Philosophy*, 79 (3), 442–427.

Francesco Orilia, 2001. “Metaphor and Truth-Makers”, *Journal of Philosophical Research*, 26, 103-129.

Nikolay Milkov, 2002, “Lotze's Concept of 'States of Affairs' and its Critics”, *Prima Philosophia* 15:437-450.

Tiansi Dong, ”SNAPVis and SPANVis: Ontologies for recognizing variable vista spatial environments”, *International Conference on Spatial Cognition*, 2004, 344-365.

Elena Casetta, 2004, La teoria meretopologica delle nicchie, *Rivista di estetica*, n.s., 26 (2/2004), XLIV, 129-148.

Damschen, G., Gómez-Lobo, A. and Schönecker, D., 2006. Sixteen days? A reply to B. Smith and B. Brogaard on the beginning of human individuals. The Journal of medicine and philosophy, 31(2), pp.165-175.

Achille C. Varzi, 2007. “Spatial Reasoning and Ontology: Parts, Wholes, and Locations” in M. Aiello, I. Pratt-Hartmann and J. van Benthem (eds.), *Handbook of Spatial Logics*, New York: Springer, 945–1038.

Peter N. Robinson and Sebastian Bauer, 2011. “Upper Level Ontologies”, chapter 6 of *Introduction to Bio-Ontologies*, Boca Raton, FL: Chapman & Hall, 139-152.

Denis Seron, 2010. “Théorie relationnelle et théorie phénoménale de l’intentionnalité” in S. Richard (ed.), *Analyse et ontologie: Le renouveau de la métaphysique dans la tradition analytique*, Paris, Vrin, 2010, 39-70.

Gary H. Merrill, 2010. "Ontological realism: Methodology or misdirection?", *Applied Ontology*, 4 (2), 2010, 79-108.

Gary H. Merrill, 2010. "Realism and Reference Ontologies: Considerations, Reflections, and Problems". *Applied Ontology* 5 (3-4), 2010, 189-221.

Michel Dumontier and Robert Hoehndorf, 2010. "Realism for Scientific Ontologies", *Formal Ontologies in Information Systems* (FOIS), 387-2010.

Geoffrey Yeo, "Representing the Act: Records and Speech Act Theory", *Journal of the Society of Archivists*, 31 (2), 2010, 95-117.

Lord, Phillip, and Robert Stevens. 2010. "Adding a Little Reality to Building Ontologies for Biology." PLoS ONE 5 (9): e12258. doi:10.1371/journal.pone.0012258.

Maojo, V, J Crespo, M García-Remesal, D de la Iglesia, D Perez-Rey, and C Kulikowski. 2011. "Biomedical Ontologies: Toward Scientific Debate." *Methods of Information in Medicine* 50, (3): 203–16 doi:10.3414/ME10-05-0004.

Alan Dawson and Jon Metcalf, 2011. "The existential philosophy of mountains", *Marhofn*, Marhofn 230.13 - May 2011.

Rafe Champion, 2011, "Defence of Fallible Apriorism", *Nuova civiltà delle macchine*, 1-2, 69-88.

Gary H. Merrill, 2011. "Ontology, Ontologies, and Science", *Topoi*, April 2011, Volume 30, Issue 1, 71–83.

Warren Bizub and Julia Brandt, 2011. "Transitioning to the Next Generation (Nextgen) Defense Training Environment (DTE)" in S. Jain, R.R. Creasey, J. Himmelspach, K.P. White, and M. Fu (eds.), *Proceedings of the 2011 Winter Simulation Conference.*

JP Smit, F Buekens, S Du Plessis, "What is money? An alternative to Searle's institutional facts", *Economics and Philosophy,* 27 (2011) 1–22.

Pierre Livet, "Web Ontologies as Renewal of Classical Philosophical Ontology", *Metaphilosophy* 43 (4): 396-404. 2012.

Edward Heath Robinson, "Reexamining fiat, bona fide and force dynamic boundaries for geopolitical entities and their placement in DOLCE", *Applied Ontology* 7 (1): 93-108. 2012.

Lars Vogt, Peter Grobe, Björn Quast, Thomas Bartolomaeus, 2012. "Fiat or Bona Fide Boundary – A Matter of Granular Perspective", *PLoS ONE* 7(12), 2012, e48603.

Juan C. González, 2013. "Interactive Fiat Objects", *Review of Philosophy and Psychology,* June 2013, Volume 4, Issue 2, 205–217.

Chris Fields, 2013 "On Recognizing an Object with a Partition", *Logique & Analyse* 224 (2013), 391-403

Hoehndorf, Robert, Michel Dumontier, and Georgios V Gkoutos. 2013. "Evaluation of Research in Biomedical Ontologies." *Briefings in Bioinformatics* 14 (6): 696–712.

Johann Gregory, 2013. Wordplay in Shakespeare's Hamlet and the Accusation of Derrida's "Logical Phallusies", *English Studies,* 94, 3, 313-330.

Maria Luiza Almeida Campos and Hagar Espanha Gomez, "Principles for domain modeling: the position of Barry Smith and Ingetraut Dahlberg", *Ciência da Informação*, 43 (1), 2014 (pt-BR), Maria Luiza de Almeida Campos and Hagar Espanha Gomes, "Princípios para modelagem de domínio: a posição de Barry Smith e de Ingetraut Dahlberg", Ciência da Informação, 43 (1), 81-94, 2014.

Marco Tedeschini, 2015 "From Phenomenology to Formal Ontology: How Barry Smith and Kevin Mulligan Made Husserl's Descriptive Psychology into a Form of Realism", *Archivio di filosofia*, 83 (3), 2015, 177-188.

Denis Seron, 2015 "Adolf Reinach's philosophy of logic". In: *Objects and Pseudo-Objets : Ontological*

Deserts and Jungles from Brentano to Carnap (B. Leclercq, S. Richard, D. Seron, Eds.). Boston/Berlin: De Gruyter, p. 167–82.

Michaël Bauwens, "What is a Game of Blind Chess? Gradualism, Dispositions and the Searle-Smith Debate", *Conference of the European Network on Social Ontology*, Palermo, September 2015.

Adrien Barton and Arnaud Rosier, 2016. "Ontologies appliquées biomédicales et ontologie philosophique: un développement complémentaire", *Revue de la Société de Philosophie des Sciences*, 3 (1), 1-8.

Jan Almäng, "Legal Facts and Dependence on Representations", *Journal of Social Ontology*, 2(1), 1-15.

Thomas Bittner, 2017. "Fiat and De Facto Objects". *The International Encyclopedia of* Geography. 2017, 1–8.

David Zarebski, 2017. "On the Realism of Human and Machine Representational Constraints: A Functionalist Account on Cognitive Ontologies", in G. Dodig-Crnkovic, and R. Giovagnoli (eds.), *Representation and Reality in Humans, Other Living Organisms and Intelligent Machines*, Springer, 2017, 347-363

Jeffrey A. Bell, 2017. "From Difference-Maker to Truthmaker (and Back)", in J. A. Bell *et al*, (eds.), *Beyond the Analytic-Continental Divide*, London: Routledge, 2017, 129-150.

> In the first section of this essay, we will turn to the arguments of Mulligan, Simons, and Smith in their now classic 1984 essay, "Truth-Makers." We will focus more precisely on what is argued to be a key advantage of adopting a truthmaker theory—namely, the separation between ontology and logic that truthmaker theory presupposes. It is this separation that will provide the explanatory gap that is thought necessary to provide the constraints for our knowledge claims about the world, for without such a gap between propositions and the ontology that makes them true, we cannot say, so truthmaker theory argues, that our explanations extend to anything but other explanations rather than to the reality that is being explained.

Nicola Guarino, 2017. "BFO and DOLCE: So Far, So Close", *Cosmos+Taxis*, 4, 2017, 10-17.

Peter Simons, 2017 "Barry Smith and His Influence On (Not Only, But Mainly My) Philosophy", *Cosmos + Taxis* 4 (4): 38-41.

Peter Simons, 2017 "Trouble Up at t'Ontological Mill: An Inconclusive Dialog", *Cosmos + Taxis* 4 (4): 64-66.

Bauwens Michaël, 2018 "Institutions as dispositions: Searle, Smith and the ontology of blind chess, *Journal for the Theory of Social Behaviour*, 6 February 2018.

Yu Liu, Lin Li, Hang Shen, Hui Yang and Feng Luo, 2018. "A Co-Citation and Cluster Analysis of Scientometrics of Geographic Information Ontology", *International Journal of Geo-Information*, 2018, 7, 120.

Baptiste Le Bihan, Adrien Barton, 2018. "Analytic Metaphysics versus Naturalized Metaphysics: The Relevance of Applied Ontology", *Erkenntnis*,1-17 (2018).

Jani Hakkarainenm "What are Tropes, Fundamentally? A Formal Ontological Account", *Acta Philosophica Fennica* 94:129-159, 2018.

Maurício B. Almeida, Christiano P. Pessanha and Renata Barcelos, 2018. "Information Architecture for Organizations: An Ontological Approach", in C. Thomas (ed.), *Ontology in Information Science*, InTechOpen, 2018.

Rasmus Rosenberg Larsen and Janna Hastings, 2018. "From Affective Science to Psychiatric Disorder: Ontology as a Semantic Bridge", *Frontiers in Psychiatry*, October 2018 9/487, 1-13.

Achille C. Varzi, "Carnapian engineering", in S. Borgo, R. Ferrario, C. Masolo, and L. Vieu (eds.), Ontology Makes Sense. Essays in Honor of Nicola Guarino, Amsterdam, IOS Press, 2019, pp. 3-23.

Timothy Tambassi, “On the Distinction Between Classical and Nonclassical Geographies: Some Critical Remarks”, in T. Tambassi (ed.), *The Philosophy of GIS*, New York: Springer, 2019, 125-134.

Timothy Tambassi, “What a Geographical Entity Could Be”, in T. Tambassi (ed.), *The Philosophy of GIS*, New York: Springer, 2019, 177-205.

Lars Vogt, “Bona Fideness of Material Entities and Their Boundaries”, Richard Davies (ed.), *Natural and Artifactual Objects in Contemporary Metaphysics. Exercises in Analytic Ontology*, London: Bloomsbury, 2019, 103-120.

Ciro De Florio and Aldo Frigerio, “A Conceptualist View in the Metaphysics of Species”, Richard Davies (ed.), *Natural and Artifactual Objects in Contemporary Metaphysics. Exercises in Analytic Ontology*, London: Bloomsbury, 2019, 121-139.

Jia Wang and Michael Worboys, “Ontologies and representation spaces for sketch map interpretation”, *International Journal of Geographical Information Science*, 31 (9), 2017, 1697-1721.

Konrad Werner, “Coordination Produces Cognitive Niches, not just Experiences: A Semi-Formal Constructivist Ontology Based on von Foerster”, *Constructivist Foundations* 12 (3):292-299 (2017).

Matt E. M. Bower, “Daubert’s naïve realist challenge to Husserl”, *Grazer Philosophische Studien*, 96 (2), 2019, 211-243.

Elselijn Kingma, 2019. “Were You a Part of Your Mother?”, *Mind*. 10 July 2019.

Smit, J., Buekens, F., and Du Plessis, S. “Cigarettes, dollars and bitcoins – an essay on the ontology of money, *Journal of Institutional Economics*, 2019, 12(2), 327-347.

Andrew Iliadis, “The tower of Babel problem: Making data make sense with Basic Formal Ontology”, *Online Information Review*, 2019, 43 (6), 1021-1045o

Guillaume Bucchioni, “Le monisme matériel de Franz Brentano”, *Canadian Philosophical Review*, 58 (4), 2019, 653-675.

Jonathan Furner, “The Ontology of Documents, Revisited”, *Proceedings from the Document Academy*, 6 (1), 2019, 1-23.

Denis Fisette, “Franz Brentano in Vienna”, in D. Fisette, G. Fréchette, F. Stadler (eds.), *Franz Brentano and Austrian Philosophy,* Vienna Circle Institute Yearbook, New York: Springer, 2020.

Philip Larrey, “From Searle’s Speech Acts to Smith’s Truth-Makers”, Raffaela Giovagnoli and Robert Lowe (eds.), *The Logic of Social Practices,* New York: Springer, 2020, 37-48.

Konrad Werner, “Enactment and construction of the cognitive niche: toward an ontology of the mind-world connection”, *Synthese* (2020) 197: 1313-1341.

Beckett Sterner, Joeri Witteveen, Nico Franz, “Alternatives to Realist Consensus in Bio-Ontologies: Taxonomic Classification as a Basis for Data Discovery”, forthcoming.

Adolfo Americano Brandão and Geilson Loureiro, “An Overview of the BFO - Basic Formal Ontology - and Its Applicability for Satellite Systems”, in: F.B.M. Tullio & L.M.B. Machado (eds.), *Ampliação e Aprofundamento de Conhecimentos nas Áreas das Engenharias,* Ponta Grossa, Brazil: Atena Editora, 2020, 30-38.

Beckett Sterner, Joeri Witteveen, Nico Franz, “Coordinating dissent as an alternative to consensus classification: insights from systematics for bio-ontologies”, *History and Philosophy of the Life Sciences,* (May 10, 2020) 42:8.

Elselijn Kingma, “Nine Months”, *The Journal of Medicine and Philosophy*, 45 (3), 2020, 371-386.

Rasmus Rosenberg Larsen and Janna Hastings, “Mapping the patient’s experience: An applied ontological framework for phenomenological psychopathology”, *Phenomenology and Mind*, 18 (2020), 200-219.

Nicola Piras, "Fiat boundaries: how to fictionally carve nature at its joints", philinq 8(2), 2020, 85-106.

Stefano Moroni and Giuseppe Lorini, "Multiple functions of drawings", *Journal of Urban Design*, Published online: 18 Aug 2020.

Paolo Valore, M. G. Dainotti & Oskar Kopczyński, "Ontological Categorizations and Selection Biases in Cosmology: The Case of Extra Galactic Objects", *Foundations of Science* (2020)

Tadeusz Szubka, "Michael Dummett o Filozofii Analitycznej", *Bibliotheca Philosophica* (Lodz), 6, 2020, 109-119.

Tambassi, Timothy "On the Content of Information Systems Ontologies", *Acta Analytica,* April 2021.

Tambassi, Timothy "Being Perspectivist on Information System Ontologies". *Foundations of Science* (2024). https://doi.org/10.1007/s10699-024-09941-4

Caterina Pietra,Roberto De Lotto, Rakan Bahshwan, "Approaching Healthy City Ontology: First-Level Classes Definition Using BFO", *Sustainability*, 2021, 13(24), 13844.

Biber, Katherine. "Conjuring documents: Informal wills." *Law's Documents*. Routledge, 2021. 178-194.

Oliver M. Lean, "Are Bio-ontologies Metaphysical Theories?", Forthcoming in *Synthese*, 2021.

Bartłomiej Skowron, *Część i całość. W stronę topoontologii*. Warsaw University of Technology Press, 2021. Section 4.3.

Thomas Pradeu, Maël Lemoine, Mahdi Khelfaoui, Yves Gingras, "Philosophy in Science: Can philosophers of science permeate through science and produce scientific knowledge?", *The British Journal for the Philosophy of Science*, 2021. This paper, which is a study of the small segment of philosophers who publish philosophical work in science journals, contains the following passage:

> On average, these philosophers had published 11.5 papers in scientific journals and 10.2 in philosophy of science journals. Strikingly, 56 had published at least as many papers in science journals as in philosophy of science journals. Extreme examples include Barry Smith (26 times as many papers in scientific journals as in philosophy journals) and Jerome Wakefield (12.5 times as many papers in scientific journals).

Baptiste Le Bihan and Adrien Barton, "Analytic metaphysics versus naturalized metaphysics: the relevance of applied ontology," *Erkenntnis* 86.1 (2021): 21-37.

Thomas Pradeu, Mael Lemoine, Mahdi Khelfaoui and Yves Gingras, "Philosophy in Science: Can philosophers of science permeate through science and produce scientific knowledge?" *British Journal for the Philosophy of Science,* 2021, https://doi.org/10.1086/715518

> We then identified highly interventionist philosophers of science, defined as those who had published at least five papers in scientific journals between 1977 and 2017. We identified 101 such philosophers of science. The majority (71) of these highly interventionist philosophers were not among the 100 most highly cited philosophers of science described above. On average, these philosophers had published 11.5 papers in scientific journals and 10.2 in philosophy of science journals. Strikingly, 56 had published at least as many papers in science journals as in philosophy of science journals. Extreme examples include Barry Smith (26 times as many papers in scientific journals as in philosophy journals) and Jerome Wakefield (12.5 times as many papers in scientific journals). The mean ratio in this group of 101 philosophers was 1.75 .

Anne Sophie Meincke, "One or two? A Process View of pregnancy", *Philosophical Studies* 179, 1495–1521 (2022).

Anders Søgaard, "Understanding models understanding language". *Synthese 200*, 443 (2022). https://doi.org/10.1007/s11229-022-03931-4 Critique of Landgrebe and Smith, Making AI Meaningful Again

Terry C. Quist (2022) "What philosophy can do for intelligence", Intelligence and National Security, 37:6, 777-790,

Sébastien Richard, "Object and Something in General in Contemporary Formal Ontology", in F. M. Zini

(ed.), *The Meaning of Something*, Springer, 2022. 133-149. DOI: 10.1007/978-3-031-09610-5_6

Gildea, Niall. "'Fanciful associations': The Perverse Endurance of Derrida's [sic] 'logical phallusies'." *Critical Survey* 34.1 (2022): 87-101.

Asher Jiang, "Truthmaking cannot be done afar", *Synthese* 201, 73 (2023). https://doi.org/10.1007/s11229-023-04052-2

Suki Finn, "The mereotopology of pregnancy", *Journal of Medicine and Philosophy*, 15 April 2023, https://doi.org/10.1093/jmp/jhad017

Błażej Mzyk, Two Concepts of Truthmaking: a Compatibilist Solution to the Controversy Between Substantive and Defationary Approach, *Acta Analytica*, July 2023, https://doi.org/10.1007/s12136-023-00564-1

Unpublished

Rafe Champion, Karl Popper and Barry Smith on the Metaphysical Research Program of Austrian Realism and Carl Menger's Economics, Critical Rationalism Blog, 2017

Abdullah Kahtani, A Case Study of the Gene Database Ontology, 2018

Mike Travers, Politics and Pragmatism in Scientific Ontology Construction, 2018

Teaching

http://cs.calstatela.edu/wiki/index.php/Courses/CS_575/Winter_2011/Week_5._Feb_5

Lindley Darden, Fall Semester, University of Maryland, 2017

https://user.phil.hhu.de/~bontcheva/WS1011.html

https://hobi.med.ufl.edu/wordpress/files/2020/09/GMS-7866-Spring-2019.pdf

https://www.academia.edu/1748552/Law_and_ontology_course_presentation_Barry_Smith_the_ontology_of_social_reality

Filosofia | Università di Parma (archive.org)

SOCIAL MEDIA

HL7 Watch: HL7 (Health Level 7) is a collection of standards and proposals for healthcare-specific data exchange between computer applications. Considerable efforts are being invested by governments and industry to use HL7 as part of national health IT projects. Many claims are made on behalf of HL7 by its advocates. The goal of this blog is to investigate the merits of these claims, and to provide some needed independent perspective on the HL7 project.

Youtube @BarrySmith

Philosophical Installations

Universidad Francisco Marroquín

Publons

PATENT APPLICATIONS

Ceusters W, Smith B, Manzoor S. R-6182 Referent Tracking. Provisional patent application filed by Hodgson Russ LLP under Docket No 011520.00632; Priority Application Serial No. 60/963,736 filed August 7, 2007

Ceusters W, Smith B, Manzoor S. Referent Tracking of Portions of Reality. Application filed by Heslin

PRESENTATIONS AT DEPARTMENTAL COLLOQUIA

Apr	1977	Institut für Philosophie, Rheinisch-Westfälische Technische Hochschule, Aachen ("Versuch einer Schichtenontologie")
Jun	1981	Institut für Philosophie, Universität Innsbruck ("Weininger und Wittgenstein")
		Institut für Philosophie, Universität Salzburg ("Über die Kategorienlehre des Aristoteles")
		Department of Philosophy, University of Edinburgh ("Husserl's Monadology")
Dec	1982	Department of Philosophy University of Edinburgh ("Husserl, Frege and the Theory of Meaning")
Jan	1983	Department of Philosophy, City University, London ("Mental Acts")
		Department of Philosophy, University of Sheffield ("Is Intentionality a Relation?")
May	1983	Faculty of Philosophy, Cambridge University ("The Frege-Husserl Question")
Dec	1983	Institute of Linguistics, Hungarian Academy of Sciences, Budapest ("On the Foundations of Dependence Grammar")
Jan	1984	Department of Philosophy, Université de Liège ("The Logic of Wholes and Parts" and "On the History of the Theory of Speech Acts")
May	1984	Institut für Philosophie, Universität Hamburg ("Formalontologische Grundlagen der Phänomenologie Edmund Husserls")
		Department of Philosophy, University of Oslo, May 25 ("Parts, Wholes and Structures, with special reference to the Foundations of Psychology")
Nov	1984	Department of Philosophy, University of Texas at Austin ("On a Theory of the A Priori")
		Department of Philosophy, University of Dallas ("The Metaphysics of the Self")
		Department of Philosophy, Stanford University ("A Theory of Indexicality")
Dec	1984	Università di Bologna, December 6 ("Husserl and the Ontology of Language")
May	1985	Académie de Paris ("Topology, Closure Algebras and Metaphysics")
Jan	1986	Department of Philosophy, Durham University, January 30 ("Austrian Origins of Logical Positivism")
Mar	1986	Department of Economics, George Mason University, Virginia, March 28 ("Hermeneutics and Economics")
Apr	1986	Department of Philosophy, Temple University, Philadelphia ("Indexicality and Perception")
		Department of Philosophy, Catholic University, Washington, April 11 ("A Substitution Theory of Art")
		Department of Economics, New York University ("Austrian Economics and Austrian Philosophy")
		Department of Philosophy, SUNY at Buffalo, New York ("Brentano and Phenomenology")
		Department of Philosophy, Brown University, Providence ("Indexicality and Things")
Jun	1986	Friedrich Naumann-Stiftung, Königswinter ("Österreichische Ökonomie und österreichische Philosophie")
		Institut für Philosophie, Universität Mannheim ("Das Ich als Zeichen")
		Institut für Soziologie und Wissenschaftslehre, Universität Mannheim ("Zur Grundlegung der Sozialwissenschaften")
May	1987	Institut für Philosophie, Universität Freiburg, Switzerland ("Die qualitative Physik: Ein philosophischer Beitrag zur Artificial-Intelligence-Debatte")
		Philosophische Gesellschaft, Fribourg, Switzerland, May 21 ("Die Aufgaben der Ontologie")
Jun	1987	Institut für Philosophie, Universität Bochum, Germany, June 4 ("Kulturtheorie und Nationalökonomie")
Sep	1987	Department of Philosophy, Indiana University, Bloomingto2n, September 11-13 ("On the Peculiar Parts of Reality to which our Sentences Correspond")
Dec	1987	Institut für Philosophie, Universität Salzburg, December 3 ("Sechs falsche Wahrheitstheorien")
		Institut für Philosophie, Universität Freiburg I. Br., December 9 ("Varianten des Idealismus")

Feb	1988	Ludwig von Mises Institute, Auburn, Alabama (“The Austrianness of Austrian Economics”)
		Department of Economics, Auburn University, Auburn, Alabama (“Philosophical Foundations of Austrian Economics”)
		Graduate Seminar, Department of Philosophy, Indiana University, Bloomington (“Varieties of Atomism”)
		Department of Philosophy, University of Iowa, Iowa City (“Notes on Ontology”)
		Department of History, University of Iowa, Iowa City (“Metahistorical Reflections on Austria-Hungary”)
		Department of Philosophy, Pennsylvania State University (“Phenomenology and the *A Priori*”)
		Department of Philosophy, Duquesne University, Pittsburgh (“New Foundations for Metametaphysics”)
		Institute for Humane Studies, Fairfax, Virginia (“Subjectivism and Objectivism in Economics”)
		Center for Study of Market Process, Dept. of Economics, George Mason University (“Austrian Economics: Principles and Provocations”)
Mar	1988	Vereinigung für wissenschaftliche Grundlagenforschung, Graz, March 17 (“Eine Einführung in die Metametaphysik”)
May	1988	Department of Mathematics, University of Wroclaw, Poland (“Two Concepts of the Continuum, with remarks on the Topology of Objects”)
		Polish Philosophical Society, Cracow Division (“The Correspondence Theory of Truth: Aristotelian and Ingardenian Reflections”)
		Department of Philosophy, University of Wroclaw, Poland (“Constraints on Correspondence”)
		Institut für Philosophie, Universität Innsbruck (“Wie vergleicht man metaphysische Systeme miteinander?”)
		Faculty of History and Social Sciences, Università di Trento, Italy (“What is Truth?”)
Oct	1988	Department of Philosophy, University of Warwick (“What are works of art built for?”)
		Internationale Akademie für Philosophie and Infor-Tele-Matik AG, Liechtenstein, 24 October (“Die Computer-Welt Beziehung. Bemerkungen über die Anwendung des Computers in der Technik”)
Nov	1988	Centre de Recherche en Epistémologie Appliquée, Paris, November 22 and 30 (“La sémantique formelle et les limites de la philosophie analytique” and “Deux perspectives sur les sciences cognitives: la physique phénoménologique et le solipsisme méthodologique”)
		Centre d’Analyse et de Mathematiques sociales, Ecole des Hautes Etudes en Sciences Sociales, Paris, November 29 (“Les structures aristotéliciennes-brentaniennes contre les constructions ensemblistes”)
Feb	1989	Faculty of Music, University of Manchester (“Schopenhauer, Music and the Will”)
		Institute for the History and Philosophy of Science, King’s College, London, February 8 (“Naive Physics and Phenomenology. A Guide for Robots”)
Apr	1989	Institut für Nationalökonomie, Universität Wien (“Die Österreichische Schule der Nationalökonomie: Philosophische und ökonomische Aspekte”)
		Department of Philosophy, Rhode Island University (“A Correspondence Theory of Intentionality”)
		Department of Philosophy, Rutgers University (“A Picture Theory of Universals”)
May	1989	Department of the Philosophy of Science, University of Umeå (“The Languages of Philosophy” and “An Introduction to Metametaphysics”)
Oct	1989	Department of Philosophy, Åbo Akademie, Åbo/Turku, Finland (“Contiguous Cultures: A Theory of Artistic Creativity”)
Dec	1989	Seminar für Philosophie, Universität Braunschweig (“Die Telefaxmaschine des Aristoteles: Zur Wesensanalyse des philosophischen Kommentierens”)
		Institut für Philosophie, Universität München (“Die Gattung Kommentar”)
Jan	1990	Department of Philosophy, University of Liverpool (“Aristotle’s Fax Machine”)
		Department of Philosophy, SUNY Buffalo (“The Culture of the Philosophical Commentary”)
Feb	1990	Department of Philosophy, Simon Fraser University, Vancouver (“An Ontological Theory of the *A Priori*”)

Apr	1990	Dipartimento di Filosofia, Università di Firenze ("Judgment and Truth in Husserl's *Logical Investigations*")
Jun	1990	Institut de Philosophie, Université de Genève ("Structures of the Commonsense World")
Sep	1990	Institut für Philosophie, Åbo Akademi, Åbo/Turku, Finland ("The Is/Ought Distinction")
		Department of Philosophy, Turku University, Finland ("On the Obscure Origins of Speech Act Theory")
Oct	1990	Department of Philosophy, Joensuu University, Finland ("On Being a Work of Art" and "The Literary Forms of Philosophy")
Nov	1990	Institut für Philosophie, Universität Kiel ("Aristoteles und die Roboter")
		Institut für Nationalökonomie, Universität Innsbruck ("Apriorische Grundlagen der Sozialwissenschaften")
Dec	1990	Centro Studi per la Filosofia Mitteleuropea, Università di Trento ("The Theory of Austria")
Feb	1991	Cognitive Science Seminar, State University of New York at Buffalo ("Naive Physics")
May	1991	Institute of Philosophy of the Czechoslovak Academy of Sciences ("Jacques Derrida: Writing to Death")
		Department of Philosophy, Prague School of Economics ("Philosophical Foundations of Austrian Economics: From Franz Brentano to Friedrich Hayek")
Sep	1991	Buffalo Logic Colloquium, University at Buffalo ("What is Formal about Formal Logic?")
Oct	1991	Department of Philosophy, Charles University, Prague ("Kafka and the Philosophers")
Nov	1991	Department of Philosophy, University of Leiden, November 11 ("The Truth Shall Prevail: Philosophy and Political Change in Eastern Europe")
Jan	1992	Institut für Philosophie, Universität Innsbruck, January 16 ("Jacques Derrida: Zum Tode schreiben")
Feb	1992	Department of Philosophy, McMaster University, Hamilton, Canada ("Jacques Derrida: Writing to Death")
		Department of Philosophy, Southern Illinois University, Carbondale ("What is Wrong with Contemporary French Philosophy?")
May	1992	Institut für Philosophie, Universität Graz ("Common Sense schlägt zurück")
Jul	1992	Institut für Philosophie, Universität Konstanz ("Ontologische Spaziergänge")
Sep	1992	Cognitive Science Seminar, University at Buffalo ("Nativism", as Panel Member)
Oct	1992	Institut für Philosophie, Universität Innsbruck ("Apriorisches Wissen und künstliche Intelligenz")
Jan	1993	Buffalo Logic Colloquium, University at Buffalo ("Commentary on Corcoran")
Feb	1993	Buffalo Logic Colloquium, University at Buffalo ("States of Affairs")
		Cognitive Science Seminar, University at Buffalo ("Feminist Epistemology", as Panel Member)
		The German Language Society, German Embassy, Washington D.C. ("Philosophie, Politik und Revolution in Osteuropa")
		Department of Philosophy, University of North Carolina at Greensboro ("Facts")
		Department of Economics, New York University ("Carl Menger: On Apriorism in Austrian Economics")
May	1993	Department of Philosophy, Turku University ("Formal Ontology and Knowledge Representation")
		Vereinigung Vorarlberger Akademie, Bregenz ("Vernunft und Unvernunft im heutigen Denken" and "Das Denken im Zeitalter des Computers")
Oct	1993	Graduiertenkolleg Kognitionswissenschaft, Universität Hamburg ("Formale Strukturen der Common-Sense Welt")
		Institut für Philosophie, Universität Hamburg ("Sachverhalte als Wahrmacher")
Dec	1993	Istituto per la Ricerca Scientifica e Tecnologia, Trento ("Formal Ontology and the Common-Sense World")
		Department of Philosophy, University of Padua ("Truth: Part I" and "Truth: Part II")
		Centro Interdepartimente di Scienze Cognitive and Department of Psychology, University of Padua ("Gestalt Theory, Topology and Common Sense: Alternative Foundations for Cognitive Science")

Feb	1994	Department of Philosophy, University of Tampere, Finland (“Husserl as Ontologist”),
		Department of Philosophy, University of Helsinki, Finland (“Boundaries”)
Oct	1994	Buffalo Logic Colloquium, University at Buffalo (“Theories of the Continuum”)
Nov	1994	University of Iowa, Gustav Bergman Lecture (“The Glory and Misery of Twentieth-Century Philosophy: From Husserl to Derrida”)
		Department of Philosophy, University of Iowa (“Ontological Form”)
		Centre for Semiotic Studies, University of Aarhus, Denmark (“The Joints of Reality”)
		Department of Comparative Literature, University of Copenhagen, Denmark (“On Philosophical Styles”)
Dec	1994	Department of History, Canisius College, Buffalo (“Culture and Capitalism”)
Feb	1995	Department of Philosophy, University of Western Ontario, London, Ontario (“Brentano’s Theory of the Continuum”)
		Department of Philosophy, University of Waterloo, Waterloo, Ontario (“Continental Philosophy: For and Against”)
Mar	1995	Institut für Ingenieurgeodäsie und Landesvermessung, Technische Universität, Wien (“Zur Kognition räumlicher Grenzen”)
		Department of History, University of Malta (“Philosophy and Political Change in Eastern Europe”)
Apr	1995	The Creighton Club. New York State Philosophical Association, 140th Meeting, Skaneateles, NY (“Rejoinder to Hardin on Spectrum Inversion”)
		State University College at Geneseo, NY (“The Identity Theory of Truth”)
		Institute of Psychology, University of Amsterdam (“Topological Foundations of Cognitive Science”)
May	1995	Department of Philosophy, Marii Curie-Sklodowskiej Universita Lublin (“What is the Visual Field?”)
		Department of Philosophy, Catholic University of Lublin (“The Identity Theory of Truth”)
		Department of Philosophy, Catholic University of Lublin (“Foundations of Cognitive Science: From Connectionism to Ontological Engineering”)
		Conversatorium in Cognition Science, Nicholas Copernicus University of Torun (“What is the Visible Field?”)
		Department of Logic, Nicholas Copernicus University of Torun (“Non-Standard Theories of the Continuum”)
		Department of Philosophy, University of Torun (“The End of Postmodernism”)
		Polish Philosophical Society, Institute of Philosophy, Warsaw University (“Why Polish Philosophy Does Not Exist”)
		Department of Philosophy, Jagiellonian University (“What is the Visual Field?”, “The Identity Theory of Truth”, “The Scandal of ‘Continental Philosophy’” and “How to Refute Idealism”)
Jun	1995	Ludwig von Mises University, Auburn University, Auburn, Alabama (“Mises and Austrian Philosophy” and “Theory and History”)
Sep	1995	Hungarian Philosophical Association, Budapest (“What is Post-modernism?”)
Nov	1995	Symposium on Michael Tye, Department of Philosophy, University at Buffalo (“Ten Problems of Consciousness”)
		Public Lecture, Technical University, Vienna (“Philosophie für Ingenieure”)
Feb	1996	Honors Seminar, Canisius High School, Buffalo (“On the Causes of War”)
		Department of Philosophy, University at Buffalo (“Bosnia: The Cognitive Geometry of War”)
		Ludwig von Mises Institute, Auburn University, Auburn, Alabama (“Bosnia: The Cognitive Geometry of War”)
		Department of Philosophy, Auburn University, Auburn, Alabama, February 21 (“Boundaries: A Hitherto Neglected Metaphysical Categories”)
		Department of Philosophy, Emory University, Atlanta, February 22 (“Husserlian Foundations of Social Ontology”)
		Buffalo Dictionary Project, Logic Colloquium, University at Buffalo (“Propositions and States of Affairs”)

Cognitive Science Colloquium, University at Buffalo ("Ontological Foundations of Geographic Information Systems", with David Mark)

Mar 1996 Department of Computer Science, University of Leeds ("Types of Boundary in Geographic Space")

Department of Philosophy, University of Leeds ("On War, Social Ontology and Organic Unity")

Mar 1996 Department of Philosophy, University of Liverpool, March 18 ("On Mental Maps and the Evolution of Human Territoriality")

Apr 1996 Department of Philosophy, University of Texas at Austin, April 22 ("Feminist Philosophy, Post-Modernism and the Deconstruction of the University")

Political Science Honor Society, Canisius College, Buffalo, April 30 ("Political Correctness in Perspective")

Jul 1996 Department of Geography and National Center for Geographic Information and Analysis, State University of New York at Buffalo, July 16 ("The Metaphysics of Real Estate")

Spatial Cognition Research Group, University of California at Santa Barbara ("Introduction to Cognitive Linguistics")

Center for Economic Personalism, Acton Institute, Grand Rapids, Michigan ("Austrian Philosophy")

Aug 1996 Ludwig von Mises University, Auburn University, Auburn, Alabama, August 10-17 (Four plenary lectures under the title: "Philosophy for Austrian Economists")

Sep 1996 New York Association of Scholars, New York, September 20 ("What is Postmodernism?")

Oct 1996 Department of Philosophy, Texas Tech University, Lubbock, Texas ("The Metaphysics of Real Estate")

Philosophy Club, Texas Tech, Lubbock, Texas, October 3 ("On the Origins of War")

Oct 1996 Department of Philosophy, York University, Toronto ("Categories Deep and Superficial")

Department of Philosophy, University at Buffalo, October 22 ("Die erkenntnistheoretische Aufspaltung der Welt (mit Bemerkungen zur kognitiven Linguistik)")

Departments of Philosophy and Sociology, SUNY Potsdam, October 24 ("What is Postmodernism?")

Nov 1996 Seminar für Philosophie, Universität Basel ("Die erkenntnistheoretische Aufspaltung der Welt")

Department of Political Science, University of Olomouc, Czech Republic ("Sovereignty and Property Rights")

Public Lecture Sponsored by the Sonderforschungsbereich Moderne of the Fonds zur Förderung der wissenschaftlichen Forschung and the University of Graz, Austria ("Moderne vs. Post-Moderne")

Jan 1997 Department of Geography, SUNY Buffalo, January 24 ("On the Varieties of Boundaries")

Feb 1997 Honors Seminar, Canisius High School, Buffalo ("Paradoxes")

Department of Economics, New York University, New York ("The Metaphysics of Real Estate")

Department of Philosophy, Rochester Institute of Technology, Rochester, NY, February 12 ("Libertarianism, Monarchy, and Property Rights")

University of Malta Foundation for International Studies, Valletta, Malta, February 18-22 ("The Geometry of War")

Philosophy Club, University of Malta ("Common Sense: A Guide for Robots")

Mar 1997 Department of Philosophy, Abo Academy, Abo/Turku, Finland ("The Adaptation Theory of Truth")

Department of Philosophy, Turku University, Turku, Finland, March 12 ("New Directions in Applied Metaphysics")

May 1997 Department of Philosophy, SUNY Binghamton, May 2 ("What is Postmodern Philosophy?")

Centre pour la Récherche en Epistemologie Appliquée (CREA), Ecole Polytechnique, Paris ("J. J. Gibson: The Adaptation Theory of Truth")

Jul 1997 The Sullivan Policy Institute, Rochester, New York ("Higher Education and Its Problems")

Sep 1997 Department of Philosophy, University of Helsinki ("Paradoxes of Contact and Separation")

Oct 1997 Public Lecture, James Madison University, Harrisonburg, Virginia, October 23 (as Distinguished Visiting Scholar) ("The State as Work of Art")

Nov 1997 Philosophisches Institut, Universität Düsseldorf, November 19 (“Ontologie des Mesokosmos: Soziale Objekte und Umwelten”)

Institut für Philosophie, Universität Würzburg (“Ontologie des Mesokosmos: Soziale Objekte und Umwelten”)

Institut für Philosophie, Universität Bamberg (“Ontologie des Mesokosmos: Soziale Objekte und Umwelten”)

Feb 1998 Institut für Geoinformatik, Universität Münster, February 26 (“Versuch einer vollständigen Ontologie geographischer Gegenstände”)

Mar 1998 UNIWorld/Hungarian Academy of Sciences, Budapest, March 1998 (“Philosophy on the Internet”)

Apr 1998 University of Albany, Public Lecture, April 16 (“What is Postmodernism?”)

Center for Cognitive Science, University at Buffalo (Tutorial on John Searle, *The Construction of Social Reality*)

Presentation to the Academic Standards Committee of the Board of Trustees of the State University of New York (“SUNY’s Core Curriculum”)

Department of Philosophy, University of Wisconsin at Green Bay, April 30 (“Ecological Foundations of Cognitive Science)

Philosophy House, University of Wisconsin at Green Bay (“In Defense of Applied Philosophy”)

May 1998 Alfred State University, Honors Convocation, Keynote Lecture (“Common Sense: A Guide for Robots”)

Jul 1998 Department of Philosophy, University of Guelph, Ontario (“Metaphysical Foundations of Biology” and “Husserl and the Theory of Part and Whole”)

Department of Philosophy, University of New England, Armidale, Australia, July 23 (“The Niche”)

Department of Philosophy, University of Sydney, July 27 (“The Niche”)

Department of Philosophy, University of Queensland, Brisbane (“The Niche”)

Department of Philosophy, Research School of Social Sciences, Australian National University, Canberra, Australia (“The Niche”)

Center for Mathematical and Information Sciences, Commonwealth Scientific and Industrial Research Organisation, Canberra, Australia (“New Directions in Ontological Engineering”)

Australian Defence Forces Academy, Canberra, Australia (“The Geometry of War”)

Aug 1998 Buffalo Socratic Society, Buffalo, NY, August 28 (“Truthmaker Realism”)

Sep 1998 Cognitive Science Center, University at Buffalo, September 23 (“Cognition, Ontology and Geographic Information Science”, with David Mark)

Oct 1998 The Greats Speaker Series, Department of Philosophy and Religious Studies, Buffalo State College, October 6 (“Ethnic Cleansing”)

Erasmus Institute for Philosophy and Economics, University of Rotterdam, Netherlands (“Social Ontology”)

Nov 1998 Department of Comparative Literature, University of Copenhagen (“Kafka and the Philosophers”)

Center for Semiotic Studies, University of Aarhus, November 5 (“An Ecological Theory of Social Objects”)

Department of Philosophy, McMaster University, Ontario, Canada (“Truthmaker Realism”)

Department of Geography, Virginia Tech, Blacksburg, VA (“Buffalo’s IGERT Program in Geographic Information Science”)

Department of Philosophy, Emory and Henry College, Emory, VA (“Why Go to Graduate School?”)

Department of Philosophy, East Tennessee State University, Johnson City, TN (“Why Go to Graduate School?”)

Jan 1999 Department of Philosophy, Hebrew University, Jerusalem, January 5 (“The Niche”)

Center for Cognitive Science, Tel Aviv University, Israel (“On the Cognition of Geographic Kinds”)

Department of Philosophy, Tel Aviv University, Israel (“Truthmaker Realism”)

Feb	1999	Department of Philosophy, University at Buffalo, February 25 (“Meme Combat”)
Mar	1999	Philosophy Club, University of Malta (“What is Postmodernism”)
		Department of Philosophy, University of Malta (“Physics, Mereology and Vagueness”)
Jun	1999	Institut für Philosophie, University of Mainz, Germany (“Die ganze Welt ist eine Bühne: Zur Ökologie und Ontologie menschlicher und tierischer Lebenswelt”)
		Institut für Philosophie, University of Koblenz, Germany, June 16 (“Die ganze Welt ist eine Bühne: Zur Ökologie und Ontologie menschlicher und tierischer Lebenswelt”)
		Department of Philosophy, University of Padua, June 21 (“Truth as an Internal Relation”)
		Istituto per Ricerche di Dinamica dei Sistemi e di Bioingegneria, Consiglio Nazionale delle Ricerche, Padua (“Hills, Bays and Body Parts: Recent Research on Geographic Ontology”)
		Faculty of History and Social Sciences, Università di Trento, Italy, June 24 (“Social Objects”)
Sep	1999	Buffalo Socratic Society, Buffalo, NY, September 15 (“What is a Substance?”)
Oct	1999	Royal Military College of Canada, Ottawa (“The Cognitive Geometry of War”)
		Department of Philosophy, University of Toronto (“On Wombs, Beaver Dams and Spaceships: An Ontology of Organism-Niche Relationships”)
		Tanner Humanities Center, University of Utah, October 21 (“Embodied Reason”, Seminar with Mark Johnson)
		Department of Philosophy, University of Utah, October 22 (“The Analytic-Continental Divide”)
		Ellis Lecture, Department of Philosophy, Weber State University, Utah (“Foreign Bodies”)
		Department of Geography, University of Utah (“Ontological Engineering and Geographic Information Science”)
Nov	1999	Department of Philosophy, University at Buffalo (“Should the Baby Live?”, Panel on the Philosophy of Peter Singer)
Dec	1999	Hamburger Kreis, Universität Hamburg (“Die ganze Welt ist eine Bühne”)
Jan	2000	Seminar für Philosophie, Universität Hamburg (“Meinong und die Phantasie-Maschine”)
Feb	2000	Graduiertenkolleg Kognitionswissenschaft, Universität Hamburg (“Gegenstände und ihre Umwelten: Der ökologische Ansatz in der wissenschaftlichen Philosophie”)
		Institut für Philosophie, Universität Salzburg (“Ein neues Kategoriensystem für die Wissenschafts-theorie”)
Mar	2000	Vorarlberger Industriellenvereinigung, Feldkirch, Austria, March 15 (“Ein Plädoyer für den Kapitalismus”)
		Department of Philosophy, Catholic University of Lublin, Poland (“Mereology and Quantum Mechanics”)
		Department of Philosophy, Marii Curie-Sklodowskiej Universita, Lublin, Poland (“Meinong and the Phantasy-Machine”)
Apr	2000	European Media Lab, Villa Bosch, Heidelberg (“Ontology: Philosophical and Computational”)
Nov	2000	Hungarian Academy of Sciences and University of Budapest, November 13 (“Common Sense and Quantum Mechanics”)
		Institut für Philosophie, Universität Graz, November 14-15 (“Referenz und Wahrheit” and “Aristoteles, das Internet und die neue Physik”)
		Universität München, Ringvorlesung (Public Lecture) in the series *Kann man heute noch etwas anfangen mit Aristoteles?*, November 20 (“Aristoteles und die vernetzte Welt”)
		Institut für Philosophie, Universität Erfurt, November 21 (“Referenz und Wahrheit”)
Jan	2001	Institut für Philosophie, Universität Düsseldorf (“Embryontology” and “Aristoteles, das Internet und die neue Physik”)
		Institut für allgemeine Sprachwissenschaft, Universität Düsseldorf (“Semantik für Realisten”)
		Center for Cognitive Science, University at Buffalo, January 24 (“The Windowing of Attention in Pictures”)
Feb	2001	Institut für Philosophie, Universität Köln, February 7 (“Intentionalität als Projektion”)
Apr	2001	Center for Cognitive Science, University at Buffalo, April 4 (“Geographic Objects and Their Categories”, with David Mark)
		Department of Philosophy, SUNY Brockport, April 12 (“The Meaning of Life”, with Berit Brogaard)

Jun	2001	Instituto de Investigaciones Filosóficas, UNAM, Mexico City, June 6 (“The Meaning of Life”)
Aug	2001	Liberty and Morality Advanced Seminar, Foundation for Economic Education, Irvington NY, August 4-9 (“Liberty and the Meaning of Life”, “Morality and the Meaning of Life”)
		Department of Philosophy, University at Buffalo, August 30 (“The Meaning of Life”)
Sep	2001	Department of Economics, George Mason University, September 7 (“Capitalism and the Meaning of Life”)
Oct	2001	Buffalo IGERT Program Workshop on Categories, October 26-27 (“Geographic Categories”, with David Mark)
Nov	2001	Buffalo Logic Colloquium (“Granular Partitions”)
Jan	2002	Institute for Logic and Philosophy of Science and Institute for Philosophy, University of Leipzig, January 17 (“Ontologische Grundlagen der Informationswissenschaft”)
		Institut für Informatik und Graduiertenkolleg Wissensrepraesentation, University of Leipzig (“Granularität und Wissensrepräsentation”)
Feb	2002	Buffalo Ontology Group, Department of Philosophy, University at Buffalo (“'Towards a General Upper Ontology”)
		History of Ideas Group, Department of Comparative Literature, University at Buffalo (“The Essence of the West”)
		Department of Philosophy, University at Buffalo, February 28 (“Searle’s Ontology of Social Reality: Its Glory and Its Misery”)
Apr	2002	Institut für Logik und Wissenschaftstheorie, Universität Leipzig (“Das glorreiche Scheitern des naturalistischen Ansatzes in der Ontologie der sozialen Wirklichkeit John Searles”)
		Colloque du ESCP-EAP, Paris (“Definitions of Terrorism”)
		Centre de Recherche en Philosophie économique, ESCP, Paris, April 11 (“The War Against the West”)
		CREA, Paris, April 12 (“Truth, Reference and Vagueness”)
		Public Lecture Series: Terror and The War Against Terror, University of Leipzig, April 23 (“Kamikaze und der Westen”)
May	2002	Faculty of Information Science and Statistics, Prague University of Economics, May 15 (“Ontology as Master Discipline of Information Science”)
		Department of Philosophy, Marii Curie-Sklodowskiej Universita, Lublin, Poland (“A Unified Theory of Vagueness and Granularity”)
		Institut für Philosophie, Universität Bonn (“Wie testet man eine philosophische Theorie empirisch?”)
Jun	2002	Philosophisches Kolloquium, Universität Leipzig, June 26 (“Was ist Wahrheit?”)
Jul	2002	Lehrstuhl für Volkswirtschaftslehre und Institut für Philosophie, Universität Würzburg, July 2 (“Vom Sinn des Lebens. Versuch einer Definition”)
		Department of Philosophy, University of Lisbon, Portugal, July 16 (“How to Test a Philosophical Theory Empirically”)
		Institut für Wirtschaftsinformatik, Universität Koblenz, July 23 (“An Application of Basic Formal Ontology to the Ontology of Services and Commodities”)
Oct	2002	Wolfgang Paul Prize Presentation, University of Leipzig (“Was ist Gesundheit?–und andere ontologische Fragen”)
Nov	2002	Cognitive Science Seminar, University at Buffalo (“SNAP and SPAN”)
		Department of Philosophy, Calvin College, Grand Rapids, Michigan, November 11 (“Morality, Happiness and the Meaning of Life”)
		Acton Institute, Grand Rapids, Michigan (“What is to be done? On Achievements and the Social Web of Meaning”)
Dec	2002	Laboratory of Applied Ontology (ISTC-CNR), Trento, Italy, December 9-11 (A series of six lectures on the “Ontology of Law, Economics and Human Interaction”, organized as part of the opening ceremonies of the new Institute for Cognitive Science and Technology of the Italian National Research Council)
Jan	2003	Department of Computing, Imperial College, London (“Formal Ontology and Information Systems”)

Feb	2003	Buffalo Ontology Group, Department of Philosophy, University at Buffalo (“Against Fantology”)
		University at Buffalo School of Management-School of Informatics Joint Study Group (“Ontology in Buffalo”)
Mar	2003	Department of Philosophy, Georgetown University, Washington DC, March 21 (“The Meaning of Life and the Measure of Civilizations”)
Apr	2003	Institut für Philosophie, Universität Leipzig, April (“Pro und Contra Iraq-Krieg”)
May	2003	Kolloquium zur praktischen Philosophie, Universität Leipzig, May (“Vielfalt des Libertarismus”)
		Department of Linguistics, Copenhagen Business School (“The IFOMIS Project”)
Jun	2003	Public Lecture, Medical Faculty, University of Leipzig (“Ontologie und die Vereinheitlichung medizinischen Wissens”)
		Department of Philosophy, University of Geneva (“Truthmakers: The Extension of a Property”)
Jul	2003	Institute for Cognitive Systems, University of Bremen (“Towards Geodynamic Ontology”)
		Public Lecture, University of Medical Informatics Tyrol (“Ontologie und die Integration des medizinischen Wissens”)
Nov	2003	Graduate School of Human and Environmental Studies, Kyoto University (“Kamikaze and the West”)
		Bioinformatics Center, Institute for Chemical Research, Kyoto University, Japan (“On the Proper Treatment of Classes in Biomedical Informatics”)
		Center for Philosophical Studies, University of Tokyo (“From Aristotle to Husserl: Towards an Ontology of Environments”)
Dec	2003	Centro Interuniversitario di Ontologia Teorica e Applicata, Dipartimento di Filosofia, Università di Torino (“On Searle’s Social Ontology”)
		Research Group in Uniform Terminology for European Private Law, Dipartimento di Scienze Giuridiche, Università di Torino (“Ontologies in Law and Medicine”)
Jan	2004	Department of Medical Informatics, University of Freiburg (“Biomedizinische Ontologien. Die Arbeit des IFOMIS-Instituts”)
Feb	2004	National Cancer Institute, Bethesda MD (“Formal Principles of Biomedical Ontologies”)
		National Library of Medicine, Bethesda MD (“Medical FactNet”)
		Department of Philosophy, Monash University, Melbourne, Australia (“The Metaphysics of Medicine”)
Mar	2004	Department of Information Systems, University of Melbourne, Australia (“The Ecological Approach to Information Processing”)
		Department of Computer Science, Deakin University, Geelong, Australia (“Basic Formal Ontology”)
		Department of Philosophy, University of Melbourne, Australia (“The Gene Ontology”)
		Logic Colloquium, University of Melbourne, Australia (“The Logic of Biological Classification”)
		Department of Information Systems, University of Melbourne, Australia, March 5 (“The Semantic Web”)
Apr	2004	Department of Philosophy, University at Buffalo (“The Gene Ontology”)
		SNERG Research Group, Department of Computer Science and Engineering, University at Buffalo, April 23 (“Medical FactNet: A New Methodology for the Construction and Validation of Information Resources for Consumer Health”)
Jun	2004	Department of Biological Structure, Faculty of Medicine, University of Washington, Seattle (“SNAP and SPAN: From the Foundational Model of Anatomy to the Physiology Reference Ontology”)
		Department of Philosophy and Department of Linguistics, Saarland University (“Prospects for Biomedical Ontology: From Aristotle to the Human Genome Project”)
Jul	2004	Max Planck Institute for Mathematics in the Sciences, Leipzig, July 26 (“Classes and Classification in Biology”)
Oct	2004	Buffalo Logic Colloquium, October 14 (“The Logic of Biological Classification”)
Dec	2004	Bioinformatics Group, RIKEN Genomic Sciences Center and Tokyo Institute of Technology, Tokyo, December 2 (“On Relations in Biological Ontologies”)
Jan	2005	Department of Computer Science, University of Manchester, January 17 (“Ontologies: The Next

Generation")

Institut für Philosophie, Saarland University, Germany, January 25 ("Aristoteles 2005, oder: Was die Metaphysik zur heutigen Biomedizin beitragen kann")

Mar 2005 Graduate School, University at Buffalo, Research Ethics Seminar, March 3 ("International Standard Bad Philosophy")

College of Arts and Sciences, University at Buffalo, Cutting Edge Lecture Series, March 5 ("Tracking the Human Genome")

May 2005 Forum: Neue Methoden und Verfahren der Informationsverarbeitung im Gesundheitswesen, Lehrstuhl für Medizinische Informatik, Universität Erlangen, May 31 ("Die Ontologie biomedizinischer Daten")

Jun 2005 LabOnt (Laboratory for Applied Ontology), University of Turin, June 20 ("The Ontology of Documents", Video)

Sep 2005 Department of Oral Biology, University at Buffalo School of Dental Medicine, September 29 ("Referent Tracking: What it is, and Why we need it.")

Presidential Fellows and Dean's Scholars 2005-2006, College of Arts and Sciences, University at Buffalo, September 29 ("Africa!")

Oct 2005 Workshop on Ontologies, Department of Philosophy, University at Buffalo, 1 October 2005 ("The Ontology of Documents")

Dean's Advisory Council, College of Arts and Sciences, University at Buffalo, 7 October 2005 ("A Philosopher's Vision for the Future of Healthcare")

Nov 2005 Center for Education and Research in Information Assurance and Security (CERIAS), Purdue University, West Lafayette, November 2 ("The Ontology of Documents and the Technologies of Identification")

Regenstrief Institute, Indianapolis, November 9 ("HL7 RIM: Exegesis and Critique")

School of Informatics, Indiana University, Indianapolis, November 9 ("Biomedical Ontologies: The Good, the Bad and the Ugly")

Department of Computer Science, University of Essex, UK, November 16 ("Why Computer Science Needs Philosophy")

CHIME, University College London, UK, November 17 ("HL7 RIM: An Ontological Analysis")

Dec 2005 Center for Inquiry, Amherst, NY, December 16 ("Universals of Human Behavior: From Adam Smith to Africa")

Jan 2006 Bolton School, Bolton, UK, January 30 ("Why All Science is Computer Science")

Feb 2006 IGERT Seminar, National Center for Geographic Information and Analysis, University at Buffalo, 17 February 2006 ("Measuring Fields: A Theory of Quantities")

Department of Oral Biology, School of Dental Medicine, University at Buffalo, February 20 ("The Mouth")

Seminar on Property Rights and Economic Development, Law School, February 22, University at Buffalo ("Legal Ontology and the Tanzania Project")

Jun 2006 Institut de biologie moléculaire et cellulaire du CNRS, Université Louis Pasteur, Strasbourg, France, June 7 ("The Future of Ontologies in Biomedical Research")

Sep 2006 Norwegian Center for Electronic Health Records, Norwegian University of Science and Technology, Trondheim, September 18 ("The Nature of Disease: Future Pathways in Biomedical Ontology"), September 19 ("Clinical Coding and Terminologies: The Past and the Future")

Norwegian Health Informatics Centre, Norwegian University of Science and Technology, Trondheim, September 18 ("A General Introduction to Biomedical Ontology", "How Ontologies Create Research Communities")

Department of Computer and Information Science, Norwegian University of Science and Technology, Trondheim, September 19 ("Critical Comments on ISO Standard 15926")

Oct 2006 Center for Cognitive Science, University at Buffalo, NY, October 11 ("Why I am Not a Philosopher"; slides and video from November 2018 version of this talk)

Duke University School of Medicine, October 31 ("How Ontologies Create Research Communitites")

Nov 2006 Duke University Department of Biostatistics and Bioinformatics, November 1 ("The Ontology of

Experiments")

Dec 2006 Faculty of Computer Science, Free University of Bolzano, December 4-5 ("The OBO Foundry", "The OBO Relation Ontology", "Towards a Reference Terminology for Talking about Ontologies and Related Artifacts")

BIT Lecture, Faculties of Computer Science, Universities of Bolzano, Innsbruck and Trento, December 5 ("Ontology Development for Commercial and for Natural Science Domains")

Feb. 2007 Center of Excellence in Bioinformatics and Life Sciences, University at Buffalo, February 14 ("The Ontology Research Group")

Mar. 2007 Department of Biostatistics, Bioinformatics, & Epidemiology, Medical University of South Carolina, Charleston, March 5 ("The Future of Health Information")

Apr 2007 Department of Philosophy, University of Utrecht, April 2 ("Languages of Medicine", "Logical Tools and Theories in Contemporary Bioinformatics")

National Center for Integrative Biomedical Informatics, University of Michigan, April 12 ("The OBO Foundry: Towards Gold Standard Terminology Resources in the Biomedical Domain")

Department of Philosophy, University of Paderborn, April 19, 2007 ("Sprechakte und Dokumentakte")

May 2007 Cognigen Corporation, Amherst NY, May 9 ("Data Standardization and the FDA Approval Process")

Department of Clinical Sciences, University of Texas Southwestern Medical Center, Dallas, May 24 ("Re-Engineering the Discipline of Clinical and Translational Science: Ontology for Clinical Investigations")

Jun 2007 Duke Clinical Research Institute, Duke University Medical School, Durham NC, June 6 ("The Problem of Reusability of Biomedical Data: OBO Foundry & HL7 RIM")

Aug 2007 Institute for Computational Biomedicine, Weill Medical College of Cornell University, New York, August 13 ("The OBO Foundry: Coordinated Evolution of Ontologies to Support Biomedical Data Integration")

Protein Data Bank, Research Collaboratory for Structural Bioinformatics, Rutgers University and (remotely) University of California at San Diego, August 20 ("The OBO Foundry")

University at Buffalo NSF IGERT Orientation, Letchworth Park, August 21-22 ("Introduction to (Geo)Ontology")

Sep 2007 Charles R. Bronfman Institute for Personalized Medicine, Mount Sinai School of Medicine, New York, September 4 ("Ontologies for Clinical and Translational Medicine")

Oct 2007 SAP, Walldorf, Germany, October 4 ("Achieving Interoperability")

NCBO Seminar Series, Stanford University (online presentation), October 9 ("Results of the Infectious Disease Ontology Meeting")

Nov 2007 Buffalo City-Wide Grand Rounds, UB Center for Clinical Ethics, November 19 ("The Future of Biomedical Informatics")

Mount Sinai School of Medicine, New York, November 26 ("First Steps Towards an Ontology for Community-Based Medicine")

Jan 2008 Buffalo IGERT Colloquium, January 25 ("The Environment Ontology and the GAZ: An Open Source Gazetteer built on Ontological Principles")

Mar 2008 New York State Center of Excellence in Bioinformatics and Life Sciences, March 19 ("Using Ontologies for Annotation of Genomic Data")

Apr 2008 Legal Theory Group, Baldy Center for Law and Social Policy, School of Law, University at Buffalo, April 23 ("Ontology of Law")

Central Intelligence Agency, Langley, VA, April 30 ("Sharing Data: Lessons from Biomedical Ontology")

Aug 2008 Division of Biomedical Informatics, Department of Clinical Science, University of Texas Southwestern Medical Center, Dallas, August 29 ("HL7 RIM: A Critical Survey")

Oct 2008 Center for Semiotic Studies, University of Aarhus, Denmark, October 7 ("Ontology (Science) vs. Ontology (Engineering)" and "Depicting Reality")

Feb 2009 Department of Philosophy, University at Buffalo, February 5 ("The Future of Ontology in Buffalo")

Mitre Corp., McLean, VA, February 10 ("Technical Briefing: UCore-Semantic Layer")

		Institute of Scientific and Industrial Research, Osaka University, February 24 ("Towards a Standard Upper-Level Ontology")
		National Center for Biomedical Ontology, Stanford University, March 24-25 ("NCBO: A Vision for the Future")
Apr	2009	Presentation to Leadership of Long Island Jewish North Shore Health System, New York State Center of Excellence in Bioinformatics and Life Sciences, April 24 ("The Gene Ontology and Beyond")
Feb	2010	Buffalo IGERT Colloquium, February 12 ("How to Build an Environment Ontology")
		Lecture to BCH 502: Genome Annotation – Halfon Honors Seminar, February 23 ("An Introduction to the Gene Ontology")
Mar	2010	Instituto de Seguridad Social del Estado de México y Municipios (ISSEMyM), Toluco, Mexico, March 23 ("Referent Tracking and the Electronic Health Record")
Apr	2010	Department of Philosophy and Swiss National Research Competence Center for Affective Sciences, University of Geneva, April 21 ("The Ontology of Collateralized Debt Obligations and the Metaphysics of the Current Economic Crisis")
May	2010	National Center for Biomedical Ontology, Stanford University, Stanford, CA, May 5 ("What developers need to know about ontologies")
Jun	2010	Intelligence and Information Warfare Directorate, Communications-Electronics Research, Development and Engineering Center (CERDEC), Fort Monmouth, NJ, June 3 ("Strategies for Developing Consistent Community of Interest Supported Data Extensions")
Jul	2010	CUBRC, Buffalo, July 14 ("Ontology in Buffalo: July 2010")
Sep	2010	South African Council of Scientific and Industrial Research (CSIR), Pretoria, September 15 ("Ontology: the why and how explained")
		Department of Computer Science and Engineering, University at Buffalo, September 30 ("Ontological Engineering")
Oct	2010	Department of Philosophy, Union College, Schenectady, NY, October 21 ("Towards an Ontology of Documents")
Jan	2011	Applied Ontology Group, University at Buffalo, January 17 ("Basic Formal Ontology (BFO) 2.0")
Mar	2011	Department of Philosophy, University at Buffalo, March 11 ("How to Publish a Philosophy Paper")
Aug	2011	University of California at Merced, Cognitive and Information Science, August 28 ("Environments Inside and Outside the Organism")
Sep	2011	Department of Philosophy, University at Buffalo, September 2 ("Defining Emotions")
		Space and Naval Warfare (SPAWAR) Systems Command, Systems Center Atlantic, Technical Brief, September 23 ("Semantic Technology and Its Practical Implications")
Mar	2012	Department of Orthopedics and Sports Medicine, University at Buffalo, March 6 ("Concussion ontology")
Sep	2012	University at Buffalo Philosophy Department Lunchtime Talks, September 14 ("Truthmakers for Time Series Graphs")
		Department of Computer Science, Brunel University, London, England, September 20 ("BFO and Disease")
		Buffalo Logic Colloquium, University at Buffalo, September 27 ("How to Do Things with Diagrams")
Oct	2012	Buffalo PANTC Colloquium, October 16 ("Discussion of 16 Days")
Nov	2012	UB Clinical/Research Ethics Seminar. Buffalo General Medical Center, November 20 ("Ethics, Informatics and Obamacare")
Jan	2013	National Center for Biomedical Ontology (NCBO) Webinar, January 16 ("HL7: An Ontologist's Guide")
		Institut für Geoinformatik, University of Münster, Germany, January 30 ("Massively Shared Social Agency")
Feb	2013	Intelligence and Information Warfare Directorate (I^2WD), US Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Aberdeen Proving Ground, MD, February 5 ("Distributed Common Ground System-Army Cloud Ontology")

Mar	2013	Cognitive Science Colloquium, University at Buffalo, March 20 ("On the Ontology of Massively Planned Social Actions")
May	2013	Air Force Research Laboratory (AFRL) Information Directorate, Rome, NY, May 8 ("Ontology and Information Integration")
Jun	2013	Center for Multisource Information Fusion, University at Buffalo, June 7 ("A Survey of Military Ontologies")
Jul	2013	Buffalo Ontology Group, July 23 ("How to Advance Reusability of Immunology Data")
Aug	2013	Immport Science Group, August 1, Stanford University ("How to make ImmPort data fit for secondary use")
		Center for Multisource Information Fusion, University at Buffalo and Pacific Northwest National Labs, August 28 ("The National Center for Ontological Research")
		Department of Philosophy, University at Buffalo, August 30 ("The Ontology of Aging and Death")
Sep	2013	Institut für Philosophie, University of Rostock, Germany, September 19 ("e-Human Beings: The Contribution of Internet Ranking Systems to the Development of Human Capital")
Oct	2013	Immport Science Group, Stanford University October 17, ("How to Enhance the Utility of Data in ImmPort")
Nov	2013	Clinical and Translational Science Ontology Affinity Group, November 12 ("Precoordination of Clinical Trial Data in the ImmPort Project")
Jan	2014	UB Clinical and Research Ethics Seminar, Clinical and Translational Science Center, Buffalo, January 21 ("Clinical Trial Data Wants to Be Free: Lessons from the ImmPort Immunology Data and Analysis Portal")
Feb	2014	Immport Science Group, Stanford University, February 27 ("Enhancing the Quality of ImmPort Data")
Mar	2014	Department of Computer Science and Engineering, University at Buffao, March 6 ("Ontology of Graphs")
		Department of Philosophy, University at Buffalo, March 14 ("Speech Acts, Economic Acts, and Poker")
May	2014	Department of Philosophy, University of Rijeka, Croatia, May 7 ("Document Acts and the Ontology of Social Reality") (Video)
		School of Advanced Studies, University of Rijeka, Croatia, May 8 ("Mind, Language and Emotions: From Austrian Philosophy to Contemporary Realist Ontology") (Video)
Jun	2014	Immport Science Group, Stanford University, June 27 ("The OBO Foundry Approach to Ontologies and Standards with Special Reference to Cytokines")
Oct	2014	Department of Mechanical and Aerospace Engineering, Syracuse University, October 3 ("An Introduction to Ontology for Engineers")
Dec	2014	Artificial Intelligence (AI) Center at SRI International, Menlo Park, CA, December 2 ("Towards an Ontology of Military Plans and Planning")
Mar	2015	UB Clinical and Research Ethics Seminar, University at Buffalo, School of Medicine and Biomedical Sciences, March 17 ("The Ontology of Aging")
Jun	2015	Leuven Social Ontology Reading Group, June 17 ("Commanding and Other Speech Acts", Slides)
Oct	2015	Buffalo Ontology Group, October 12 ("Towards an Ontology of Deontic Entities")
Nov	2015	Department of Biomedical Informatics Grand Rounds, University at Buffalo, November 25 ("Aboutness: Towards Foundations for the Information Artifact Ontology")
Dec	2015	Department of Computer Science and Engineering, University at Buffalo, Dec 3 ("Ontology in Buffalo: An Overview")
Mar	2016	Penn Bioinformatics Forum, University of Pennsylvania, March 23 ("The Glory and Misery of Electronic Health Records")
Apr	2016	Ontology Summit 2016: Semantic Integration – Health Sciences, April 7 ("An Ontology Ecosystem Approach to Electronic Health Record Interoperability", online presentation)
		Department of Philosophy, University at Buffalo, April 14 ("Jobs for Philosophers")

Sep	2016	Department of Mechanical and Aerospace Engineering, University at Buffalo, September 6 ("Ontology for Product Lifecycle Management")
		Air Force Research Lab (AFRL), Wright-Patterson AFB, Dayton, OH, September 12 ("AFRL Ontology")
Oct	2016	Capen Lecture, Department of Philosophy, University at Buffalo, October 4 ("The Future of the History of Philosophy") (Video)
		Brown Box Lecture, Department of Philosophy, October 7 ("The Ontology of the Organigram")
		Paderborn University, Germany, Lecture in the series "Economy/Technology/Gender", October 24 ("Digitale Umwelten")
Nov	2016	School of Oriental and African Studies, University of London, UK, November 9 ("The Ontology of Terrorism") (Video)
Dec	2016	Romanell Clinical and Research Ethics Lecture, School of Medicine, University at Buffalo, December 20 ("How the NIH Plans to Solve the Replication Crisis") (Video)
Jan	2017	School of Engineering, Swiss Federal Institute of Technology, Lausanne, January 31 ("Building Ontologies", Video: Part 1, Part 2)
Feb	2017	National Institute of Standards and Technology (NIST) Industry Ontology Foundry Working Group, February 17 ("BFO: An Overview", online presentation)
Mar	2017	ImmPort Science Group, University of California at San Francisco, March 9 ("The Replication Crisis – and How ImmPort Could Help")
		National Institute of Standards and Technology (NIST) Industry Ontology Foundry Working Group, March 17 ('Building Ontologies with BFO", online presentation)
		Jet Propulsion Laboratory, March 22 ("The Engineering Ontology Landscape", online presentation) (Video)
		Enterprise Data Modeling and Data Service Capability Coordination Working Group, Mitre Corporation, Maclean, VA, March 29, 2017
May	2017	Los Alamos National Laboratory, Los Alamos, NM, May 23 ("The Evolving Ontology Landscape")
Jun	2017	Japan Advanced Institute for Science and Technology, Kanazawa, Japan, June 16 ("What is the Difference between Goods and Services?")
		Keio University, Tokyo, Japan, June 21 ("Applied Ontology: A New Philosophical Discipline" and "Foundations of the Ontology of Law")
Sep	2017	Sustainable Manufacturing and Advanced Robotic Technologies (SMART) Conference, University at Buffalo. University at Buffalo, September 14 ('CHAMP: Coordinated Holistic Alignment of Manufacturing Processes")
		Department of Philosophy, Nankai University, Tianjin, China, September 25 ("What is a capability?")
		Institute of Basic Medical Sciences, Chinese Academy of Medical Sciences, Beijing, China, September 23 ("Molecules, Cells, Diseases, Networks")
Nov	2017	Ontology Group Meeting, University at Buffalo, November 20, 2017 ("Granularity and Capabilities from a BFO Perspective")
Feb	2018	Ontology Summit 2018 – Upper Ontologies for Specifying Context, February 7 ("How BFO Deals with Data from Multiple Contexts", Video)
		INCOSE / Rochester Engineering Society, February 15 ("Ontology for Systems Engineers" Video)
		Department of Philosophy, University at Buffalo, February 16 ("Is Terrorism a Crime", Video)
Mar	2018	Romanell Philosophy of Medicine and Bioethics Workshop, University at Buffalo, March 10, 2018 ("What do IQ tests measure?", Video)
		Department of Philosophy, University of Maryland, College Park, MD, March 28 ("The Ontology of Terrorism")
		DC-Maryland History and Philosophy of Biology Discussion Group, Washington, DC, March 29 ("Functions in Basic Formal Ontology")

Apr	2018	Kickoff Meeting for Naval Postgraduate School Research: Data Science Approaches to Analytic Workflows, Center for Multi-Source Information Fusion, Buffalo, April 11 ("Ontology Strategy")
		Department of Philosophy, University of Tampere, April 26 ("Introduction to Basic Formal Ontology")
Sep	2018	Romanell Center for Clinical Ethics and the Philosophy of Medicine, University at Buffalo, September 14 ("Disability: A Realist Approach")
		Grand Rounds, Department of Biomedical Informatics, University at Buffalo, September 25 ("Defining Disability")
		Department of Pharmaceutical Sciences, University at Buffalo, September 27 ("The Replication Crisis in Pharmaceutical Science" Video)
Nov	2018	Institut Jean Nicod, Ecole Normale Supérieure, Paris, November 16 ("Driverless Philosophy" (Video), "Driverless Cars")
Mar	2019	Data Science Approaches to Analytic Workflows, Final Report: Part 1 (online presentation), March 12.
Mar	2019	Romanell Center for Clinical Ethics and the Philosophy of Medicine, Buffalo, NY, March 2 ("In Defense of the Container Theory: A Contribution to the Metaphysics of Pregnancy", Video)
Apr	2019	Faculty of Communication Sciences, Università della Svizzera italiana, Lugano, Switzerland, April 10 ("Ontology of Language, Ontology of Terrorism, Ontology of Obligations", Video)
		Swiss Institute for Artificial Intelligence Research (IDSIA: Istituto Dalle Molle di Studi sull'Intelligenza Artificiale), Lugano, Switzerland, April 11 ("Ontology-Driven Automotive Repair Claims Management", with Jobst Landgrebe)
May	2019	School of Engineering, Swiss Federal Institute of Technology (EPFL), Lausanne, May 6 ("Ontology for Systems Engineering")
		Colloque de recherche, Institut de Philosophie, Université de Neuchâtel, Switzerland, May 7 ("Will World War III Be Fought on the Internet?" Video)
		Department of Philosophy, University of Geneva, May 9 ("Dialogue Beats the Turing Test")
		Romanell Center for Clinical Ethics and the Philosophy of Medicine, University at Buffalo, May 11 ("Normality")
		Cognition Data Framework Kick-Off Meeting, CUBRC, Buffalo, NY (May 13) ("Ontology Survey")
Aug	2019	Joint Artificial Intelligence Center (JAIC), Washington DC, August 16 ("Addressing Failures of Interoperability across the DoD and IC")
		Department of Business Administration, ITAM, Mexico City, August 22 ("AI: What it can do and what it cannot do for the business enterprise")
Oct	2019	Meeting of the Task Force for Intelligent Materials Standards, University at Buffalo, October 8-9 ("Current Status of Ontology Modelling"; "Ontologies for materials – BFO, IOF & EMMO")
		Ontology Working Group Meeting, Joint Artificial Intelligence Center (JAIC) and SAIC, Reston, VA, October 24 ("Current Ontology efforts in DoD and the IC and the way ahead for collaboration")
Feb	2020	Office of the Under Secretary of Defense for Acquisition and Sustainment, Pentagon, February 12 ("Ontology 101 Information Brief")
Apr	2020	Top-Down Working Group, Industrial Ontologies Foundry (IOF), April 24 ("Introduction to ISO/IEC 21838")
May	2020	Technical Oversight Board, Industrial Ontologies Foundry (IOF), May 29 ("What problem does BFO 2020 solve?", Video)
Jun	2020	Ontology Summit, National Institute of Standards and Technology (NIST), Gaithersburg, MD, June 3 ("ISO/IEC 21838", Video)
		Grand Rounds, Department of Biomedical Informatics, Jacobs School of Medicine and Biomedical Sciences, June 8 ("COVID-19 Ontology", Video (with John Beverley))
Jul	2020	Technical Oversight Board, Industrial Ontologies Foundry (IOF), July 3 ("How to do reasoning with Information Artifacts", Video; "BFO 2020 Temporalized Relations", Video)
Oct	2020	Romanell Center for Clinical Ethics and the Philosophy of Medicine, October 14 ("The

Impossibility of Digital Immortality", Video).

Department of Computer Science and Engineering, University at Buffalo, October 27 ("Complex Systems and the Limits of Stochastic Models" (with Jobst Landgrebe))

Digital Science Center and Department of Christian Philosophy, University of Innsbruck, October 30 ("The Impossibility of Digital Immortality")

Jan 2021 Navy Digital / Systems Engineering Transformation Brown Bag Series Kickoff Event, January 13 ("On Useful Ontologies")

Feb 2021 Additive Manufacturing Data Management Working Group (NIST and ASM), February 22 ("Building an Additive Manufacturing Ontology")

Colloquium of the Department of Philosophy, February 17, University at Buffalo ("Defining Intelligence", Video, with Jobs Landgrebe)

Department of Defense and Intelligence Community Ontology Working Group (JAIC DoD/IC Ontology WG), Joint Artificial Intelligence Center, Washington, DC, February 26 ("Ontology Training: Basic Formal Ontology")

Mar 2021 Society and Computing Club, University at Buffalo, March 13 ("The Limits of Artificial Intelligence")

Department of Philosophy, University of Georgia, March 18, ("Why Not Robot Police? On the Limits of Artificial Intelligence", video)

Workshop on AI and Human Values, Rochester, March 19 ("Why Machines Cannot Conduct Convincing Dialogues", with Jobst Landgrebe)

University at Buffalo Digital Scholarship Studio and Network, March 20 ("Ontology and Digital Humanities")

Oct 2021 Graduate Philosophy Association, University at Buffalo, October 5 ("Jobs for Philosophers")

Department of Philosophy, Union College, Schenectady, NY, October 26 ("Jobs for Philosophers", Video; and "The Meaning of Life", Video)

Nov 2021 Romanell Center for Clinical Ethics and the Philosophy of Medicine, University at Buffalo, November 5 ("Is Psychology Finished?", Video)

Department of Philosophy, University of Toronto, November 23 ("AI and the Ontology of Complex Systems", Video, with Jobst Landgrebe)

Jan 2022 West Point Philosophy Forum, United States Military Academy, January 25 ("Why Not Robot Cops?")

Apr 2022 Food and Drug Administration (FDA) Data Standards Advisory Board, April 15 ("BFO and the Role of Standards in Ontology", Video)

May 2022 Institute of Philosophy, University of Neuchâtel, Switzerland, May 19 ("The Ontology of Complex Systems")

Department of Architecture and Urban Studies, Milan Polytechnic, May 23 ("Shaping Space and Time", Video)

Sep 2022 Systems Engineering, Cornell University, Ithaca, NY, September 2 ("The Ontology of Complex Systems and the Limits of Artificial Intelligence")

UB Institute for Artificial Intelligence and Data Science (IAD) Distinguished Speakers Series, September 20 ("Why Machines Will Never Rule the World", with Jobst Landgrebe).

Nov 2022 Department of Defense and Intelligence Community Interest Group (DIOWG), Online meeting, November 4 ("The OUSD Question of All Questions", Slides, Video)

Office of the Undersecretary of Defense (OUSD), Online meeting, November 8 ("The Quantum Metascience Inititative Proof-of-Concept Project")

Air Force Research Lab, Online meeting, November 9 ("Modular Ontology Development to Support Mission Engineering")

Mar 2023 Dean's Speaker Series on Business Analytics, University at Buffalo School of Management, March 10 ("Why ChatGPT Will Never Rule the World", Slides)

Department of Philosophy, Université de Montréal, March 23 ("Realms of the A Priori: Law, Economics, and Mathematics")

Digital Society Initiative, University of Zurich, Switzerland, March 29 ("The Glory and the Misery

of ChatGPT", Video)

Apr 2023 The Ethics and Empirics of Engineering Humanity Speaker Series, Department of Law, Villa Nova University, Pennsylvania, April 3 ("AI Ethics and the Human Will", "ChatGPT Cracks Conversation")

May 2023 Department of Homeland Security Ontology Work Group Kickoff Meeting, May 4 (with John Beverley)

May 2023 Department of Architecture and Urban Studies, Milan Polytechnic University, May 15 ("Making Cities Smarter: The Limits of AI", Video)

Jul 2023 Buffalo Toronto Ontology Alliance (BoaT) Meeting, University of Toronto, July 14 ("AI and the future of ontology in the defense and intelligence domain")

Aug 2023 Fentanyl Ontology Working Meeting, Customs and Border Protection Buffalo HQ, August 1-4 ("Use cases for a Fentanyl Ontology")

Pop-Up Ontology Meeting, University at Buffalo, August 9 ("UB Ontology Overview")

Nov 2023 UB Ontology Meeting, University at Buffalo, November 27 ("Process Profiles")

Jan 2024 Institute of Informatics, Federal University of Rio Grande do Sul, Porto Alegre, Brazil, January 21-25 ("ChatGPT & Co. The Glory and the Misery", "The Information Artifact Ontology", "Functions, Capabilities and Dispositions")

PRESENTATIONS AT PROFESSIONAL MEETINGS AND SYMPOSIA

Jun 1975 Roman Ingarden Colloquium (organized on the 5th anniversary of his death, Department of Philosophy, Jagiellonian University, Cracow, June 14 ("Roman Ingarden and the Aesthetics of Mathematical Objects")

May 1977 Philosophy, Literature and Art, Balliol and St. Catherine's College, Oxford ("Ingarden and Literary Theory")

Jun 1977 Hegel and Husserl Workshop, University of Warwick ("Husserlian Phenomenology and the Principles of Methodological Individualism")

Aug 1977 Wittgenstein and His Impact on Contemporary Thought: 2nd International Wittgenstein Conference, Kirchberg am Wechsel, Austria ("Wittgenstein and the Background of Austrian Philosophy")

Aug 1978 Wittgenstein, the Vienna Circle, and Critical Rationalism: 3rd International Wittgenstein Conference, Kirchberg am Wechsel, Austria ("On Tractarian Law")

Sep 1978 Die Philosophie Franz Brentanos, Conference in Graz, sponsored by the Brentano Foundation

Apr 1979 The Theory of the Free Society, Liberty Fund Colloquium in St. Anne's College, Oxford

Jul 1979 Zweites Tübinger Wittgenstein Symposium, sponsored by the Fritz Thyssen Stiftung, Tübingen, July 1-6

Aug 1979 Language, Logic and Philosophy: 4th International Wittgenstein Conference, Kirchberg am Wechsel, Austria ("It")

Sep 1979 Kunst und Öffentlichkeit, Colloquium organised as part of the Steirische Herbst, Graz ("Kunst, Konkurrenz und Kapitalismus")

Apr 1980 Liberty and Tradition, Liberty Fund Colloquium in Oxford

Oct 1980 Österreichische und ungarische Philosophie, Colloquium sponsored by the Austrian Cultural Institute, Budapest, October 3-4 ("Austrian and Hungarian Philosophy: On the Logic of Wittgenstein and Pauler")

Apr 1981 Liberty and the Market, Liberty Fund Colloquium in Oxford

Jun 1981 Aesthetics and the Philosophy of Literature, Colloquium sponsored by the Nordic Council in Åland, Finland ("Phenomenological Foundations of Literary Theory")

Jul 1981 Joint Session of the Mind Association and the Aristotelian Society, Manchester ("Logic, Form and Matter")

Aug 1981 Language and Ontology: 6th International Wittgenstein Conference, Kirchberg am Wechsel, Austria ("Some Formal Moments of Truth")

Apr 1982 The Theory of the Free Society II, Liberty Fund Colloquium in Oxford, April 18-23 (as commentator)

Aug 1982 Epistemology and Philosophy of Science: 7th International Wittgenstein Conference, Kirchberg

		am Wechsel, Austria (“Acts and their Objects”)
		Ehrenfels-Konferenz, sponsored by the Niederösterreichische Landesregierung, Schloss Lichtenau, August 31-September 3 (“Mach und Ehrenfels: Zur Theorie der Abhängigkeit”)
May	1983	Intentionality, 5th International Colloquium of the Institut de Méthodologie, held in Bienne, Switzerland, May 5-8 (“Acta cum fundamentis in re”)
Jun	1983	Present Thinking about Parts and Wholes, Conference of the Swedish Committee for Future Oriented Research in Lund, Sweden, June 1-3 (“Logical and Philosophical Remarks on Parts and Wholes”)
Aug	1983	Aesthetics–Philosophy of Religion: 8th International Wittgenstein Conference, Kirchberg am Wechsel, Austria (“How not to talk about what does not exist”)
Dec	1983	Symposium Adolf Reinach, Conference organised by the Centrale Interfaculteit, Rijksuniversiteit Utrecht, Holland, December 9 (“Judgment and Belief: Some Reinachian Notes on Logic”)
May	1984	Methods for the Study of Cultural Objects, Conference organised by the Nordic Council in the University of Göteborg, Sweden, May 21-24 (“The Concept of Aesthetic Order”)
Jun	1984	The Descriptive Psychology of the Brentano School, International Conference organized in Trieste und Bologna by the Brentano-Foundation and by the Universities of Graz, Trieste und Bologna, June 13-15 (“The Substance of Brentano’s Ontology”)
		Foundations of Cognitive Psychology: The Work of Köhler, Selz and Lewin, Colloquium of the Werner Reimers-Stiftung held in Bad Homburg, Germany, June 8-20 (“On the Foundations of Gestalt Theory”)
Aug	1984	Philosophy of Mind–Philosophy of Psychology: 9th International Wittgenstein Conference, Kirchberg am Wechsel, Austria (“On the Structures of Perceptual Gestalten”)
Oct	1984	Vienne 1880–1938: Fin de Siècle et Modernité, Conference organised by the Centre Georges Pompidou and the Institut Autrichien in Paris, October 8-12 (“On the Modification of Feeling”)
Nov	1984	Essential Necessity, Conference organised by the International Academy for Philosophy, Dallas, Texas, November 9-10 (“Material A Priori Structures”)
		Sprachtheorie im Anschluss an Karl Bühler, Colloquium organised by the University of Essen and sponsored by the Deutsche Forschungsgemeinschaft, November 21-24 (“Materials Towards a History of Speech Act Theory”)
Dec	1984	Zur Philosophie und Sprachtheorie Anton Martys, Colloquium of the Fritz Thyssen Stiftung in the Université de Fribourg, Switzerland, December 7-9 (“Brentano and Marty: A Correspondence Theory of Intentionality”)
Apr	1985	Emozioni e sentimento nel pensiero filosofico contemporaneo, Symposium organised by the Commune di Bolzano, Italy and the University of Milan in Schloss Maretsch, Bolzano, April 12-13 (“Über Gefühle und Phantasiegefühle: Eine Betrachtung zur Ontologie der Kunsterfahrung”)
May	1985	Phénoménologie et Gestaltthéorie: Histoire et Actualité de l’Ontologie formelle, Conference organised by the Ecole des Hautes Etudes en Sciences Sociales, Paris, May 2-6 (“Boundaries and the Continuum”)
Aug	1985	Austrian Philosophy, Colloquium organised as part of the 10th International Wittgenstein Conference, Kirchberg am Wechsel, Austria (“A Theory of Austria”)
Sep	1985	The Habsburg Monarchy in Transition, 1890-1914, Conference organised by the Institute of Slavonic and East European Studies in the University of London, September 16-20 (“Theories of Austria”)
Oct	1985	Lukács und Österreich, Colloquium organised by the Hungarian Academy of Sciences and by the Österreichisches Kulturinstitut, Budapest, October 1-3 (“Bela Zalai und die Metaphysik des reinen Seins”)
		The Philosophy of Roman Ingarden, International Conference held in Cracow, Poland, October 25-27 (“The Ontology of Epistemology”)
		Beiträge zur österreichischen Philosophie, Colloquium organised by the Forschungsstelle und Dokumentationszentrum für österreichische Philosophie, Graz, October 28-29 (“Die Kreativität der österreichischen Philosophie: Einige Erklärungsversuche”)
Dec	1985	Linguaggio e società oggi, Colloquium organised by the University of Trieste and the Goethe Institut, Trieste, December 2-3 (“Die Substitutionstheorie der Kunst”)
		Symposium Alexander Pfänder, Conference organised by the Centrale Interfaculteit of the

Rijksuniversiteit, Utrecht, December 13 (“What is special about Munich Phenomenology?”)

Mar 1986 Interpretation, Human Agency and Economics, Conference organised by the Center for the Study of Market Process, Fairfax, Virginia (as commentator)

Sep 1986 Husserlian Perspectives on Cognition and Ontology, International Symposium organised by the Institute for the Philosophy of Language, University of Milan, in the Villa Feltrinelli, Gargnano, Lago di Garda, Italy, September 5-7 (“Indexicality and Categorial Grammar”)

The Vienna Circle and the Lemberg-Warsaw School, an International Symposium organised at Jablonna, Warsaw, by the Polish Academy of Sciences and the Austrian Institute in Warsaw, September 26-30 (“Vienna–Prague–Lemberg–Berlin”)

Nov 1986 100 Years of Polish Philosophy, an International Conference in the University of Manchester, 14-November 15 (“Kotarbinski on the Nature of Things”)

May 1987 The Object and Its Identity, International Conference in Bolzano and Trento, sponsored by the University of Trento and the Cultural Assessorat of Bolzano, Italy, May 27-30 (“An Overview of Brentanian Ontology”)

Nov 1987 La Critique de la raison en Europe centrale, Conference held in the University of Geneva, November 20-21 (“Kafka and Brentano” and “Critique de la raison économique”)

Mar 1988 The Philosophy of Edmund Husserl, Annual Conference of the British Society for Phenomenology in St Edmund Hall, Oxford, March 25-27 (“Husserl’s Idealism: The Grain of Truth”)

Apr 1988 The Descriptive Psychology of Franz Brentano, International Conference in the University of Würzburg, April 27-30 (“The Soul and Its Parts”)

Jun 1988 L’Ontologie formelle aujourd’hui, International Conference in the University of Geneva, June 3-5 (“Universals”)

Jul 1988 Theorie und Erfahrung in der neuen kognitiven Psychologie, International Conference of the Werner Reimers Stiftung, Bad Homburg, Germany, July 4-6 (“Die Bausteine des Psychischen: Versuch einer Kategorienlehre der Intentionalität”)

Aug 1988 Philosophy of the Natural Sciences, 13th International Ludwig Wittgenstein Conference in Kirchberg am Wechsel, Lower Austria (“Topology for Philosophers”)

Seminar Joachim Jungius, Organised as part of the 13th International Ludwig Wittgenstein Conference in Kirchberg am Wechsel, Lower Austria (“Logica Kirchbergensis”)

Sep 1988 Praxeology and the Philosophy of Economics, Conference organised by the Polish Academy of Sciences and the Austrian Institute in Warsaw, September 2-5 (“Austrian Philosophy and Austrian Economics”)

Rationalité et Objectivités. Nouvelles approches, Conference organised by the Centre Culturel International de Cerisy-la-Salle, Cerisy, Normandy, September 9-18 (“Aristotelian Robotics”)

Wo bin ich? Selbstbewusstsein, Selbstbestimmung und die Reflexivität der Kommunikation, Conference organised in the University of Freiburg im Breisgau, Germany (Commentator on H.-N. Castañeda)

Dec 1988 Symposium of the American Association for the Philosophical Study of Society at the Eastern Division meeting of American Philosophical Association. Commentator: E. Lepore, Chair: D. Davidson, December 29 (“Realism and the Correspondence Theory of Truth”)

Mar 1989 Hermeneutique et Nihilisme, Premier Congres Européen de Philosophy, Université Libre de Bruxelles, March 8-10 (“Sur l’impossibilité de traduire la philosophie allemande”)

Computer und Bildung. Praktische und theoretische Aspekte, Interdisciplinary Symposium of the International Academy for Philosophie, Schaan, Liechtenstein, March 31 (“Einführung zum Programm”)

Apr 1989 The Legacy of Carl Menger, International Conference in Duke University, Durham, NC, April 14-16 (“Ludwig von Mises and the Mengerian Legacy”)

Zur philosophischen Aktualität Heideggers, Symposium of the Alexander von Humboldt-Stiftung, Bonn-Bad Godesberg (“Über die Gründe für die Nichtübersetzbarkeit der deutschen Philosophie”)

May 1989 The Artist and His Work, Conference of the Nordic Society for Aesthetics in Helsinki, May 21-24 (“What are Works of Art Built For?”)

Aug 1989 Wittgenstein: Eine Neubewertung, 14th International Wittgenstein Symposium in Kirchberg am Wechsel, Austria (“Wittgensteinian Philosophy and the Culture of the Commentary”)

Sep	1989	Evolving Knowledge in Natural Science and Artificial Intelligence, Symposium of the British Society for the Philosophy of Science and of the Institution of Electrical Engineers, University of Reading, September 22-24 (“Naive Physics and Folk Psychology”)
Oct	1989	Die Gedankenwelt Sir Karl Poppers. Kritischer Rationalismus im Dialog, Conference of the Ludwig Boltzmann-Institut für neuere österreichische Geistesgeschichte, Schloß Hofen, Lochau (“Grundlegung eines fallibilistischen Apriorismus”)
Nov	1989	Gestalt Psychology: Its Origins, Foundations and Influence, An International Workshop of the Centro Fiorentino di Storia e Filosofia della Scienza, Florence (“Theories of the Commonsense World”)
Jan	1990	The Methodology of Carl Menger, Symposium in King’s College, London (“Austrian Aristotelianism: The Thought of Carl Menger”)
May	1990	Internationale Brentano-Konferenz. Conference organized by the Forschungsstelle und Dokumentationszentrum für Österreichische Philosophie, Graz (“Die neue Brentano-Forschung”)
Sep	1990	Cognitive Science in Finland, Conference organized by the Finnish Academy of Sciences at the Seili Island Research Institute in Finland (“On the Methodologies of Cognitive Science” and “On the Structures of the Common-Sense World”)
Oct	1991	Geisteswissenschaftliches und literarisches Übersetzen im internationalen Kulturaustausch, Symposium of the Alexander von Humboldt Stiftung, Sonthofen (“Über die Grenzen der Übersetzbarkeit: Eine philosophische Fallstudie”)
		T. G. Masaryk und die Brentano-Schule, International Symposium organized by the Czecho-slovak Academy of Sciences in Prague, October 15-17 (“From T. G. Masaryk to Václav Havel”)
Mar	1992	Philosophy and Political Change in Eastern Europe, Monist Colloquium sponsored by the Bradley and Soros Foundations in the Hungarian Academy of Sciences, Budapest (“The New European Philosophy”)
Apr	1992	Ansatz und Wirkung der philosophischen Psychologie Franz Brentanos, International Colloquium sponsored by the Universities of Würzburg and Trento at the Villa Vigoni, Loveno di Menaggio, Como (“Franz Brentano: Eine Zusammenfassung”)
May	1992	Weltanschauung, Ideologie und Philosophie. Kolloquium zu Ehren von Professor Joseph M. Bochenski, University of Freiburg, Switzerland (“Die wissenschaftliche Philosophie und ihre gegenwärtigen Herausforderungen”)
Jun	1992	Wie erkennt man Naturrecht?, Interdisciplinary Symposium at the International Academy for Philosophy, Schaan, Liechtenstein (“Philosophische Argumente gegen die Erkennbarkeit des Naturrechts”)
Feb	1993	European Philosophy and the American Academy, The Second Monist Colloquium, held at Wingspread, Wisconsin (“Commentary on Norris”)
Mar	1993	International Workshop on Formal Ontology in Conceptual Analysis and Knowledge Representation, National Research Council of Italy, Padua (“Ontology and the Logistic Analysis of Reality”)
Apr	1993	Ungarn und die Brentano-Schule: Zu einem Kapitel mitteleuropäischer Philosophie, Conference organized by the Institute of Philosophy of the Hungarian Academy of Sciences in collaboration with the Austrian Institute, Budapest (“Brentano, Mach and Hayek”)
		Hayek Memorial Conference, organized by the Department of Economics, University College, London in collaboration with the Goethe Institute and the Austrian Institute, London (“The Intellectual Order: A Study of Hayekian Psychology”)
Jun	1993	Internationales Symposium der Deutschen Hegel-Vereinigung, Stuttgart, (“Philosophieren und Kommentieren. Überlegungen zu ihrem Verhältnis”)
Nov	1993	The Legacy of Brentano, Conference organized by the Jagiellonian University, the International Cultural Centre and the Austrian General Consulate in Cracow (“Boundaries”)
		The Formal Ontology of Space, Conference organized by the National Research Council of Italy, Padua (“On the Coincidence of Boundaries”)
Dec	1993	The Sensory Order, Conference organized by the Scuola Superiore di Studi Universitari, Pisa, Italy (“Steps Towards a Cognitive Economics: Connectionism, Individualism and The Sensory Order”)
Feb	1994	Räume, 11th Hamburg Colloquium on Cognitive Science, Graduiertenkolleg

Kognitionswissenschaft, Universität Hamburg ("Kognitive Geographie")

Der Begriff des Sachverhalts zwischen Linguistik und Philosophie, Graduiertenkolleg Kognitionswissenschaft, Universität Hamburg ("Die Einheit der Sachverhalte")

Mar 1994 The Creighton Club. New York State Philosophical Association, 139th Meeting, Skaneateles, NY ("Zeno's Paradox for Colors")

Apr 1994 Philosophy and Westernization, Central European University, Prague ("Which Western Philosophy?")

May 1994 The Phenomenology of Values and Valuing, Center for Advanced Research in Phenomenology, Florida Atlantic University, Boca Raton, Florida ("The Background of Value Theory")

Jul 1994 Topological Foundations of Cognitive Science, Workshop organized as part of the First International Summer Institute in Cognitive Science, Buffalo ("Introduction: Topological Foundations of Cognitive Science")

Aug 1994 Parts and Wholes, Conceptual Part-Whole Relations and Formal Mereology, Workshop organized as part of the 11th European Conference on Artificial Intelligence, Amsterdam ("Fiat Objects")

The British Tradition in 20th Century Philosophy, 17th International Wittgenstein Symposium, Kirchberg am Wechsel ("The Vindication of Common Sense")

Formal Techniques in Ontology, Workshop organized by the Institut für Philosophie, Universität Konstanz ("The Joints of Reality: On the Typology of Demarcations")

Sep 1994 The Ontology and Epistemology of Relations, Conference organized by the Department of Philosophy, SUNY Buffalo ("Comment on McMahon")

Theories of Judgment: Assertion and Truth-Making, Leiden Seminar for the History and Philosophy of Logic and Semantics, University of Leiden, Holland ("The Grain of Truth")

Nov 1994 Austrian Philosophy: From Brentano to Haller, University of Arizona, Tucson ("The Neurath–Haller Thesis")

The Actuality of Gestalt Theory, International Conference of the University of Copenhagen, Denmark, November 24–27 (Plenary Lecture: "Cognitive Metaphysics"; Closing Speech: "Ehrenfels, Musil, Lakoff: On the Actuality of Gestalt Theory")

Dec 1994 Ecological Phenomenology, American Philosophical Association, Eastern Division, Boston ("Ethical Relativity and Husserl's Crisis: Commentary on Kohak")

Society for the Study of Husserl's Philosophy, American Philosophical Association, Eastern Division, Boston ("The Categorial Field")

Mar 1995 Phänomenologie und logischer Empirismus, Internationale Tagung aus Anlass des Zentenariums des österreichischen Philosophen, Mathematikers, Rechts- und Sozialwissenschaftlers Felix Kaufmann (1895-1949), Wien, Juridicum der Universität Wien ("Wien, Österreich und die Hauptströmungen der gegenwärtigen Philosophie")

Symposium on Ontology, American Philosophical Association, Pacific Division, San Francisco ("The Immaculate Replacement: Commentary on Ehring")

Society for the Study of Husserl's Philosophy, American Philosophical Association, Pacific Division, San Francisco ("The Ontology of Edmund Husserl")

May 1995 The Cultural Context of Electronic Networking, Kulturwissenschaftliches Institut, Essen ("Electronic Networking: The Market for Information")

Dziedzictwo Filozofii Analitycznej: Dorobek Szkoly Lwowsko Warszawskeij, University of Lublin (UMCS), Poland ("Why Polish Philosophy Does Not Exist")

Science et Philosophie en France et en Autriche de 1880 à 1930, CNRS and Austrian Institute, Paris ("The Geography of Convention")

Sep 1995 Conference on Spatial Information Theory (COSIT 1995), Semmering, Austria ("Performative Maps")

International Meinong-Conference, University of Graz ("More Things in Heaven and Earth")

Oct 1995 Actualité cognitive de la Phénoménologie: Les Défis de la Naturalisation, Université de Bordeaux III, France, October 19-21 ("Truth and the Visible Field")

Nov 1995 The Open Society After 50 Years, Centre for the Study of Nationalism, Central European University, Prague, November 8-10 ("The Open Society and Its New Enemies")

Dec 1995 Topology and Dynamics in Cognition and Perception, Centro Internationale di Studi Semiotici e

		Cognitivi, Università degli Studi, Repubblica di San Marino, December 11-13 (“Cognitive Geography”)
		Society for Philosophy and Geography, Session at the American Philosophical Association Eastern Division Meeting in New York City (“On Drawing Lines on a Map”)
Apr	1996	Kinds and Categories, The University of North Carolina at Greensboro Twentieth Annual Symposium in Philosophy, April 12-14 (“Categories, Deep and Superficial”)
		Inherent and Instrumental Value, 24th Conference on Value Inquiry, International Society for Value Inquiry. D’Youville College, Buffalo, NY, April 18-20 (“Blind Realism”)
		The Austrian Tradition in Logic: From Bolzano to the Vienna Circle, University of Texas at Austin and Austrian Cultural Institute, April 19-21 (“Austrian Philosophy and the Brentanian Tradition”)
		E Pluribus Unum, A Conference on Diversity, University at Buffalo, April 26-28 (“The Pedagogy of Pluralism”)
May	1996	Shadows, Holes, Blobs, Surfaces, and Other Entia Minora: A Workshop in Ontology, Columbia University, New York, May 19 (“The Metaphysics of Real Estate”)
Aug	1996	Current Issues in Political Philosophy: Justice and Welfare in Society and World Order, 19th International Wittgenstein Symposium Kirchberg am Wechsel, Austria, August 11-18 (“The Cognitive Geometry of War”)
Sep	1996	Can Epistemology be Unified? Marvin Farber Conference, University at Buffalo, September 26-28 (“Commentary on L. Hankinson Nelson”)
Oct	1996	The Austrian Tradition: From Bolzano to the Vienna Circle. Symposium II, University of Texas at Austin and Austrian Cultural Institute, October 4-6 (“Husserl and Ontology”)
Nov	1996	Formal Models of the Common-Sense World, Initiative 21 Conference of the National Center for Geographic Information and Analysis, San Marcos, Texas (“The Formal Ontology of Common Sense”)
		The Metaphysics of Real Estate: Comparative (Cross-Cultural) Ontologies for Cadastral Systems, Department of Geoinformation, Technical University, Vienna, Austria, November 25-26 (“Ontology, Epistemology and the Parceling of Space”)
Dec	1996	The Intellectual Legacy of the Austro-Hungarian Monarchy, István Széchenyi College for Advanced Studies of the Budapest University of Economics, Budapest, December 12-15 (“Philosophy in Austria-Hungary from Bolzano to Hayek”)
Mar	1997	Society for Philosophy and Geography, Session at the American Philosophical Association Pacific Division Meeting (“Prolegomena to a Metaphysics of Real Estate”)
		American Philosophical Association Pacific Division Meeting, Invited Paper (“From Cognitive Linguistics to Cognitive Metaphysics”) (Reply by Dallas Willard)
Apr	1997	Austrian Scholars Conference, Ludwig von Mises Institute, Auburn University, Auburn, Alabama April 4-5 (“The Political Economy of Geography”)
		History of the Concepts of Space, Workshop sponsored by the Department of Philosophy, the Center for Cognitive Science, and the National Center for Geographic Information and Analysis of the University at Buffalo, April 18-19 (“The State as Work of Art: Theories of Space in Baroque Philosophy”)
		Academic Freedom in Perspective, A Conference at Canisius College, April 25-26 (“Academic Freedom and Academic Responsibility”)
		Annual Conference of the Society for Academic Freedom and Scholarship, University of Toronto (Keynote Speech: “The Open Society and Its New Multiculturalist Enemies”)
May	1997	Les Revues parlées, Centre Pompidou, Paris, May 22 (“Jargon philosophique ou Langage technique?”)
Sep	1997	La Philosophie autrichienne, Conference of the Centre Culturel International de Cerisy, Cerisy-la-Salle, France, September 3-10 (“Les Objets sociaux”)
Oct	1997	Postmodernism and the Sokal Affair, International Conference sponsored by the Department of Physics, University of Helsinki, October 1-2 (Debate with Alan Sokal)
		Conference on Spatial Information Theory (COSIT 1997), University of Pittsburgh, October 15-19 (“Fiat and Bona Fide Boundaries”, with Achille Varzi)
		Annual Assembly, National Center for Geographic Information and Analysis, Buffalo (“Formal Ontology of Geographic Objects”, with Achille Varzi)

		The Origins of Property, Conference organized in the Department of Philosophy, University at Buffalo ("Property and Sovereignty")
		Teaching Development Forum, University at Buffalo, October 20 ("On Teaching with a Debate Format")
		Geographic Information Systems and Political Redistricting: Social Groups, Representational Values, and Electoral Boundaries, Conference of the National Center for Geographic Information and Analysis, University at Buffalo, October 24-26 ("Bizarre Shapes")
Feb	1998	Cognition and Ontology, Zentrum für interdisziplinäre Forschung, Universität Bielefeld, February 23-26 ("Small Worlds: The Ecology of Cognition")
Apr	1998	A Symposium on Truth and Truth-Makers, University at Buffalo, April 11 ("Interesting Truth-Makers")
Jun	1998	International Conference on Formal Ontology in Information Systems (FOIS), Trento, sponsored by the Italian National Research Council, June 6-8 ("The Basic Tools of Formal Ontology" (Opening Keynote Address); "Ontological Tools for Geographic Representation" (with Roberto Casati and Achille Varzi))
		Ontology of Fields. Research Meeting of the NSF Varenius Initiative, Bar Harbor, Maine, June 10-13 ("Basic Tools of Ontology")
Jul	1998	Australasian Association of Philosophy, Annual Conference, Sydney, July 12-17 ("Truthmaker Realism")
Aug	1998	Panel on the Philosophy of John Searle, World Congress of Philosophy, Boston ("Real Estate as Institutional Fact", with response by Professor Searle)
		Symposium on Technology and Communication, World Congress of Philosophy, Boston (Invited Talk: "The Genres of Philosophy")
Sep	1998	The World in Perspective, conference honoring the 90th birthday of Lewis H. Hahn, Southern Illinois University, Carbondale, IL, September 25-26 ("Context, Ontology and Perception")
		Carl Stumpf: Internationale Interdisplinäre Fachkonferenz, University of Würzburg, September 30–October 3 ("From Stumpf to Iowa")
Oct	1998	The Self and the Other. International Conference of the Nordic Association for Semiotics, Oslo, October 29-31 (Plenary lecture: "The Cognitive Geometry of War")
Nov	1998	Spontaneous Orders: Austrian Economics, Philosophy, and Aesthetics, International Conference sponsored by the University of Copenhagen and the Carlsberg Academy, Copenhagen, Denmark, November 2-3 (Two plenary lectures: "The Ontology of Social Reality – From Carl Menger to John Searle" and "The Ecology of Social Reality – From Aristotle to Roger Barker")
		Center for Law and Ontology: A Symposium, University at Buffalo, November 20 ("Towards a Center for Law and Ontology")
Jan	1999	Bridging the Analytic-Continental Divide, Tel Aviv University, January 17-20 ("A Theory of Divides")
Feb	1999	Annual Meeting of the Husserl Circle, University of Memphis ("Husserlian Ecology")
Mar	1999	Philosophical Realism and the Central European Tradition, Fourth Matchette Foundation Symposium, University of Texas at Austin, March 26-29 ("Truth and Truthmaking", Symposium with David Armstrong)
Apr	1999	Annual Conference of the National Association of Scholars, Chicago ("The Construction of Social Reality", Debate with John R. Searle)
May	1999	Nature de l'expérience perceptive, CREA, Paris, May 28-29 ("Ecology", with Roberto Casati)
Aug	1999	Current Issues in Political Philosophy. 19th International Wittgenstein Conference, Kirchberg am Wechsel, Austria, August 15-21 ("Surrounding Space: Principles of Topological Ecology")
		International Congress of Logic, Methodology and Philosophy of Science, Cracow, August 20-26 ("Mereology, Topology, Ecology: A Formal Theory of Organism-Niche Relations")
		COSIT 1999–Conference on Spatial Information Theory, Hamburg, Germany, August 26-29 ("Agglomerations" and "Ontology and Geographic Objects: An Empirical Study of Cognitive Categorization" (with David M. Mark and Barbara Tversky))
Oct	1999	The Last Days of the Human Race: Karl Kraus Symposium, University at Buffalo, October 16 ("Kraus and Serbia, Kraus and Weininger, Kraus and Women")

Nov 1999 The Metaphysics of Consciousness: David Chalmers' *The Conscious Mind* in Historical and Contemporary Perspective, University at Buffalo, November 5-6 ("The Environment of Mind")

Dec 1999 Analytic Philosophy at the Turn of the Millennium, University of Santiago de Compostella, December 1-4 ("On Analytic and Continental Philosophy: A Case Study in the Ontology of Ideas and Institutions")

La Structure du Monde: objets, propriétés, états du choses, Colloque international de Philosophie de Grenoble, December 9-13 ("The Geography of Reality")

Mar 2000 Brain Death and Human Identity, Symposium, University of Hamburg ("Ontology and Identity")

Apr 2000 American Philosophical Association Pacific Division Meeting, Albuquerque, Invited Paper ("Truth in the Logical Investigations")

Committee on International Cooperation, American Philosophical Association Pacific Division Meeting, Albuquerque, Invited Panel Session on Philosophy and the Internet ("On Philosophy on the Internet")

Society for the Study of Husserl's Philosophy, American Philosophical Association Pacific Division Meeting, Albuquerque ("Formal Ontology in the Logical Investigations")

Society for Philosophy and Geography, American Philosophical Association Pacific Division Meeting, Albuquerque ("On Setting into Relief: The Ontology and Cognition of Space")

May 2000 Writing the Austrian Traditions: A Conference on the Relations between Austrian Philosophy and Literature, University of Toronto ("Meinong and the Phantasy-Machine")

Husserl's *Logische Untersuchungen*–A Centenary Conference, University of Copenhagen ("Grids")

Kataster Symposium, Institut für Geoinformation und Landesvermessung, Technische Universität, Vienna ("Wie man eine Welt schafft: Eine Einführung in die Ontologie des Katasters")

Jun 2000 Ontologische Aspekte der Wissensrepräsentation, University of Leipzig ("Ontologie für Informatiker")

Philosophie und Wissenschaft, University of Koblenz ("Kant, Husserl und die Physik")

Aug 2000 Rationality and Irrationality. 23rd International Wittgenstein Conference, Kirchberg, Austria ("The Chinese Rune Argument")

Sep 2000 Geographical Domain and Geographical Information Systems: Euro-Conference on Ontology and Epistemology for Spatial Data Standards, Sponsored by the European Commission, La Londe-les-Meures, September 22-27 (France), (Two Plenary Lectures: "Partitions" and "Mont Blanc, Lake Constance, Sakhalin Island: Gaps, Gluts and Vagueness")

Oct 2000 GIScience 2000: First International Conference on Geographic Information Science, Savannah, Georgia, October 28 (Opening Plenary Lecture: "Ontological Imperialism")

Feb 2001 Die Philosophie und die Wissenschaften: Beckers Überlegungen zur Begründung der Mathematik, Fernuniversität Hagen, February 2 ("Was heisst mathematische Existenz"?)

Ontologische Aspekte der Wissensmodellierung. Workshop des Graduiertenkollegs Wissens-repräsentation, Universität Leipzig, February 12-13 ("Eine Lehre von Aufteilungen" and "Referenz als Projektion")

Mar 2001 The Metaphysical Society of America Annual Meeting, University at Buffalo. Categories, March 9-11 ("Carving up Reality: A Theory of Categories")

Austrian Law and Economics: The Contributions of Adolf Reinach and Murray N. RothbardV, Ludwig von Mises Institute, Auburn, Alabama ("The *A Priori* Ontology of Social Reality")

Austrian Scholars Conference, Ludwig von Mises Institute, Auburn, Alabama ("Searle's New Theory of Social Objects")

May 2001 Les Recherches Logiques d'Edmund Husserl: Origines et Posterite de la Phenomenologie, Université du Québec à Montréal and McGill University, May 28-30 ("Intentionality as Projection")

Jun 2001 Ontological Foundations for Geographic Information Science, Summer Assembly of the University Consortium for Geographic Information Science (UCGIS), Buffalo ("Ontology Good and Bad")

Jul 2001 The I in Geographic Information Science, Meeting on Fundamental Questions in GIScience organized by Keele University, Manchester ("A General Theory of Spatial and Non-Spatial

Partitions")

Aug 2001 Wittgenstein and the Future of Philosophy: A Reassessment after 50 Years, 24th International Wittgenstein Conference, Kirchberg, Austria ("The Grain of Truth")

Sep 2001 Spatial Information Theory: Foundations of Geographic Information Science, COSIT 2001, Morro Bay, California, September 20-23 ("True Grid", "A Taxonomy of Granular Partitions" (with Thomas Bittner), "Features, Objects, and Other Things: Ontological Distinctions in the Geographic Domain" (with David Mark and André Skupin)

The Philosophy of a Free Society, Ludwig von Mises Institute, Auburn, Alabama, September 28-29 ("Capitalism and the Meaning of Life")

Oct 2001 Formal Ontology and Information Systems (FOIS): Second International Conference, Ogunquit, Maine ("Granular Partitions and Vagueness" (with Thomas Bittner), "GOL–A General Ontological Language" (with Wolfgang Degen, Barbara Heller and Heinrich Herre)

International Conference on Culture and Space, Quebec, Canada, October 19-20 ("Language, Maps and Other Cultural Artefacts")

Nov 2001 European Union COST Action G9 on Modeling Real-Property Transactions, University of Bremen, Germany ("The Metaphysics of Real Estate and the Cadastre")

Assessing Analytic Philosophy: Twentieth Century Analytic Philosophy in Retrospect 1900–2000, University at Buffalo, November 9-10 ("Response and Further Issues in Continental Analytic Philosophy")

Dec 2001 New York Association of Scholars, New York, December 2 ("Academic Standards and the Meaning of Life")

Apr 2002 Ontological Spring, Introductory Workshop in Ontology, Naumburg, Germany (Four talks: "What is Ontology", "Tools of Ontology: Parts, Wholes and Universals", "Partitions of Reality", "Ontology in Information Science: Its Glory and Its Misery")

May 2002 Higher Education and Democracy in Peace and War. Tenth National Conference of the National Association of Scholars, Washington DC, March 31–June 2 ("After Relativism, What?")

Jun 2002 Opening Lecture, Alexander von Humboldt Conference of Philosophers, Berlin, 19–20 June ("How to Test a Philosophical Theory Empirically")

Physik, Information und Informationssysteme. Symposium of the Arnold-Sommerfeld-Gesellschaft and the University Leipzig, June 20-21 ("Quantentheorie–Kein Trost für Kantianer")

Jul 2002 Between Data Science and Everyday Web Practice. Annual Conference of the Gesellschaft für Klassifikation, Universität Mannheim ("The Theory of Granular Partitions: A New Paradigm for Ontology")

Aug 2002 Persons–An Interdisciplinary Approach, 25th International Wittgenstein Conference, Kirchberg, Austria, August 11-17 ("The Moral Significance of the Question When a Human Being Begins to Exist" and "The Metaphysics of Human Origins" (both with Daniel Cohnitz))

MIE2002: 17th International Congress of the European Federation for Medical Informatics, Budapest, August 25-29 ("Understanding the Message: Linking Aristotelian Realism to Linguistic Functionalism", keynote lecture, co-authored with Werner Ceusters)

Oct 2002 Ontologie Analitiche, Centro Interuniversitario di Ontologia Teorica e Applicata, Dipartimento di Filosofia, Università di Torino, October 24-26 ("The True™ Story")

Nov 2002 Action-Oriented Approaches in Geographic Information Science, University of Maine, November 2-4 (Barry Smith and Pierre Grenon, "Ontology for Dynamic Entities")

Formal Concepts, University of Geneva, November 22-25 ("The Cornucopia of Formal Relations")

A New Research Agenda for Philosophy, Hungarian Academy of Sciences, November 29-30 ("The World as Database")

Jan 2003 Properties, Modalities, and States of Affairs, University of Konstanz, January 24-25 ("Against Fantology: The Case of Properties")

Feb 2003 Towards Intelligent Dictionaries? Seminar on Multilingual Terminography, Department of Applied Linguistics, Erasmus University, Brussels (Werner Ceusters and Barry Smith, "Ontology for Multilingual Terminography")

Apr 2003 The Mystery of Capital and the Construction of Social Reality, University at Buffalo ("Searle and de Soto: The New Ontology of the Social World")

		Colloquium on Knowledge Management, Department of Language and Speech, Nijmegen University (Werner Ceusters and Barry Smith, "A Realist Ontology for Natural Language Understanding")
		Ontologia della proprietà intellettuale, Centro Interuniversitario di Ontologia Teorica e Applicata, Dipartimento di Filosofia, Università di Torino ("How to Rent a Car, and Why You Can't Rent a Person")
		6th AGILE Conference on GIScience (Annual Conference of the Association of Geographic Information Laboratories), Lyon, France, April 24-26 (David M. Mark, Andrew Turk, Barry Smith, Werner Kuhn: "Ontology, Semantics, Natural Language, and Information Systems: Methodological Implications of Cross-Linguistic Studies of Geographic Terms")
May	2003	MIE 2003 (18th International Congress of the European Federation for Medical Information), St Malo, France (Opening Plenary Lecture: "Ontology, the Semantic Web, and the Unification of Medical Knowledge"), May 4-7, 2003.
		MIE 2003 (18th International Congress of the European Federation for Medical Information), St Malo, France (Werner Ceusters, Ignace Desimpel, Barry Smith, Stefan Schulz, "Using Cross-Lingual Information to Cope with Underspecification in Formal Ontologies")
		MIE 2003 (18th International Congress of the European Federation for Medical Information), St Malo, France (Werner Ceusters and Barry Smith, Workshop on Ontology for the Medical Domain)
		TEPR (Toward an Electronic Patient Record) 2003: Electronic Patient Management, 19th Annual Conference of the Medical Records Institute, San Antonio, Texas (Werner Ceusters and Barry Smith, "Ontology and Medical Terminology: Why Description Logics are not Enough", read by Werner Ceusters)
		Mobile Communication, 5th Annual Conference of the Society for Phenomenology and Media, Helsinki ("The Ecological Approach to Mobile Communication")
		Semantic Ontology–Ontological Semantics, University of Leipzig ("Ontology: Generalizing Davidsonian Semantics")
		Searle and the Ontology of Civilization, Center for Theoretical Studies, Charles University, Prague, Czech Republic ("On Free-Standing Y-Terms", Audio)
Jun	2003	Wissenschaftstheorie in Ökonomie und Wirtschaftsinformatik, University of Koblenz ("Vertrag. Vertrauen und Verbindlichkeit: Die Ontologie der menschlichen Interaktion")
		Workshop on Medical Ontology, Division of Medical Informatics, University of Geneva, June 27 ("Problems of Medical Ontology")
Aug	2003	International Congress on Logic, Methodology and Philosophy of Science, Oviedo, Spain ("Cognitive Science and Biomedical Informatics: From the Gene Ontology to the Unified Medical Language System")
		Symposium on Integrative BioInformatics, University of Bielefeld, August 4-5 ("Ontology assisted database integration", paper read by Jean-Luc Verschelde)
Sep	2003	International Spatial Cognition Summer Institute (ISCSI), Bad Zwischenahn, Germany (Tutorial and Workshop on "Ontology, Space and Language", with John Bateman)
		KI 2003: Annual Conference of the German Artificial Intelligence Society, Hamburg, Germany ("The Unified Medical Language System and the Gene Ontology" (with Anand Kumar))
		Reference Ontology and Application Ontology, Workship at KI 2003: Annual Conference of the German Artificial Intelligence Society, Hamburg, Germany ("Reference Ontology, Application Ontology, Terminology Ontology")
		Conference on Spatial Information Theory (COSIT 2003), Ittingen, Switzerland ("Layers: A New Approach to Locating Objects in Space" (with Maureen Donnelly))
Oct	2003	Workshop on Ontologies in Medicine, CNR-ISTC and Laboratory for Applied Ontology Rome, October 8-9, 2003 ("Parts and Classes in Biomedical Ontology")
Nov	2003	Third International Meeting for Husserl Studies, Kyoto University ("Husserlian Ecology")
Jan	2004	Inaugural Meeting of the European Union Network of Excellence in Medical Informatics and Semantic Datamining, Linköpping ("Challenges to Biomedical Ontology")
Mar	2004	International Workshop on Data Integration in the Life Sciences (DILS 2004), Leipzig ("On the Application of Formal Principles to Life Science Data: A Case Study in the Gene Ontology")
Apr	2004	International Joint Meeting of the European Centre for Medical Informatics, Statistics and

Epidemiology (EuroMISE 2004), Prague ("A General Framework for Implementation of Clinical Guidelines by Healthcare Organizations")

May 2004 The Formal Architecture of the Gene Ontology, Leipzig, May 28–29 ("Smart Terminologies through Ontological Principles (STOP!)")

Jun 2004 First International Workshop on Formal Biomedical Knowledge Representation (KR-MED 2004), Whistler, Canada ("Investigating Subsumption in DL-based Terminologies: A Case Study in SNOMED-CT")

International Workshop on Holistic Epistemology and Action Theory, University of Leipzig ("Searle and De Soto – The New Ontology of the Social World")

Jul 2004 Husserl and the Historical Epistemology of the Sciences, Max Planck Institute for the History of Science, Berlin ("Formal Ontology and Biomedical Informatics: Aristotle, Darwin, Husserl")

Tutorial in Ontology, Summer School of European Union Network of Excellence in Medical Informatics and Semantic Datamining, Balatonfüred, Hungary, July 4-6 ("Foundations of Ontology")

Ontology Workshop, Summer School of the European Union Network of Excellence in Medical Informatics and Semantic Datamining, Balatonfüred, Hungary ("Anatomy and Time")

Seventh Annual Bio-Ontologies Workshop, International Conference on Intelligent Systems for Molecular Biology, Glasgow ("Ontology and Biology")

Aug 2004 Analysis and Experience. 27th International Wittgenstein Conference, Kirchberg, Austria ("Forms of Life", Plenary Lecture; "Against Predicate Logic")

Coling: The 20th International Conference on Computational Linguistics, University of Geneva, Switzerland ("The Unbearable Lightness of Biomedical Informatics", Keynote Lecture)

Computerm 2004–3rd International Workshop on Computational Terminology, Geneva, Switzerland ("Dependence Relationships between Gene Ontology Terms based on TIGR Gene Product Annotations", with Anand Kumar and Christian Borgelt)

Sep 2004 Medinfo 2004, 7-11 September, San Francisco ("The Role of Foundational Relations in the Alignment of Biomedical Ontologies"; "Ontology-Based Error Detection in SNOMED-CT"; "Foundational Issues in Medical Ontology"; "Aspects of Ontology Creation")

Logic, Ontology, Aesthetics: The Golden Age of Polish Philosophy, Université de Quebec à Montréal and Concordia University, September 23-26 ("Biomereology: From Formal Ontology to Biomedical Ontology")

GMDS Innsbruck ("Biomedizinische Ontologie in Saarbrücken", "Ontologie-basierte Qualitätssicherung medizinischer Terminologien", "Normalizing Medical Ontologies using Basic Formal Ontology")

Nov 2004 Formal Ontology and Information Systems (FOIS), Turin, Italy, November 3-6 ("Beyond Concepts", "Individuals, Universals and Collections", "The Ontology-Epistemology Divide", "A Formal Theory of Substances, Qualities, and Universals")

Conference: Medicine and Metaphysics, University at Buffalo, November 13-14 ("Formal Ontology and Biomedical Informatics")

Applied Ontology Colloquium, Ontology Works Incorporated, Odenton, MD, November 16 ("From Knowledge Representation to Reality Representation")

Ontology: Interoperability of Patient Records and Biomedical Informatics, Belgian Ministry of Health and European Commission, Brussels, November 25 ("The Future of Clinical Bioinformatics: Overcoming Obstacles to Information Integration")

Interdisciplinary Ontology Forum in Japan, Keio University, Tokyo, November 29–30 ("Ontology and Its Applications", keynote lecture, lecture on relations)

Dec 2004 Truthmakers: Twenty Years After, Université Paul Cezanne, Aix-en-Provence, France, December 9-11 ("True Stories", with Jonathan Simon)

Author Meets Critics Session on Harry Heft, *Ecological Psychology in Context*, American Philosophical Association Eastern Division Annual Conference, Boston, December 27-30 ("The Hole Story")

Jan 2005 The Theory of European Unification, Europa Institute, University of Saarbrücken, Germany, January 18 ("The Ontology of Unification")

Aspects of Mereotopology and Granularity in Bioontologies, University of Freiburg, Germany, January 21-22 ("Relations in Biological Ontologies")

Apr	2005	The Future of the UMLS Semantic Network. Workshop of the National Library of Medicine, National Institutes of Health, Bethesda MD, April 7-8, 2005 ("Semantic Network vs. Biomedical Ontology")
		Mapping the Human Body, National Center for Ontological Research, Buffalo April 16–17 ("Wounded Knees")
		Ontologies and Biomedical Informatics, Conference of the International Medical Informatics Association, Rome, April 29–May 2 ("New Desiderata for Biomedical Terminologies")
May	2005	Forum Engelberg, Luzern, Switzerland, May 21–24 ("Language and the Future of Biomedicine")
		Ontology of Personal Memory, German Research Center for Artificial Intelligence, Saarbrücken ("The Ontologically Privileged Status of the Past": keynote address)
		Universität am Schlossplatz, Volkshochschule Saarbrücken, May 29 ("Aristoteles und die Medizininformatik")
Jun	2005	E-CAP (European Computing and Philosophy), Mälardalen, Sweden, June 2–4 (Carl Linnaeus Lecture, "Biological Ontologies")
		Bio-Ontologies Workshop, Intelligent Systems for Molecular Biology (ISMB 2005), Detroit, June 24 ("On the Proper Treatment of Pathologies in Biomedical Ontologies")
Jul	2005	European Centre for Ontological Research, Inaugural Meeting, Saarland University, Saarbrücken, July 27-28 ("Africa!")
Aug	2005	Medical Informatics Europe, Geneva, August 24-30 ("Wüsteria", "The Significance of SNODENT", "Tracking Referents in Electronic Healthcare Records")
Sep	2005	Conference on Spatial Information Theory, Ellicottville NY, September 15–17 ("Anatomical Information Science")
		Knowledge-Based Bioinformatics Workshop, FungalWeb, Montreal, September 21–23 ("Biomedical Ontologies: The Good, the Bad and the Ugly")
Oct	2005	Ontology and Taxonomy Coordinating Work Group Meeting, Mitre Corp., McLean, Virginia, October 5 ("The National Center for Ontological Research")
		Ontolog Forum, October 13 ("How to Do Things with Paper: The Ontology of Documents and the Technologies of Identification" (Slides, Audio)
		American Medical Informatics Association Annual Conference, Washington DC, October 22–26 ("An Ontology-Based Methodology for the Migration of Biomedical Terminologies to Electronic Health Records", "Resolving ambiguities in current uses of the term 'concept'", "How to Distinguish Parthood from Location in Bioontologies" (with Stefan Schulz *et al*.), "A Strategy for Improving and Integrating Biomedical Ontologies" (with Cornelius Rosse *et al*.), "Ontology: The New Era" (Invited panel presentation)).
		Inaugural Conference of the National Center for Ontological Research, University at Buffalo, October 27 ("The National Center for Ontological Research", Video)
		Bio-Ontologies: Workshop of the Buffalo Center for Ontological Research, October 28 ("Symposium on the Gene Ontology" (with David Hill))
Nov	2005	Hegeler-Carus Foundation, La Salle, Illinois, November 4-6 ("*The Monist*, Monism, and the Future of Philosophy")
		Ontolog Forum Panel on eGovernment-Related Ontology – Differentiation and Synergy, November 10 ("Five Steps to Interoperability")
Dec	2005	Quantities, Numbers, and Parts, Workshop of the Institute for Formal Ontology and Medical Information Science, Saarbrücken, December 1–2 ("The Ontology of Measurement")
		Naturalisierung des Menschen, Humboldt-University, Berlin, December 2–4 ("Ontologie des menschlichen Körpers als Organismus")
Feb	2006	Fourth Semantic Interoperability for E-Government Conference, Mitre, McLean VA, February 9–10 ("HL7 RIM")
		Functional Genomics Investigation Ontology (FuGO) Workshop, University of Pennsylvania, February 13–15 ("How to Build an Ontology").
Mar	2006	Biomedical Informatics Research Network (BIRN) Ontology Workshop, National Center for Biomedical Ontology, Stanford University, March 1 ("Tutorial: Critical Review of BIRN Ontologies")
		Japanese Ontology Forum, Second Conference, March 10–11 (Keynote Speech: "How to Build

an Ontology")

Japanese Artificial Intelligence Society Annual Conference, March 10 ("Forming JCOR")

Upper Ontology Summit, National Institute of Standards and Technology, Gaithersburg MD, March 14–15 ("Basic Formal Ontology")

Philosophical Aspects of Quantum Mechanics, Workshop of the Institute for Formal Ontology and Medical Information Science and the Department of Philosophy, Saarland University, March 15 ("Quantum Mechanics and Realism")

Naturalisierung des Menschen, Humboldt-University, Berlin, March 17–19 ("Definitionen der Gesundheit")

Ontology Workshop: Focus on Immunity, National Institute of Allergy and Infectious Disease, National Institutes of Health, Bethesda MD, March 21–22 ("Biomedical Ontologies: An Overview")

Image Ontology Workshop, National Center for Biomedical Ontology, Stanford University, March 23–24 ("Principles of Ontology Design")

St. Croix, Gene Ontology Consortium Annual Meeting, 30 March–April 2 (Invited Tutorial: "Principles of Biomedical Ontology Design")

May 2006 Philosophy and Informatics Conference, German Informatics Society, Saarbrücken, 3–4 May (Keynote Lecture: "Ontology and the Future of Biomedical Research")

NCBO/OBO Consortium Workshop on PATO: The Phenotype Ontology, 17–20 May ("Towards a Single Hierarchy Phenotype Ontology")

Jun 2006 Workshop on Multi-Lingual Semantic Annotation: Theory and Applications, Saarland University, Saarbrücken, Germany, June 26-27 ("Pax Terminologica")

Jul 2006 Naturalisierung des Menschen, Humboldt-University, Berlin, July 13-14, 2006 ("Ontologie des menschlichen Lebewesens: Substanz und Funktion")

Milanesiana, Teatro del Verme, Milan, July 16 ("Document Acts")

National Centers for Biomedical Computing and National Institutes of Health, Bethesda, MD, July 17, 2006 ("Ontology: A Vision for the Future and Its Realization")

Functional Genomics Investigation Ontology Workshop, European Bioinformatics Institute, Hinxton, Cambridge, UK, July 24-28, 2006 ("The OBO Foundry Principles", "Formal review of BFO and DOLCE", "The Need for an Investigation Ontology")

Aug 2006 Cultures: Conflict – Analysis – Dialog: 29th International Wittgenstein Conference, August 6–13 ("Document Acts" (plenary talk), "Ways of Worldmarking")

Medical Informatics Europe, Maastricht, Netherlands, August 27–30 ("HL7 RIM: An Incoherent Standard", "Referent Tracking: The Problem of Negative Findings" (with Werner Ceusters and Peter Elkin))

Sep 2006 Model Organism Anatomy Ontology, National Center for Biomedical Ontology, Seattle, September 8-9 ("Principles of Ontology Design")

EDV-Gerichtstag, Saarland University, Saarbrücken, September 13 (Keynote lecture: "Die Ontologie des Dokuments"; Workshop presentation "Ontologien: ein Überblick")

Oct 2006 National Center for Biomedical Ontology and PharmGKB, Stanford University, October 25, 2006 ("How to Build an Ontology")

The Philosophy of Biology, National Center for Ontological Research, Buffalo, October 28, 2006 ("On the Canonical Life")

Nov 2006 Disease Ontology, National Center for Biomedical Ontology, Baltimore, Noveber 6-7, 2006 ("What a Disease Ontology is For")

Biomedical Ontology in Action (KR-MED 2006), November 8, 2006, Baltimore, MD ("Towards a Reference Terminology for Ontology Research and Development")

Formal Ontology and Information Systems (2006), Johns Hopkins University, Baltimore, Nov 8-10, 2006 ("Against Idiosyncracy in Ontology Development")

Biomedical Imaging Ontologies, Workshop, American Medical Informatics Association Annual Symposium, Washington DC, November 11, 2006 ("Ontology over Images")

Genomics Knowledge Representation for Clinical Trials, Workshop, American Medical Informatics Association Annual Symposium, Washington DC, November 12, 2006 ("Towards an Ontology for Clinical Trials")

		Panel on the Future of HL7, American Medical Informatics Association Annual Symposium, Washington DC, November 14, 2006 ("HL7 RIM")
		NAS Conference, Boston, November 17-19, 2006 ("Legislation and the Academic Bill of Rights")
		Ontology for the Intelligence Community, Conference of the National Center for Ontological Research, Columbia, MD, November 30-December 1, 2006 ("Ontology: A Guide for the Intelligence Analyst"; "Ontology: A Strategy for the Future")
Dec	2006	Knowledge Environments for Biomedical Research, National Institutes of Health, Bethesda, December 12, 2006 ("The Virtuous Knowledge Environment Cycle")
		NIST / Ontolog Forum / NCOR Series on Ontology Measurement and Evaluation, December 21, 2006 ("Ontology Evaluation in Biomedicine: The OBO Foundry Initiative")
		Society for Machines and Mentality, American Philosophical Association Eastern Division Meeting, December 28, 2006 ("Software and Other Cultural Artifacts")
Jan	2007	Ontology for Biomedical Investigations, La Jolla Insitute for Allergy and Immunology, San Diego, January 29-February 2, 2007 ("The Clinical Trial Ontology")
Mar	2007	Towards Interoperability of Biomedical Ontologies, Dagstuhl Seminar, March 25-29 ("Basic Formal Ontology")
Apr	2007	eHealth: From Strategies to Applications, Messe Berlin, April 18, 2007 ("Referent Tracking: Towards Semantic Interoperability and Knowledge Sharing")
		Visual and Conceptual Structuring of Action-Dependent Knowledge Representation, April 19-20, Department of Philosophy and Heinz Nixdorf Institute, University of Paderborn, Germany ("Ontologie als konkretisierte Darstellungen der Wirklichkeit")
		Semantic Days, Stavanger, Norway, April 24-25 ("The art of creating useful ontologies")
May	2007	Clinical Trial Ontology Workshop, NCBO and National Heart, Lung and Blood Institute/NIH, Bethesda, MD, May 16-17, 2007 ("Clinical Trial Ontology: Creating Consensus")
Jun	2007	Sharing Knowledge through the ICF: 13th Annual North American WHO Collaborating Center Conference on the ICF, Niagara Falls, June 7, 2007 (Tutorial on Biomedical Ontologies)
		The Role of Service Oriented Architecture in Achieving Semantic and Technical Interoperability, IBM and German Ministry of Health, IBM Stuttgart, June 19 ("The role of ontologies and terminologies in electronic health services")
		European Union OPEN eHealth Initiative Working Meeting, Prague, June 26-28 ("Semantic Interoperability and the Provision of Patient Data for Cross-Border Emergency Care")
July	2007	Bio-Ontologies Workshop, Intelligent Systems for Molecular Biology (ISMB), Vienna, Austria, July 19, 2007 ("Gene Ontology Annotations: What they mean and where they come", with Judith Blake and David Hill).
Aug	2007	The EnvO Workshop: Developing an Ontology for Describing the Environments of organisms and Biological Samples, UK National Environment Research Council, OERC: Oxford e-Research Centre, UK, August 29-31 ("Introduction to Ontologies for Environmental Biology")
Oct	2007	Evolution of Semantic Systems, Frege Center for Structural Sciences, University of Jena, Germany, October 5-6 ("Evolving Ontologies: The Future of Biomedical Informatics")
		The Metaphysics of Vectors, University of Geneva, Switzerland, October 20-21 ("How Philosophy of Science Can Help Biomedical Research")
		Methods and Metrics for Ontology Evaluation Workshop (Sponsors: NIST and NIH), National Institute of Standards and Technology, Gaithersburg, MD, October 25-26 ("Evaluation of Ontologies through an Editorial Process")
Nov	2007	Hegeler-Carus Foundation Advisors Meeting, LaSalle, IL, November 3-4 ("The Monist: Past, Present and Future")
		Environment Ontology, Cold Spring Harbor Laboratories, Long Island, NY, November 15-16 ("Development of the Environment Ontology")
		Ontology for the Intelligence Community, Columbia MD, November 28-29 (with T. Janssen, *et al*., "A Multi-INT Geospatial and Temporal Semantic Reasoning Framework for Intelligence Analysis Support")
Dec	2007	Protein Ontology Kick-Off Meeting, Georgetown University, Washington DC, December 2-4, 2007 ("The Protein Ontology within the OBO Foundry").
Jan	2008	Ontology for Biomedical Investigations, British Columbia Cancer Foundation, Vancouver, Jan.

28-30 (OBI, the OBO Relation Ontology and the Information Ontology)

Feb 2008 Inaugural Conference of the Japanese Center for Ontological Research, February 26-27 ("The Evaluation of Ontologies: Peer Review vs. Democratic Ranking").

Mar 2008 Ontology of Cellular Networks, National Center for Biomedical Ontology, Newark, NJ, March 26-27 ("Introduction to Biomedical Ontology")

Apr 2008 Ontolog Forum-NIST-NCOR Ontology Summit, Gaithersburg, MD, April 28-29 ("Ontology Quality Control and Gatekeeping")

May 2008 The Organism-Environment System, Center for the Ecological Study of Perception and Action (CESPA), University of Connecticut, May 15 ("The Environment Ontology")

The Relation Ontology, School of Medicine, University of Colorado, Denver, May 19-20 ("The OBO Relation Ontology: Preliminaries")

Jun 2008 First Information Entity Ontology Workshop, Science Commons, MIT, Cambridge MA, June 9-10 ("What are Information Entities?")

Evolutionary Biology and Ontologies. workshop organized as part of the Evolution 2008 Conference in the University of Minneapolis, MN on June 20, 2008 ("An Introduction to Ontology for Evolutionary Biology")

Jul 2008 First Open Biomedical Ontologies Foundry Summit, European Bioinformatics Institute, Hinxton, Cambridge, July 7-8 ("The OBO Foundry Principles")

Ontology for Biomedical Investigations, European Bioinformatics Institute, Hinxton, Cambridge, July 9-11 ("BFO and the Relation Ontology").

Aug 2008 Seminário de Pasquisa em Ontologia no Brasil, August 11-12, Department of Information Science, Universidade Federal Fluminense, Brazil ("Ontology Science vs. Ontology Engineering: The Case of Biomedicine")

Sep 2008 Discrete Clinical Data Acquisition, Modeling, and Use, Cleveland Clinic Department of Cardiovascular Surgery, September 22 ("What's an Ontology and Why Do I Care?")

Oct 2008 epSOS Workshop on Semantic Services, German Institute for Medical Documentation and Information, Cologne, October 1 ("Ontology-Supported Semantic Services")

Philosophy's Relevance in Information Science, Heinz Nixdorf Institute, Paderborn, Germany, October 3-4 ("The Relevance of Ontology in Information Science")

Nov 2008 Formal Ontology in Information Systems (FOIS), Saarbrücken, Germany, 2-4 November ("Ontology (Science)")

Second Annual Protein Ontology Meeting, Georgetown University, Washington DC, November 18-19 ("PRO within the OBO Foundry").

Conference of the Congenital Heart Surgeons' Society, Sick Kids Hospital, Toronto, November 21 ("Ontology of Congenital Heart Disease")

Dec 2008 Ontology for the Intelligence Community, George Mason University, December 3 ("Ontology for the Intelligence Community: A Strategy for the Future")

Workshop on Approaches to Legal Ontologies, Department of Law, European University Institute, Florence, Italy, December 9 ("Legal Ontology: The Scientific Perspective")

Jurix 2008: 21st International Conference on Legal Knowledge and Information Systems, University of Florence, Italy, December 10 ("How To Do Things With Documents")

Jan 2009 Second Evolutionary Biology and Ontologies Workshop. Organized as part of the Annual Meeting of the Society for Integrative and Comparative Biology (SICB) in Boston, MA on January 5 ("What is Ontology and Why do you need it?")

Volkswagen Foundation, Berlin-Brandenburg Academy of Sciences, January 12-13 ("Humanities and the Natural Sciences")

Command and Control Core Ontology Exchange Meeting, National Center for Ontological Research and Army Net-Centric Data Strategy Center of Excellence, January 15-16
Buffalo NY ("Success Stories in Use of Ontologies: Examples from Biomedicine and Lessons Learned for the Command and Control Ontology")

Feb 2009 InterOntology: 2nd Interdisciplinary Ontology Conference, Keio University, Tokyo, February 27-March 1 ("How to Build an Ontology" and "Ontology: The Road to Coordination" (keynote lecture))

Mar 2009 Ontolog-Forum Panel, March 12 ("How to Organize the World of Ontologies")

American Medical Informatics Association Translational Summit, San Francisco, March 15-17 ("Towards an Ontology of Disease and Diagnosis", with Richard Scheuermann)

International Association for Dental Research Consensus Workshop: Convergence on an Orofacial Pain Taxonomy, Miami, March 30-April 1 ("Ontology: Background and Rationale" (plenary lecture))

May 2009 epSOS Terminology Working Group, German Institute for Medical Documentation and Information, Cologne, May 20 ("epSOS Pilot Project in Semantic Interoperability")

Jun 2009 OBO Foundry Workshop, European Bioinformatics Institute, June 7-8, 2009 ("Reviews of OBO Foundry Ontologies")

EBI-Industry Group, European Bioinformatics Institute, Wellcome Trust Genome Campus, Hinxton, Cambridge, June 9 ("The OBO Foundry: Governance")

Workshop on the OBI Ontology for Biomedical Investigations, European Bioinformatics Institute, Wellcome Trust Genome Campus, Hinxton, Cambridge, June 10-11 ("The OBO Foundry: Requirements")

Ontology-Driven Semantic Interoperability in eHealth, European Commission Directorate General Information Society and Media, Brussels, June 22-23 ("Semantic Interoperability and Strategies for the Standardization of Medical Information: An epSOS Demonstrator Project")

Aug 2009 Concept Types and Frames in Language, Cognition and Science, University of Düsseldorf, August 24-26 ("The Relation Ontology")

Medical Informatics Europe, Sarajevo, Bosnia, August 29-September 2 ("Why are ontologies needed to achieve EHR interoperability?"; "An Evolutionary Approach to the Representation of Adverse Events", with Werner Ceusters, Maria Capolupo and Georges De Moor)

Sep 2009 Signs, Symptoms and Findings: Towards an Ontology for Clinical Phenotypes, Italian National Research Council Institute for Biomedical Technologies and University of Milan, September 4-5 ("BFO and Disease")

Plant Ontology Workshop, Cornell University, Ithaca, NY, September 14 ("Towards a Common Plant Ontology")

Performance Metrics for Intelligent Systems (PERMIS) Conference, September 21-23, National Institute of Standards and Technology (NIST), Gaithersburg, MD (with Lowell Vizenor, "Universal Core Semantic Layer: A Roadmap to Semantic Interoperability")

UCore Users Conference, Mitre Corp., McLean, VA, September 23-24 ("UCore Semantic Layer")

Conference on Ontology, North Carolina State University Logic and Cognitive Science Initiative (LACSI), September 25-26 ("Towards a Common Upper Level Ontology")

Oct 2009 IHTSDO Conference on SNOMED-CT, Bethesda, MD, October 8 ("Basic Formal Ontology")

Ontology for the Intelligence Community, George Mason University, Fairfax, VA, October 21-22 ("Universal Core Semantic Layer"; "Referent Tracking for Command and Control Messaging Systems")

Nov 2009 Ontolog Forum, November 5 ("Towards Ontology Certification")

Dec 2009 Pistoia Alliance Cross-Industry Vocabulary Workshop. Exploring Public-Private Partnership Models for Sustainable Pharmaceutical Vocabulary Services, December 2-3, Pfizer Technology Research Center, Cambridge MA ("The Pistoia Neurotoxicity Pilot")

2010 Ontology Summit Launch Event, December 10 ("Towards Ontology Certification: Meeting the Need for Trained Ontologists")

Jan 2010 Disease Ontology, Northwestern University, Chicago, January 16-17 ("The Ontology for General Medical Science")

Feb 2010 Ontology Summit 2010, on-line panel session, February 11 ("A Template for Ontology Training Programs")

OBO Foundry Workshop, European Bioinformatics Institute, Wellcome Trust Genome Campus, Hinxton, February 15-16, 2010 ("The Disease Ontology", "Basic Formal Ontology Version 2.0")

Pistoia Alliance Conference, European Bioinformatics Institute, Wellcome Trust Genome Campus, Hinxton, Cambridge, February 17-18 ("OBO Foundry: Recent Developments")

Mar 2010 ARGOS: Transatlantic Observatory for Meeting Global Health Policy Challenges through ICT-Enabled Solutions, Consortium Meeting, Barcelona, Spain, March 15 (with Werner Ceusters)

Ontology Summit 2010, National Institute of Standards and Technology (NIST), Gaithersburg, MD, March 15-16 ("What are we doing right, and what are we doing wrong, in ontology education")

Apr 2010 First Paolo Bozzi Ontology Lecture, University of Turin, April 15 ("Towards a Theory of Document Acts")

Third Annual Protein Ontology Meeting, University of Delaware, April 26-28 ("The OBO Foundry in 2010")

May 2010 FOIS Workshop on Ontology Education, University of Toronto, May 11 ("Creating a Common Body of Knowledge for the Discipline of Ontology")

Formal Ontology in Information Systems (FOIS), University of Toronto, May 12-15 ("Evaluating Ontologies" (with Mathias Brochhausen), "Dispositions and the Infectious Disease Ontology", with Albert Goldfain and Lindsay Cowell)

Open Toxicology (OpenTox) Consortium Virtual Meeting, May 13 ("Introduction to OBO Ontology Development")

Jun 2010 International Workshop on Bio-Ontologies, Institute for Formal Ontology and Medical Information Science, Saarland University, Saarbrücken, Germany, June 28 ("Classification Then and Now")

La métaphysique appliqué: Séminaire des Treilles, Fondations les Treilles, Tourtour, France, June 29-July 2 ("Applied Ontology" and "BFO and Disease")

Aug 2010 Conference on Collective Intentionality VII, August 23-26, Basel, Switzerland ("New Foundations for Social Ontology" and "Is Money a 'Product of Massive Fantasy'?")

Sep 2010 Joint Forces Command Next Generation Training Environment, Norfolk, VA, September 1 ("Coordination Management Process for Ontology-Based Information Integration")

Infectious Disease Ontology Workshop, 13th World Congress on Medical and Health Informatics (Medinfo 2010), Cape Town, South Africa, September 11, 2010 ("IDO and the OBO Foundry"),

13th World Congress on Medical and Health Informatics (Medinfo 2010), Cape Town, South Africa, September 13, 2010 ("A Unified Framework for Biomedical Terminologies and Ontologies", with Werner Ceusters)

Oct 2010 Joint Forces Command Live, Virtual, Constructive Architecture Framework (LVCAF), Virginia Modeling and Simulation Center (VMASC), Suffolk, VA, October 4 ("Ontology Development Best Practices")

Nov 2010 Plant Ontology Workshop, New York Botanical Gardens, Bronx, NY, November 5 ("BFO and the Plant Ontology")

Transatlantic Observatory for Meeting Global Health Policy Challenges through ICT-Enabled Solutions, Argos Consortium Conference, Washington DC, November 12 ("Semantic Interoperability: Reuse of EHR Data", with Werner Ceusters)

Feb 2011 Disease Ontology Workshop and Advisory Board Meeting, Institute for Genomic Sciences, University of Maryland, February 8-9 ("OGMS' Spawn")

Ontology and Analytical Metaphysics, Open Research Centre for Logic and Formal Ontology, Keio University, Tokyo, February 24-25 ("Materials Towards an Ontology of Pain", "The Ontology of Documents")

Mar 2011 National Center for Biomedical Ontology Project Meeting, March 1-3 ("Dissemination and Ontology Best Practices")

Advancing Oral Health Worldwide, International Association for Dental Research General Meeting, San Diego, March 16 ("Development of the Field of Biomedical Ontology" and "Saliva Ontology: A Unique Controlled Vocabulary for Salivary Research'')

Apr 2011 Jubileumsseminar Anders Grimsmo, Department of Public Health and General Practice, Norwegian University of Science and Technology, Trondheim, April 7 (Keynote speech, "Toward an Ontological Treatment of Disease and Diagnosis")

EviCare Workshop on Ontology and the Representation of Clinical Guidelines, Department of Computer and Information Science, Norwegian University of Science and Technology, Trondheim, April 8 ("An Introduction to Biomedical Ontology")

Workshop on Ontology Driven Implementation of Semantic Services for the Enterprise Environment (ODISSEE), sponsored by US Federal Government, Alion Science and

Technology and the National Center for Ontological Research, Washington DC, April 12-13 ("Coordinated Development of Ontologies Across Diverse Communities of Interest")

May 2011 Ratio Conference on Metaphysics, Reading University, Reading, United Kingdom, May 7 ("Classifying Diseases")

ARGOS Transatlantic Observatory for Meeting Global Health Policy Challenges through ICT-Enabled Solutions, Budapest, Hungary, May 11 ("An Evolutionary Strategy for Incremental Realization of Genuine Semantic Interoperability in the EHR Domain")

Jun 2011 Ontology-Based Research on Medicare/Medicaid Data, School of Pharmacy and Pharmaceutical Sciences, University at Buffalo and Department of Pharmacological Sciences, Stony Brook University, June 15 ("Biomedical Ontology in Buffalo")

How to Build Ontologies for Clinical and Translational Research, Department of Human Genetics, Emory University, June 29, 2011 ("Review of ONSTR: the Ontology for Newborn Screening Translational Research")

Jul 2011 International Conference on Biomedical Ontology (ICBO), Buffalo, NY, July 28-30, 2011 ("Panel: Collaborative Ontology Development: Why? and How?")

Working with Multiple Biomedical Ontologies. Workshop organized in conjunction with the International Conference on Biomedical Ontology (ICBO), Buffalo, NY, July 26-27, 2011 ("Towards a Body Fluids Ontology: A Unified Application Ontology for Basic and Translational Science" and "Coordination of Multiple Biomedical Ontologies: Basic Methodological Principles")

Sep 2011 12th Genomic Standards Consortium Meeting (GSC 12), Max Planck Institute for Marine Microbiology, Bremen, September 28-29 ("The World Wide Web Consortium (W3C)", "An Introduction to Ontology as a Strategy for Data Integration", "The Structure of the Environment Ontology")

Nov 2011 Research Data: Management, Access and Control, University Libraries, University at Buffalo, November 14 ("Ontologies: What Librarians Need to Know")

Visual Learning Lab (VLL), Budapest University of Technology, November 3 ("How Vision Works" (remote presentation))

Semantic Technology for Intelligence, Defense and Security (STIDS 2011), George Mason University, Fairfax, VA, November 16-17 ("Integration of Intelligence Data through Semantic Enhancement" (with David Salmen); "Semantic Enhancement for Data Retrieval and Integration in the Cloud")

Jan 2012 What Are Artworks and How Do We Experience Them, Winter Symposium, Aarhus University, Denmark, January 26-28 ("The Emotion Ontology")

Feb 2012 Interdisciplinary Ontology Conference (InterOntology12), Keio University, Tokyo, February 23 ("On Classifying Material Entities in Basic Formal Ontology")

Ontology for Big Systems, Ontology Summit 2012, on-line symposium, February 9 ("Big Data that would benefit from ontological technology")

Mar 2012 Financial Reference Data Management Conference (FIMA 2012), New York, March 21 ("Reference Data Integration: A Strategy for the Future")

Gradualist Approaches to Health and Disease: Philosophical, Medical and Legal Perspectives, Humboldt University, Berlin, March 23-25 ("Disease, and Other Clinical Natural Kinds")

Apr 2012 UK Ontology Network. Connecting the UK Ontology Community, University of Manchester, April 12 ("Looming Ontology Chaos")

Jun 2012 Conference on Immunology Ontologies and Their Applications in Processing Clinical Data, National Center for Biomedical Ontology, Buffalo, NY. June 11-13 ("Bio-Ontologies for Immunology Research: An Introduction")

Jul 2012 Towards an Ontology of Mental Functioning, ICBO Workshop, Medical University of Graz, Austria, July 22 ("Mental Functioning and the Ontology of Language")

How to Deal with Sectarianism in Biomedical Ontologies, 3rd International Conference on Biomedical Ontology (ICBO), Medical University of Graz, Austria, July 23 ("What causes sectarianism in ontology development and how to alleviate it?")

Aug 2012 Basic Formal Ontology 2.0 Preliminary Development Workshop, Center of Excellence in Bioinformatics and Life Sciences, National Center for Ontological Research. August 18-19

("Main Features of BFO 2.0")

Sep 2012 Genomic Standards Consortium 14th Annual Conference, Biocode Commons Hackathon, Oxford, September 18-20 ("Sample Ontology for Biodiversity Genomics", "Critical Review of EnvO 2.0")

Oct 2012 Semantic Technology for Intelligence, Defense and Security (STIDS), George Mason University, Fairfax, VA, October 23-25 ("Horizontal Integration of Warfighter Intelligence Data")

Nov 2012 Austrian Thought at the Turn of the 20th Century, University of Texas, Arlington, TX, November 1-3 ("Ontology and the Austrian Tradition")

Dec 2012 Visual Learning: Communication – Cognition – Curriculum, International Conference, Budapest University of Technology and Economics, December 7-8 ("Diagrams and Time" Slides)

Briefing to Chief of Naval Operations Strategic Studies Group (SSG), Naval War College, Newport, RI, December 18 ("Towards Joint Doctrine for Military Informatics")

Feb 2013 Building Ontologies to Meet Evaluation Criteria, Ontology Summit 2013, Session-04, February 7 ("Ontological Realism as a Strategy for Integrating Ontologies")

Clinical and Translational Science Ontology Workshop, Orlando, FL, February 11-12 ("Limning the CTSA Ontology Landscape")

Phenotype Ontology Research Coordination Network Summit, National Evolutionary Synthesis Center, Duke University, Durham, NC, February 24 ("On the Future of the Neuro Behavior Ontology and Its Relation to the Mental Functioning Ontology")

Apr 2013 Ontologies for Information Integration, National Center for Ontological Research, Buffalo, NY, April 18 ("The Role of Ontology in the Era of Big (Military) Data")

May 2013 Basic Formal Ontology 2.0 Development Workshop, National Center for Ontological Research, University at Buffalo, May 13 ("The BFO 2.0 Specification")

PRO-PO-GO: Challenges of Ontology Coordination Across Organisms, Plant Ontology Consortium, Protein Ontology Consortium and National Center for Biomedical Ontology, Buffalo, NY, May 15-16 ("Critique of the Phenotype Ontology and of the Trait Ontology" and "Species-Neutral vs. Multi-Species Ontology")

Information Systems and the Four-Category Ontology, University of Durham, May 21 ("The Six Category Ontology: BFO and Its Applications")

Talk About What You See: Objects, Colors, Sounds and Trajectories. Conference in Memory of Paolo Bozzi, University of Trento, Italy, May 30-31 ("Figure and Ground in Time", "Applications of Bozzi's Naïve Physics")

Jun 2013 Bioinformatics and Computational Biology in the Era of Big Data, University at Buffalo, June 6 ("Biomedical Ontology in Buffalo")

Jul 2013 International Workshop on Definitions in Ontologies, co-located with the International Conference on Biomedical Ontology (ICBO), Montreal, Canada, July 7 (Keynote lecture: "An Introduction to the Logic of Definitions")

International Conference on Biomedical Ontology (ICBO), Montreal, Canada, July 8-9 ("Ontological-Based Annotation of Contextualized Vital Signs" (with Albert Goldfain); "Suggested Principles for an Ontologist's Code of Ethics" (Panel Contribution); "Representing Disease Courses: An Application of the Neurological Disease Ontology to Multiple Sclerosis Typology" (Poster presentation))

Aug 2013 Bioethics and the Philosophy of Medicine, PANTC Conference, University at Buffalo, August 2-3 ("Diseases, Diagnoses, Signs and Symptoms")

Sep 2013 ImmPort Site Visit, NIAID Bioinformatics Integration Support Contract (BISC), Stanford University, September 3 ("Immune-Related Ontologies")

ImmPort Ontology Conference, NIAID Bioinformatics Integration Support Contract (BISC), Stanford University, September 4-5 ("A Debate on Strategies for Use of Ontologies in ImmPort" (with Alan Ruttenberg))

ImmPort External Advisory Board Meeting, NIAID, Bethesda, MD, September 12 ("The Rho Strategy for Empirical Testing of Ontology Methods")

Rostock Symposium on Systems Biology and Bioinformatics in Aging Research, Institute for Biostatistics and Informatics in Medicine and Ageing Research, Rostock, Germany, September

20-21 (Keynote address: "Ontology of Aging and Death", Video)

CUBRC – CMIF – NCOR Collaboration Meeting, CUBRC, Buffalo, 23 September ("Ontology Research and Opportunities")

Oct 2013 NCBO SAB Meeting, Stanford, CA, October 1-2 ("NCOR Dissemination")

Training and Strategy for ImmPort Data Submitters, Rho Federal Systems Division, Chapel Hill, NC, October 9-10 ("A Practical Introduction to ImmPort and to NIH Mandates for Data Sharing and Reuse", "Introduction to Allergy Ontology")

Philosophy of Emerging Media, College of Communication, Boston University, October 25-27 ("Towards Emerging Media Science" and "Media and Agency")

Nov 2013 Globalization and Documentality, Käte Hamburger Kolleg / Center for Advanced Study, University of Bonn, November 19 (on-line presentation: Documents and Massive Social Agency)

8th International Conference on Semantic Technologies for Intelligence, Defense, and Security (STIDS 2013), George Mason University, Fairfax, VA, November 12-15 ("IAO-Intel: An Ontology of Information Artifacts in the Intelligence Domain")

Jan 2014 Big Data and Semantic Web Meet Applied Ontology, Ontology Summit 2014 Launch Event, January 14 ("Introduction on behalf of the National Center for Ontological Research"; on-line presentation)

Feb 2014 Humanomics Research Centre Opening Seminar, University of Copenhagen, February 7, ("The Philosophome: An Exercise in the Ontology of the Humanities")

Apr 2014 Ontologie und Zeit, Saarland University, Saarbrücken, Germany, April 26 ("Eine Korrespondenztheorie von Graphen")

Philosophy of Medicine Seminar Series, King's College, London, April 29 ("The Ontology of Disease") Video

May 2014 Consequences of Realism, Rome, May 4-6 ("The Fifth Cycle of Philosophy")

HIMA Imaging Science Workshop, Pathology Informatics 2014, Pittsburgh May 13 ("A Guide to Ontology for the Pathologist of the Future")

Jun 2014 The Ends of Life – Deepening Reflections on Bioethical Issues at the Beginning and End of Life, Edmond J. Safra Center for Ethics, Tel Aviv University, Israel, June 8-10 ("The Ontology of Aging and Death")

Protein Ontology Workshop, Georgetown University, DC, June 19 ("Introduction to the Relation Ontology")

Ontology and Imaging Informatics, University at Buffalo, NY, June 23-25 ("Introduction to Ontology for Pathology Imaging")

Aug 2014 Bioethics and the Philosophy of Medicine, 2014 PANTC Conference, University at Buffalo, August 1-2 ("Ontology of Aging")

Clinical and Translational Science Ontology Group, August 12, Online Presentation on Imaging Ontologies

American Society of Mechanical Engineers (ASME) International Design Engineering Technical Conference and Computers and Information in Engineering (IDETC/CIE), Buffalo, August 17-20 (Keynote Lecture, "Ontological Engineering")

Sep 2014 Inaugural Conference of the World Interdisciplinary Network for Institutional Research (WINIR) , Old Royal Naval College, Greenwich, London, September 12 (Keynote address: "From Speech Acts to Document Acts: An Ontology of Institutions").

BISC Site Visit / External Advisory Board Meeting, Rockville, MD, September 18 ("The Role of Ontology in the ImmPort Project", on-line presentation)

Formal Ontology in Information Systems (FOIS), Rio de Janeiro, September 21-25 ("The Fifth Cycle of Philosophy: Eulogy for Nicola Guarino"; "Applying the Realism-Based Ontology-Versioning Method for Tracking Changes in the Basic Formal Ontology", with Selja Seppälä)

Oct 2014 International Conference on Biomedical Ontology (ICBO), Houston, TX, October 8-11 (MedDRA technical workshop and panel; "Creating a MedDRA ontology"; NASA Panel, "The Ontology for General Medical Science"; Presentation: "Data Wrangling Clinical Research Datasets using Ontology and Referent Tracking", with Werner Ceusters; Lightning talk: "Ontological

Representation of CDC Active Bacterial Core Surveillance Case Reports")

Truth, Image, Normativity, University of Cagliari, Sardinia, October 21-26 ("The Division of Deontic Labor")

Nov 2014 Semantic Technology for Intelligence, Defense and Security (STIDS 2014), George Mason University, Fairfax, VA, November 18-20 ("A Computational Framework for Living Plan Specification, Execution and Evaluation" (with Erik Thomsen); "An Ontological Approach to Territorial Disputes" (with Neil Otte and Brian Donohue); Panel: Semantics for Collaboration ("Collaboration Through Military Doctrine"))

Leveraging Standards and Ontologies to Improve HIPC Data Submission and Analysis, National Institute of Allergy and Infectious Diseases (NIAID), Rockville, MD, November 19 ("Leveraging Ontologies for Human Immunology Research")

Dec 2014 NCBO SAB Meeting, Stanford, CA, December 3 ("NCOR Dissemination"; Panel: "Lessons from the Past 10 Years")

Feb 2015 United Nations Environment Program, New York, Feb 27-Mar 1, Senior Expert Meeting on Ontology of Indicators for Sustainable Development ("Environment Ontology and Ecosystems: Basic Examples")

Mar 2015 Internet of Things: Toward Smart Networked Systems and Societies. Ontology Summit 2015. Beyond Semantic Sensor Network Ontologies, March 5 ("Ontology of Sensors: Some Examples from Biology")

Apr 2015 American Philosophical Association, Pacific Division Meeting, Vancouver, BC, Canada, April 2 ("Towards an Ontology of Philosophy")

Philosophy as Science: A Key Idea of the 19th Century, Utrecht, Netherlands, April 9 (Keynote address: "Metaphysics after Darwin")

Advanced Defense Studies Institute, Italian Ministry of Defense, Rome, April 24 ("New Foundations for Military Ethics")

May 2015 HIMA Imaging Science Workshop, Pathology Informatics 2015, Pittsburgh, May 5 ("An Introduction to Biomedical Ontology for Imaging Informatics")

Briefing on "Ontology for Military Doctrine", Department of Defense Training and Doctrine Command (TRADOC), May 11, Pentagon, Washington, DC

The Role of Ontology in Big Cancer Data, National Cancer Institute, Bethesda, MD, May 12-13 ("The Cancer Ontology Landscape")

United Nations Environment Programme, New York, May 16-18, Senior Expert Meeting on Ontology of Indicators for Sustainable Development ("The SDG Ontology Framework")

Medical Informatics Europe, Madrid, Spain, May 27-31 (Lecture: "Biomarkers in the Ontology for General Medical Science"; Panel: "Basic Formal Ontology Meets Critics")

Jun 2015 Joint CUBRC / Air Force Research Laboratory, Wright Patterson Air Force Base IT Summit, June 25 ("BFO and the Joint Doctrine Formalization Initiative")

Jul 2015 Workshop on the Ontology of Chemistry, Department of Chemistry, University of Southampton, United Kingdom, July 20 ("Introduction to BFO and OBI"; "Building a Chemical Image Ontology")

Taking Pregnancy Seriously in Metaphysics: The Foetus and The Maternal Organism, University of Southampton, United Kingdom, July 21 ("Embryontology", Video)

International Conference on Biomedical Ontology (ICBO), Lisbon, Portugal, July 27-31 ("Aboutness: Towards Foundations for the Information Artifact Ontology" with Werner Ceusters, Slides)

Aug 2015 Bioethics and Philosophy of Medicine, 2015 PANTC Conference, July 30-August 1 ("The Emotion Ontology", "Video")

INCITS/DM32.8 Meeting, August 24 ("On the Need for a Common Standard Upper Ontology")

Air Force Research Laboratory – Navy Distributed Operations Summit, August 26 ("Joint Ontology")

Federal Big Data Working Group (on-line presentation), August 31 ("Building Ontologies with Basic Formal Ontology")

Sep 2015 Briefing to Joint Doctrine Staff, Pentagon, September 4 ("Joint Doctrine Ontology")

Information Meeting on Joint Doctrine Ontology, Multi-Agency Collaborative Environment (MACE) Center, Herndon, VA, September 16-17 ("Addressing DoD information and coordination needs")

BISC Site Visit / External Advisory Board Meeting, University of California at San Francisco, CA, September 18 ("ImmPort Ontology Update")

Ontology in Practice: Fourth Clinical and Translational Science Ontology Workshop, Charleston, SC, September 23-25 ("FHIR and Ontology")

Oct 2015 HelsIT: Health Information Technology, Trondheim, Norway, October 20 (Keynote lecture: "The Glory and Misery of Electronic Health Records")

Nov 2015 Symposium on Military Codes of Ethics, University at Buffalo, November 2 ("Building an Ethical Warfighter", Video)

Planteome Curation Workshop: Ontology Curation and Data Annotation, Oregon State University, Corvallis, November 9-10 ("What do plant scientists need ontologies for?" and "Trait Ontology: Introductory discussion")

International Standards Organization (ISO) Committee on MetaData Standards, National Cancer Institute, Bethesda, MD, November 18 ("Common Ontology Standards")

Semantic Technology for Intelligence, Defense and Security (STIDS 2015), George Mason University, Fairfax, VA, November 18-20 ("Joint Doctrine Ontology: A Benchmark for Military Information Systems Interoperability")

56th Joint Doctrine Planning Conference, Joint Warfighting Center, Suffolk, VA, November 5 ("Joint Doctrine Ontology: Interim Report")

Dec 2015 Digital Thread / Digital Twin Applications for Next Generation and Legacy Aerospace Systems and Engines, Kick-Off Meeting, Wright Brothers Institute, Dayton, OH, December 4 ("Ontology Development for Air Force Logistics")

Federal Big Data Working Group (on-line presentation), December 7 ("Joint Doctrine Ontology")

Jan 2016 KAUST Research Conference on Computational and Experimental Interfaces of Big Data and Biotechnology, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia, Jan 25-27 ("The Glory and Misery of Electronic Health Records")

Feb 2016 Workshop on BFO and the Ontology of Deontic Entities, University of Florida School of Medicine, Gainesville, FL, February 17-19 ("Developing a Framework of Ontologies for Social Entities")

Apr 2016 Completing the Model Based Development, Digital Manufacturing and Design Innovation Institute (DMDII) Technical Interchange Meeting, National Institute of Standards and Technology (NIST), Gaithersburg, April 11 ("Coordinated Holistic Alignment of Manufacturing Processes (CHAMP)")

May 2016 Ontological Approaches to Sensor Data Analysis, National Center for Geographic Information and Analysis, Buffalo, NY, May 19-20 ("The Ontology of Sensors: A Critical Overview")

Jun 2016 57th Joint Doctrine Planning Conference, Joint Warfighting Center, Suffolk, VA, June 1-2 ("Joint Doctrine Ontology: Progress Report")
International Standards Organization (ISO/IEC JTC 1/SC 32/WG 2), Memphis, TN, June 14-15 ("Basic Formal Ontology: New Work Item Proposal")

Jul 2016 Perspectives on Deontology from Early Phenomenology and Contemporary Philosophy. Workshop with Barry Smith, University of Geneva, July 6, 2016 ("Deontology Ontology: Towards an Ontology of Deontic Entities") Video

9th International Conference on Formal Ontology in Information Systems (FOIS 2016), Annecy, France, July 6-9 ("The Functions of Definitions in Ontologies", with Selja Seppälä and Alan Ruttenberg; "Permanent Generic Relatedness and Silent Change", with Niels Grewe and Ludger Jansen [winner of FOIS/IAOA Ontology Competition])

Bioethics and the Philosophy of Medicine, PANTC Conference, University at Buffalo, July 30 ("The Metaphysics of the Embryo")

Aug 2016 International Conference on Biological Ontology, Corvallis, OR, August 1-4 ("The Ontology of the Organigram", "The United Nations Environment Program Sustainable Development Goals Ontology", Panel: The Future of Ontology)

Addressing the Big Data Challenges of Pathology Imaging through Biomedical Ontology, National Cancer Institute, August 15 ("Ontology and Quantitative Histopathology", with Alan Ruttenberg)

Sep 2016 Clinical Terminology Shock and Awe, University at Buffalo, September 7-8 ("Clinical Terminology: Shock and Awe")

Turbine Engine Technology Symposium (TETS), Wright-Patterson AFB, Dayton, OH, September 12 ("Propulsion Digital Thread/Digital Twin Spiral 0.1: Use of Ontology in Digital Thread")

Oct 2016 Intelligence Support to Command and Control Working Group (ISC2WG), Pentagon (JS, J6 and J2), October 12 ("Joint Doctrine Ontology")

Top-Level Ontologies, UB Ontology Group, October 21 ("Proposed ISO Top Level Ontology Standard")

Big Data – Herausforderung für Wissenschaft und Gesellschaft, ZiF Zentrum for interdisziplinäre Forschung, Universität Bielefeld, October 25 ("Die Datenwelt von Morgen") (Video)

Normative Drawings and Deontic Artifacts, University of Cagliari, Sardinia, October 27-28, 2016 ("The Ontology of the Organigram") (Video)

Nov 2016 International Standards Organization (ISO) Committee on Metadata Standards, Oxford, UK, November 10 ("Proposed Top Level Ontology Standard Parts 1 and 2")

Dec 2016 First Industrial Ontology Foundry Workshop, Systems Integration Division, National Institute of Standards and Technology (NIST), Gaithersburg, MD, December 8 ("How to Build the Industry Ontology Foundry", "Draft of a Product Lifecycle Management Ontology" (with Dimitris Kiritsis)

Feb 2017 The Metaphysics of Quantities, Istituto di Studi Filosofici, Facoltà di Teologia di Lugano, February 2-3 ("Quantities as Fiat Universals") (Video)

FOUST Workshop on Foundational Ontologies, Bolzano, Italy, February 27-28 ("Basic Formal Ontology: An Overview", Video)

Apr 2017 Second Industry Ontology Foundry Workshop, National Institute of Standards and Technology (NIST), Gaithersburg, MD, April 10-11 (Panel presentation: "Comparing Upper Level Ontologies")

May 2017 Ontology Summit 2017 Symposium, National Institute of Standards and Technology (NIST), Gaithersburg, MD, May 15-16 (Keynote address: "The Industry Ontology Foundry")

Jun 2017 Franz Brentano Centenary 1838–1917, University of Vienna, June 1 ("Four Phases of Philosophy and Its Present State")

International Standards Organization (ISO) Committee (JTC1/SC32/WG2) on Metadata Standards, Okayama, Japan, June 20 ("Draft Top-Level Ontology Standard, Parts 1 and 2")

Jul 2017 Romanell Conference 2017: Personal Identity and Our Origins, University at Buffalo, July 28-29 ("Personae")

Aug 2017 A Strategy for Promoting Data Interoperability Across the Enterprise, workshop organized as part of the ASME 2017 International Design Engineering Technical Conferences (IDETC) and Computers & Information in Engineering Conference (IDETC/CIE). Cleveland, OH, August 6 ("Introduction to BFO and the Industry Ontologies Foundry", Video)

Aug 2017 IAOA Summer Institute on Upper Ontologies, University of Toronto, August 8-11 ("Why do we need upper-level ontologies?", "Relationships between upper-level ontologies", Slides)

Sep 2017 Second Workshop on Representing Social and Legal Entities in the Biomedical Domain, International Conference on Biomedical Ontology (ICBO), Newcastle, UK, September 13 (Keynote lecture on "Functions, Dispositions and Capabilities", Video, online)

Nankai University Workshop on the Philosophy of Economics and the Social Sciences, Tianjin, P.R. China, September 25-26 ("Goods vs. Services: An Ontological Exploration", Video)

Journées sur l'Interopérabilité des Applications d'entreprise (JIAE), conference of the Virtual Interoperability Lab, September 28-29 ("The Vision of the Industry Ontologies Foundry", online)

Oct 2017 3rd Big Data Interagency Working Group (BDIWG) Workshop on an Open Knowledge Networks: Enabling the Community to Build the Network, National Institutes of Health, Bethesda, MD, October 4-5 ("Manufacturing 1", "Manufacturing 2")

ASM International, Materials Properties Database Committee, Pennsylvania, PA, October 8 ("Introduction to the Industry Ontologies Foundry", on-line presentation)

Protein Ontology Consortium Workshop 2017, Bar Harbor, MN, October 11-12 ("How To Define 'Causally Upstream Of'")

Microbiology for the CTSA: Ontological Approaches: Sixth Clinical and Translational Science Ontology Workshop, University of Michigan, Ann Arbor, October 24-25 ("Building a Microbiome Ontology")

Nov 2017 European Materials Modelling Council (EMMC) Workshop on Interoperability in Materials Modelling, St John's Innovation Centre, Cambridge, UK, 7-8 November ("Introduction to the Industry Ontologies Foundry", online)

International Standards Organization (ISO) Committee on MetaData Standards, University of Colorado, Anschütz, OR, November 28 ("ISO NWIP: Top-Level Ontologies")

Apr 2018 Boston Phenomenological Circle Symposium, Boston College and Boston University, April 13-14 ("The Ontology of Emotions", Video)

Capabilities: Human and Machine, Workshop, University at Buffalo School of Engineering and Applied Sciences, April 20 ("What are Capabilities?", Video)

Medical Informatics Europe (MIE 2018), April 23-26 Gothenburg ("Bruxism", with Werner Ceusters)

Metaphysics and Formal Ontology, Dynamis: Finnish Network of Metaphysics, Tampere, April 27 (Keynote Lecture, "Driverless Philosophy" Video)

May 2018 Ontology Summit 2018, NIST, Washington DC, May 1 ("The Great Debate: John Sowa vs. Barry Smith", Video of BS contribution, Audio of Entire Debate, Audio of closing exchanges, Slides)

Jun 2018 Society for Automotive Engineers Automated and Connected Vehicle Systems Testing Symposium, June 20–21, 2018 Hosted by Clemson University – International Center for Automotive Research (CU-ICAR) Carroll A. Campbell Jr. Graduate Engineering Center, 5 Research Dr, Greenville, SC 29607 (Keynote Lecture: "Ontology: Tool for Broad Spectrum Knowledge Integration" Video)

Jul 2018 Industrial Ontologies Foundry Workshop, Buffalo, July 18-19 ("The Industrial Ontologies Foundry: Introduction", "Diversity of ontologies inside and outside the IOF")

Navy Model-Based Systems Engineering Transformation Technical Interchange Meeting, San Diego, July 25-26 ("Ontology for Systems Engineering")

Romanell Philosophy of Medicine and Bioethics Conference 2018, University at Buffalo, July 28-29 ("Capabilities")

Aug 2018 256th American Chemical Society National Meeting, Boston, MA (Invited lecture: "Big Chemistry Data")

Sep 2018 Navy SYSCOM and DoD Ontology Workshop, Engility, Washington DC, September 18-19 ("Ontology and the Navy SYSCOMs Systems Engineering Transformation Process")

Oct 2018 DOCAM Conference: Annual Meeting of the Document Academy, Turin, October 4-6 (Keynote Lecture: "Documentome")

Nov 2018 The Philosophy of Achille Varzi on the Occasion of His Un-Birthday, November 5, Department of Philosophy, University of Milan ('Some Neglected Parts", online)

International Standards Organization (ISO) Committee (JTC1/SC32/WG2) on Metadata Standards, Sendai, Japan, November 9 ("ISO/IEC 21838")

Feb 2019 International Industrial Ontologies, Det Norske Veritas, Oslo, Norway, February 4-7, 2019 ("Industrial Ontologies Foundry: An open, shared reference ontology framework" Video)

Ontology for Precision Medicine: From Genomes to Public Health, Orlando, FL February 20-21 ("The Mental Functioning Ontology")

May 2019 The Ontology of Economics: Capital, Exchanges and Preferences, Institute of Philosophy, University of Neuchâtel. May 8 ("The Ontology of Human Capital")

Jul 2019 Romanell Summer Conference on Death, Disease, and Identity, University at Buffalo, NY July 25-27 ("Minds made of Software vs. Minds made of Flesh")

International Conference on Biomedical Ontology (ICBO), University at Buffalo, Buffalo NY, July

30 ("Foundations for a Realist Ontology of Cognitive Processes", with D. Kasmier and D.Limbaugh; "Warranted Diagnosis", with D. Limbaugh, D. Kasmier, and W. Ceusters; "Mental Capabilities", with E. Merrell, D. Limbaugh and A. Anderson)

International Conference on Biomedical Ontology (ICBO), University at Buffalo, Buffalo NY, August 1 (Keynote: "Identity and Immortality" (Video); "Ontology as Product-Service System: A Study of GO, BFO and DOLCE" (Video); Panel on Opportunities for collaboration between the OBO Foundry community and SNOMED)

Aug 2019 25th International Conference on Production Research — Manufacturing Innovation: Cyber Physical Manufacturing, Chicago, August 13 (Keynote: "What is a Cyber-Physical System?")

Sep 2019 Joint Ontologies Workshop (JOWO) 2019, Graz, Austria, September 23-25 ("A First-Order Logic Formalization of the Industrial Ontology Foundry Signature Using Basic Formal Ontology", "Toward an Ontology of Commercial Exchange")

Oct 2019 Protein Ontology Consortium Workshop, Georgetown University Medical Center, October 23-24 ("Basic Formal Ontology and the Ontology for General Medical Science")

Nov 2019 Rudolf Haller und die Österreichische Philosophie, University of Graz, 8-9 November ("Wittgenstein und der Turing Test", Video)

Ontology Technical Exchange, Johns Hopkins University Applied Physics Lab, November 14, 2019 ("How to Build an IC / DoD Foundry")

Dec 2019 Industrial Ontologies Foundry Meeting, National Institute of Standards and Technology (NIST), December 4-5 ("Ontology Workflow Management")

Feb 2020 Fixing Science: Practical Solutions for the Irreproducibility Crisis, The Independent Institute, Oakland, CA, February 7-8 ("The Reproducibility Crisis and the Lehman Crash", Video)

Mar 2020 Ground System Architectures Workshop (GSAW), Los Angeles, CA, March 1-4, ("Developing Ontologies and Their Role in Engineering Information Fusion Systems" (with David Limbaugh and Ron Rudnicki))

Industrial Ontologies Foundry Meeting, University at Buffalo, March 5 ("The New ISO Ontology Standard: ISO/IEC 21838")

Aug 2020 IEEE Conference on Cognitive and Computational Aspects of Situation Management (CogSIMA), Virtual Conference hosted by the University of Victoria, British Columbia, August 22-28 (Keynote (online): "Command and Control", Video),

CogSIMA Workshop on Interoperability for Situation Management and Decision-Making, August 28 ("Facts and Truthmakers")

Oct 2020 United Nations General Assembly – ISC Science @ UNGA 75: How to deliver during the COVID-19 pandemic SDG (Sustainable Development Goals) 16.9: Legal Digital Identity (DID) to all by 2030, October 1 ("Digital Identity in Medical Records")

Roman Ingarden and the Lvov-Warsaw School, The Lvov-Warsaw School Research Center (Faculty of Philosophy, University of Warsaw), October 22-24 ("Relatively Isolated Systems", Video (online))

Nov 2020 Industrial Ontologies Foundry Panel, I-ESA 2020 Interoperability in the Era of Artificial Intelligence, Tarbes, France, November 18 ("Basic Formal Ontology" (online))

Ontobras: 13th Seminar on Ontology Research in Brazil, Federal University of Espírito Santo, in Vitória, ES, November 24 (Keynote talk, "ISO/IEC 21838 as the Basis for a Sustainable Ontology Development Strategy" (online), VIdeo)

Mar 2021 OntoCommons Top-Level and Mid-Level Ontologies Multi-Disciplinary Workshop, March 30 ("BFO and ISO/IEC 21838" (online))

Classifying Philosophy: Problems and Strategies, University at Buffalo, March 31 ("Introduction and Welcome" (online))

May 2021 The Sherry Turkle Miracle, Hungarian Academy of Sciences, Budapest, May 25 ("Neural Chitchat" (online), Video)

Interdisciplinary Symposium on Cognitive Ontologies (ISCO), Centre for Cognitive Neuroscience, University of Salzburg, May 26 ("From BFO to MFO: A Modular Approach to Cognitive Ontologies" (online))

Sep 2021 8th International Conference on Spatial Cognition, Rome, September 13-17 (Keynote address:

		"Making Space: The Natural, Cultural, Cognitive and Social Niches of Human Activity", Video (online))
		International Association for Ontology and Its Applications (IAOA) Educational Series on Applied Ontology (ESAO), Bolzano, Italy, September 10 ("On Realizables: Roles, Dispositions, Capabilities, and Functions", Video (online))
Oct	2021	Artificial vs. Natural Intelligence. New Perspectives from Metaphysics, Ethics and Robotics University of Turin, October 29, 2021 ("Digital Immortality")
Nov	2021	OntoCommons. Enabling Intra-Ontology Interoperability through Shared Terminology, November 2 ("ISO/IEC 21838" (online))
Mar	2022	Eighth Clinical and Translational Science Ontology Workshop: AI and Complex Systems in Biomedicine, Orlando, Florida, March 16-18 ("Capabilities", Video)
Apr	2022	5th Annual Bovay Workshop on Engineering and Applied Ethics, Texas A&M University, College Station, TX, April 26 ("The Machine Will", Video)
May	2022	What is our Future in Space. McGill's Space Research Conference, McGill University, Montreal, Canada, May 3-4 ("For a Useful Space (Medicine) Ontology", Video)
		2nd Conference on the Ontology of Economics, Institute of Philosophy, University of Neuchâtel. May 20 ("Producing Capabilities")
May	2022	Industrial Ontologies for Smart Manufacturing, Purdue University Smart Manufacturing Institute, May 24 ("What is an Industrial Ontology?", Video: from 39:40)
Jun	2022	Department of Defense and Intelligence Community Working Group (DIOWG), June 24 ("Ontology Foundries", Video)
Jul	2022	US Customs and Border Protection Systems Engineering Community of Practice, July 26 ("Systems Engineering Ontology")
Aug	2022	Laws of Form Conference, Liverpool, United Kingdom, August 4-6 ("LoF and BFO")
		Ontology of Social Services (OSS), Joint Ontologies Workshops (JOWO), Jönköping, Sweden, August 16 ("The Ontology of (Social) Services", Extended Abstract, Video)
		ASM International Material Properties Data Committee, International Materials, Applications and Technology Conference, New Orleans, September 12 ("IOF and BFO")
Sep	2022	12th International Workshop on Formal Ontologies meet Industry (FOMI22), Tarbes, France September 13-14 ("Industrial Ontologies Foundry", "Digital Twins and the Problem of Model-Induced Escape (Video)", "The Ontology of (Supply Chain) Services (Video)")
		IEEE Quantum Week, Broomfield, CO, September 22 (Panel on Acceleration of Quantum Sciences and Engineering via Metascience, ("Introduction to the Quantum Metascience Initiative (QMI)", Video)
		International Conference on Biomedical Ontology (ICBO), University of Michigan, Ann Arbor, Workshop on Financial & Legal Dimensions of Healthcare, September 26 ("Towards an Ontology of Social Services", Video)
		International Conference on Biomedical Ontology (ICBO), University of Michigan, Ann Arbor, September 27 ("Response to Jobst Landgrebe")
Oct	2022	Ontology Day (Meeting of University at Buffalo and University of Toronto Ontologists), Department of Philosophy, University at Buffalo, October 24 ("Buffalo Approach to Ontology", "Ontology of Services")
Nov	2022	Association of Brazilian Software Enterprises, Annual Meeting, São Paulo, Brazil (November 7), (Keynote Speech on *Artificial Intelligence and the New World Order*)
		Facing the Future, Facing the Screen. 10th Budapest Visual Learning Conference, Hungarian Academy of Sciences, Budapest, November 17 ("Model-Induced Escape", Video)
Dec	2022	W3C Human Services Ontology Group Meeting, December16 (online presentation, "The Ontology of Services")
Jan	2023	SPIE 2023 Photonics West, International Society for Optics and Photonics San Francisco, January 30 ("Acceleration of quantum sensing and engineering via metascience")
Feb	2023	Ontologies, AI and Electronic Health Records. 10th Clinical and Translational Science Ontology Workshop, Medical University of South Carolina, Charleston, February 23-24 ("My life with

ChatGPT")

Mar 2023 Workshop: Why Machines Will Never Rule the World, Università della Svizzera italiana, Lugano, Switzerland, March 1-2 ("The argument of the book", Smith Slides, Landgrebe Slides, Video)

Innovation Platform, McGill University Faculty of Medicine, Montreal, March 23 ("The Application of AI to Clinical Research, Teaching, and Care with a Special Focus on ChatGPT")

May 2023 Ontology of Economics III: Doing, Owing, Owning, Knowing, Neuchatel, Switzerland, May 12 ("Realms of the A Priori: Law, Economics, and Mathematics", Video, Supplementary Video on Reinach and ChatGPT)

Basic Formal Ontology Summit Meeting, University of Buffalo, March 23-25 ("Capabilities", "Common Sense, BFO and Physics")

June 2023 Second Global Workshop – OntoCommons addressing the challenges of the Industry 5.0 transition, University of Oslo, June 13-15 ("Manufacturing and Ontologies: (Air Force) Roots of the IOF", "BFO as ISO Standard", "Industrial Ontologies Foundry – Some Foundational Issues", "The Ontology of Organizations")

Enhanced Object-Based Production Conference, Washington DC, June 22-23 ("Basic Formal Ontology", "Stasis", "Warrant")

Open Source Biopharmaceutical Manufacturing Ontology, 2023 National Meeting of the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL), Washington DC, June 28, 2023 ("Industrial Ontologies Foundry", Video)

July 2023 EINS Interdisciplinary Summer School in Digital Health and Interdisciplinary School on Applied Ontology (IAOS), Université de Sherbrooke, Quebec, Canada, July 11, (Basic Formal Ontology 2023, Video).

Aug 2023 International Conference on Biomedical Ontology (ICBO), Brasilia, August 28-September 1 (Beyond the Goods-Services Continuum, Video and Keynote: AI in Medical Research)

Sep 2023 CBP Data Integration, Governance, and Applied Ontology Summit, Ashburn, VA, September 12 ("The Immigrant Life Cycle Ontology")

Oct 2023 BFO. IOF and PhysO/MathO considerations: Debate with Michael Halvorson, IOF Architecture Working Group Meeting, October 10 (Video, Slides)

Nov 2023 Essentialism, Mentalism and Apriorism in Austrian Economics, Università della Svizzera italiana, Lugano, Switzerland, November 9-10 ("On Some Historico-Mathematical Entities", Video)

AI: From Robotics to Philosophy: The Intelligent Robots of the Future – Or Human Evolutionary Development Based on AI Foundations, Hungarian Academy of Sciences, Budapest, November 25 ("ChatGPT: Not Intelligent" (online), Video)

Feb 2024 2024 Industrial Digital Ecosystem Summit, Arizona State University, Tempe AZ, February 5-9 ("Roles of Generically Dependent Continuants", "Capabilities")

Mar 2024 Will Machines Rule the World, Karel Čapek Center for Values in Science and Technology, Prague, March 11, 2024 ("Artificial Intelligence and the Future of Humanity")

Enhanced Object-Based Production. Part 2, Tampa, FL, March 21-22, ("Introduction to Referent Tracking")

Apr 2024 Discorso Sergio Ricossa 2024, OGR Tech and Bruno Leoni Institute, Turin, Italy, April 15 ("AI, Complex Systems, and the Indispensable Role of Human Will and Human Creativity", Video, Interview)

Free International University of Social Sciences (LUISS), Rome, Italy, April 16 ("The Indispensability of Human Creativity")

Netinsurance, Rome, Italy, April 17 ("AI and Risk Management")

WORKSHOPS AND CONFERENCES ORGANIZED

Mar 1977 Senses, Propositions, and States of Affairs, Department of Philosophy, University of Sheffield, March 4-5

Jun 1977 Hegel and Husserl Workshop, Department of Philosophy, University of Warwick, June 2-3

Dec 1977 Ontology and the Philosophy of Number, Seminar for Austro-German Philosophy and

Department of Philosophy, University of Sheffield, England, December 2-3

Jan 1978 Wittgenstein and the Background of Austro-German Philosophy, Seminar for Austro-German Philosophy and Department of Philosophy, University of Sheffield, England, January 21-22

Feb 1978 Colloquium, Seminar for Austro-German Philosophy and Department of Philosophy, University of Sheffield, England, February 10-12

Mar 1978 The Philosophy, Literature and Arts of Austria-Hungary, Seminar for Austro-German Philosophy in Conjunction with the Institute of Contemporary Arts, London, March 11

Apr 1978 Diverse Approaches to the Theory of Language, Seminar for Austro-German Philosophy and Department of Philosophy, University of Sheffield, England, April 7-8

May 1978 Whole-Part Theory and the History of Logic, Seminar for Austro-German Philosophy and Department of Philosophy, University of Sheffield, England, May 12-13

Jul 1978 Kant and Husserl: Varieties of Idealism, Seminar for Austro-German Philosophy and Department of Philosophy, University of Sheffield, England, July 1-2

Sep 1978 Psychology, Logic and Ontology, Seminar for Austro-German Philosophy and Department of Philosophy, University of Sheffield, England, September 29-30

Nov 1978 Phenomenology and Value Theory, Seminar for Austro-German Philosophy and Department of Philosophy, University of Sheffield, England, November 24-25

Jan 1979 Origins of the Twentieth Century, Seminar for Austro-German Philosophy and Department of Philosophy, University of Sheffield, England, January 27-28

May 1979 Phenomenology and Social Rules, Seminar for Austro-German Philosophy and Department of Philosophy, University of Sheffield, England, May 4-5

Jun 1979 On Austrian Methodology, Seminar for Austro-German Philosophy and Department of Philosophy, University of Sheffield, England, June 1-2

Jul 1979 Men Without Qualities: Philosophy and Literature in Austria and Germany, Seminar for Austro-German Philosophy and the Institute of Contemporary Arts, London, July 7-8

Nov 1979 Human Action and the Social Sciences, Seminar for Austro-German Philosophy and Department of Philosophy, University of Sheffield, England, November 10-11

Dec 1979 Grammar and the *Begriffsschrift*: A Centenary Celebration, Seminar for Austro-German Philosophy, Bedford College, London, December 15-16

Feb 1980 Formal Logic and Formal Ontology in Husserl's Logical Investigations, Seminar for Austro-German Philosophy and the Higher Institute of Philosophy, University of Louvain, Belgium, February 2-3 (Peter Simons and Barry Smith, "Synthetic A Priori Structures")

Apr 1980 Austrian Philosophy and Austrian Politics, Seminar for Austro-German Philosophy, the Carl Menger Society, and the Institute of Contemporary Arts, London, April 26-27

May 1980 Meaning and Structure, Seminar for Austro-German Philosophy and Department of Philosophy, University of Manchester, May 17-18

Nov 1980 A Seminar on the History of Logic, Seminar for Austro-German Philosophy and Department of Philosophy, University of Manchester, November 22-23

Jan 1981 A Symposium to Mark the Centenary of the First Edition of Kant's *Critique of Pure Reason*, Seminar for Austro-German Philosophy and the Northern Association for Philosophy, Manchester, January 31.

Mar 1981 Phenomenology and its Applications, Seminar for Austro-German Philosophy, University of Edinburgh, March 6-7

May 1981 Objects of Thoughts, Seminar for Austro-German Philosophy, Queen's College, London, 23-24 May

Jun 1981 Leibniz, Bolzano und die neue Ontologie, Seminar for Austro-German Philosophy and Institut für Philosophie, University of Salzburg, June 6-7

Feb 1982 Formal Ontologies, Seminar for Austro-German Philosophy and Department of Philosophy, University of Manchester, February 5-6

Mar 1982 The Austro-German/Scottish Axis, Seminar for Austro-German Philosophy and Department of Philosophy, University of Edinburgh, March 18-20 ("Relations of Ideas and A Priori Structures: Material Ontology from Hume to Husserl")

Jun 1982 Intentionalität als objektiver Bezug: Die Philosophie von Roderick M. Chisholm, Seminar for Austro-German Philosophy and Institut für Philosophie, University of Salzburg, June 10-11

("Intentionality, and Related Matters")

Aug 1982 Ehrenfels-Konferenz, Seminar for Austro-German Philosophy, sponsored by the Niederösterreichische Landesregierung, Schloss Lichtenau, Lower Austria, August 31-September 3

Jan 1983 Acts, Actions and Accidents, Seminar for Austro-German Philosophy and Bochum Cognitive Science Group, University of Bochum, January 7-8 ("Intentionality and the Theory of Relations")

Feb 1983 Realism and the Philosophy of Science, Seminar for Austro-German Philosophy and Northern Association for Philosophy, Manchester Polytechnic, February 25-26 (Jeremy Shearmur and Barry Smith, "Dialogues Concerning Naturalistic Realism")

Dec 1983 Symposium Adolf Reinach, Seminar for Austro-German Philosophy and Centrale Interfaculteit, University of Utrecht, December 9

Jun 1984 Foundations of Cognitive Psychology: The Work of Köhler, Selz and Lewin, Symposium of the Werner Reimers-Stiftung and the Seminar for Austro-German Philosophy, Bad Homburg, Germany, June 18-20

Dec 1984 Zur Philosophie und Sprachtheorie Anton Martys, Seminar for Austro-German Philosophy and University of Fribourg, Switzerland, December 7-9

May 1985 Phenomenology and Gestalt Theory. The History and Contemporary Relevance of Formal Ontology, Seminar for Austro-German Philosophy and Ecole des Hautes Etudes en Sciences Sociales, Paris, May 2-6

Symposium: Aspects of Continuity, Seminar for Austro-German Philosophy, University of Manchester, May 10-11 ("What is a Boundary?")

Aug 1985 Kunstgefühl, Sprachgefühl, Rechtsgefühl: Zum Problem des praktischen Wissens, Seminar for Austro-German Philosophy and Forschungsstelle für Österreichische Philosophie, Schloss Lichtenau, Lower Austria, August 26-27

Dec 1985 Symposium Alexander Pfänder, Seminar for Austro-German Philosophy and Centrale Interfaculteit, University of Utrecht, December 13

Nov 1986 100 Years of Polish Philosophy: An International Conference, Seminar for Austro-German Philosophy, University of Manchester, November 14-15

Mar 1989 Computer und Bildung. Praktische und theoretische Aspekte, International Academy for Philosophie, Schaan, Liechtenstein, March 31, 1989

Mar 1992 Philosophy and Political Change in Eastern Europe, Monist Colloquium sponsored by the Bradley and Soros Foundations in the Hungarian Academy of Sciences, Budapest

Feb 1993 European Philosophy and the American Academy, The Second Monist Colloquium, held at Wingspread, Wisconsin, February 12-14. 1993

Aug 1993 Philosophy and the Cognitive Sciences, 16th International Wittgenstein Conference, Kirchberg am Wechsel, Austria.

Jul 1994 First International Summer Institute in Cognitive Science (FISI-CS), University at Buffalo, July 5-30 (Co-Director, with Robert Van Valin).

Topological Foundations of Cognitive Science, Workshop organized as part of FISI-CS, Buffalo

Apr 1997 History of the Concepts of Space, Workshop sponsored by the Department of Philosophy, the Center for Cognitive Science, and the National Center for Geographic Information and Analysis of the University at Buffalo

Academic Freedom in Perspective. A Conference at Canisius College, Buffalo, NY, April 25-26

Oct 1997 The Origins of Property, Conference organized in the Department of Philosophy, University at Buffalo

Apr 1998 Applied Ontology. An International Conference on Law and Institutions in Society (Marvin Farber Conference), University at Buffalo, April 24-25

Jun 1998 Ontology of Fields. Research Meeting of the NSF Varenius Initiative, Bar Harbor, Maine

Aug 1998 Panel on the Philosophy of John Searle, World Congress of Philosophy, Boston

Nov. 1998 Symposium on: The Ontology of Integrated Products – The Microsoft/Netscape Browser Wars, Department of Philosophy. University at Buffalo (with David Koepsell)

Oct 1999 The Last Days of the Human Race: Karl Kraus Symposium, University at Buffalo

Aug 2000 Rationality and Irrationality. 23rd International Wittgenstein Symposium, Kirchberg, Austria, August 13-19

Oct	2001	Formal Ontology in Information Systems (FOIS 2001): Second International Conference, Ogunquit, Maine (with Chris Welty), October 17-19.
Apr	2002	Ontological Spring, Introductory Workshop in Ontology, Naumburg, Germany, April 17-20, 2002
Sep	2002	Academic Freedom and Intellectual Pluralism: US and Canadian Perspectives, Medaille College, Buffalo, September 20–21
Nov	2002	Ontology and WordNet, University of Leipzig, Germany, November 27
Mar	2003	After Modernism and Postmodernism: New Directions in the Arts, Hegeler Institute, La Salle, Illinois (with David R. Steele), March 28-30
Apr	2003	The Mystery of Capital and the Construction of Social Reality. A multi-disciplinary workshop with Hernando De Soto and John Searle, held in the University at Buffalo, sponsored by the National Science Foundation (with David Mark and Isaac Ehrlich), April 12-15
Sep	2003	Reference Ontology and Application Ontology, Workship at KI 2003: Annual Conference of the German Artificial Intelligence Society, Hamburg, Germany
May	2004	The Formal Architecture of the Gene Ontology, sponsored by the EU FP6 Network in Medical Informatics Semantic Datamining and the Max Planck Institute for Evolutionary Anthropology, Leipzig, May 28–29.
Jul	2004	Ontology Workshop, Summer School of the European Union Network of Excellence in Medical Informatics and Semantic Datamining, Balatonfüred, Hungary, 4–6 July 2004.
Nov	2004	Medicine and Metaphysics, University at Buffalo, Buffalo, NY, November 13-14
		Description Logics and Reasoning about Patient Data, Saarland University, Saarbrücken, Germany, November 22-23
		Ontology: Interoperability of Patient Records and Biomedical Informatics, November 25, Brussels, Belgian Ministry of Health and European Commission (organized in conjunction with EUROREC 2004)
Jan	2005	The Theory of European Unification, Europa Institute, University of Saarbrücken, Germany, January 18
Apr	2005	Mapping the Human Body, National Center for Ontological Research, Buffalo April 16-17
		Ontologies and Biomedical Informatics, International Medical Informatics Association Working Group 6, Rome, April 29–May 2 (with Jim Cimino)
Jul	2005	Workshop on Health Messaging Standards, Summer School of the European Union Network of Excellence in Medical Informatics and Semantic Datamining, Tihany, Hungary, 3 July 2005.
Oct	2005	Ontology and Cancer Bioinformatics: Joint Columbia-Buffalo Workshop, Hauptmann-Woodward Institute, Buffalo, October 14, 2005 (“The National Cancer Institute Thesaurus”)
		National Center for Ontological Research Inaugural Event, University at Buffalo, October 27, 2005 (Video)
		Workshop on Bio-Ontologies, University at Buffalo and National Center for Ontology Research, October 28, 2005 (“Symposium on the Gene Ontology”, with David Hill)
Mar	2006	Image Ontology Workshop, National Center for Biomedical Ontology, Stanford University, March 23-24, 2006
Apr	2006	The Metaphysics of E. J. Lowe, National Center for Ontological Research, University at Buffalo, April 8-9, 2006 (jointly with R. Dipert and D. Hershenov)
Sep	2006	Workshop on Model Organism Anatomy Ontology, Seattle, September 8-9, 2006.
Nov	2006	Workshop on Disease Ontology, Baltimore, November 6-7, 2006
		Biomedical Ontology in Action (KR-MED 2006), November 8, 2006, Baltimore, MD (with Olivier Bodenreider and Fabian Neuhaus)
		Genomics Knowledge Representation for Clinical Trials, Workshop, AMIA Annual Symposium, Washington, November 12, 2006
		Panel on the Future of HL7, AMIA Annual Symposium, Washington DC, November 14, 2006
		Ontology for the Intelligence Community (NCOR) Columbia, MD, November 30-December 1, 2006
Mar	2007	Towards Interoperability of Biomedical Ontologies, Dagstuhl Seminar, March 25-29, 2007
May	2007	Ontology of Clinical Trials. Workshop of the National Center for Biomedical Ontology, NIH

Campus, Bethesda, MD, May 16-17, 2007

Jun 2007 Reasoning with Biomedical Information: Training Course in Logic for Biomedical Research, Schloss Dagstuhl, 20-23 June 2007

Aug 2007 The EnvO Workshop: Developing an Ontology for Describing the Environments of Organisms and Biological Samples, UK National Environment Research Council, OERC: Oxford e-Research Centre, UK, August 29-31 (with Michael Ashburner, *et al*.)

Sep 2007 Infectious Disease Ontology, Cold Spring Harbor Laboratory, Long Island, NY, 19-21 September 2007, sponsored by the Burroughs Wellcome Fund (with Lindsay Cowell)

Nov 2007 EnvO Workshop II, Cold Spring Harbor Laboratories, November 15-16 (with Michael Ashburner, *et al.*)

Ontology for the Intelligence Community 2007, Columbia, MD and Mitre Corporation, November 28-30.

Dec 2007 Protein Ontology Kick-Off Meeting, Georgetown University, Washington DC, December 2-4 (with Darren Natale).

Feb 2008 Inaugural Conference of the Japanese Center for Ontological Research, February 26-27 (with Mitsu Okada).

Mar 2008 EnvO Workshop III, University of Manchester, UK, March 13-16, sponsored by the Genome Standards Consortium (with Michael Ashburner, *et al.*).

Ontology of Cellular Networks, Newark, NJ, March 26-27 (with Yves Lussier and Alan Ruttenberg)

Jun 2008 Evolutionary Biology and Ontologies Workshop. Organized as part of the Evolution 2008 Conference in the University of Minneapolis, MN on June 20 (with Paula Mabee, Todd Vision, Monte Westerfield)

Jul 2008 First OBO Foundry Summit Meeting, European Bioinformatics Institute, Hinxton, Cambridge, UK, July 7-8 (with Susanna Assunta-Sansone and the OBO Foundry Coordinating Editorial Board)

Sep 2008 Signs, Symptoms and Findings: First Steps Toward an Ontology of Clinical Phenotypes, University of Texas Southwestern Medical Center, Dallas, Texas, on September 3-4, (with Richard Scheuermann)

Second Information Artifact Ontology Workshop, University at Buffalo, September 15.

Second Infectious Disease Ontology Workshop, sponsored by the Burroughs Wellcome Fund, University at Buffalo, September 16-17 (with Lindsay Cowell)

Nov 2008 Second Annual Protein Ontology Meeting, Georgetown University, Washington DC, November 18-19

Jan 2009 Second Evolutionary Biology and Ontologies Workshop. Organized as part of the Annual Meeting of the Society for Integrative and Comparative Biology (SICB) in Boston, MA on January 5 with Paula Mabee, Todd Vision, Monte Westerfield)

Feb 2009 2nd Interdisciplinary Ontology Conference, Keio University, Tokyo, Japan, February 27-March 1 (with Mitsu Okada)

Jun 2009 Ontology-Driven Semantic Interoperability in eHealth, European Commission Directorate General Information Society and Media, Brussels, June 22-23 (with Ilias Iakovidis and Erwin Bartels)

Jul 2009 International Conference on Biomedical Ontology (ICBO), University at Buffalo, July 20-26

Sep 2009 Signs, Symptoms and Findings: Towards an Ontology for Clinical Phenotypes, Italian National Research Council Institute for Biomedical Technologies and University of Milan, September 4-5 (with Richard Scheuermann)

Feb 2010 Ontologies for the Virtual Physiological Human, February 14, European Bioinformatics Institute, Cambridge (with Bernard de Bono and Alan Ruttenberg)

3rd Interdisciplinary Ontology Conference, Keio University, Tokyo, Japan, February 26-28 (with Riichiro Mizoguchi)

Mar 2010 Ontology Summit 2010, National Institute of Standards and Technology (NIST), Gaithersburg, MD, March 15-16 (Co-Chair, with Steve Ray)

Apr 2010 Infectious Disease Ontology Collaborators Meeting, Duke University, Durham NC, April 6-9 (with Lindsay Cowell)

3rd Annual Protein Ontology Meeting, April 26-28, Newark, USA.

Sep 2010 Infectious Disease Ontology Workshop, 13th World Congress on Medical and Health Informatics (Medinfo 2010) in Cape Town, South Africa on September 11, 2010 (with Albert Goldfain and Lindsay Cowell)

Oct 2010 An Introduction to Ontology Building, Buffalo, October 23

Dec 2010 Workshop on Infectious Disease Ontology, Baltimore, MD, December 8-9 (with Lindsay Cowell)

Apr 2011 Workshop on Ontology Driven Implementation of Semantic Services for the Enterprise Environment (ODISSEE), sponsored by US Federal Government, Alion Science and Technology, and the National Center for Ontological Research, Washington DC, April 12-13 (with Lowell Vizenor)

Jun 2011 Ontology-Based Research on Medicare/Medicaid Data, School of Pharmacy and Pharmaceutical Sciences, University at Buffalo and Department of Pharmacological Sciences, Stony Brook University, Buffalo, NY, June 15.

Jul 2011 International Conference on Biomedical Ontology (ICBO), Buffalo, NY, July 26-30, 2011 (Conference Chair)

Sep 2011 Alzheimer's Research in the University at Buffalo, Buffalo, NY, September 2, 2011.

Oct 2011 Kick-Off Meeting, Alzheimer's Research Forum and Protein Ontology, Buffalo, NY, October 4-5, 2011(with Alan Ruttenberg and Cathy Wu)

Nov 2011 Basic Formal Ontology 2.0, Center of Excellence in Bioinformatics and Life Sciences, University at Buffalo, NY, November 10-11, 2011

Apr 2012 Ontology for the Intelligence Community, Training and Coordination Event for the US Army DSC Cloud, Aberdeen Proving Grounds, Aberdeen, MD, April 19-20, 2012

First Clinical and Translational Science Ontology Workshop, National Center for Biomedical Ontology, Baltimore, MD, April 25-26, 2012

May 2012 Basic Formal Ontology and the Signature Discovery Ontology, UB Ontology Research Group and the Pacific Northwest National Laboratory, CUBRC, Buffalo, NY, May 1-2, 2012

Jun 2012 Immunology Ontologies and Their Applications in Processing Clinical Data, Workshop sponsored by the National Center for Biomedical Ontology, and by the Protein Ontology and Infectious Disease Ontology Consortia, Buffalo, NY, June 11-13, 2012.

Jul 2012 Towards an Ontology of Mental Functioning, Workshop organized in conjunction with the Third International Conference on Biomedical Ontology (ICBO), Medical University of Graz, Austria, July 22, 2012

Aug 2012 Basic Formal Ontology 2.0 Preliminary Development Workshop, Center of Excellence in Bioinformatics and Life Sciences, National Center for Ontological Research. August 18-19

Feb 2013 Second Clinical and Translational Science Ontology Workshop, Orlando, FL, February 11-12, sponsored by the Translational Network of the University of Arkansas for Medical Sciences (with William Hogan and Melissa Haendel)

Apr 2013 Ontology for Information Integration: The Challenges of Big Data in Military, Security, and Intelligence Domains, NCOR Workshop, Buffalo, NY, April 18 (with Ron Rudnicki)

May 2013 Basic Formal Ontology 2.0 Development Workshop, National Center for Ontological Research, University at Buffalo, May 13-14

PRO-PO-GO: Challenges of Ontology Coordination Across Organisms, Plant Ontology Consortium, Protein Ontology Consortium and National Center for Biomedical Ontology, May 15-16

Sep 2013 ImmPort Ontology Conference, NIAID Bioinformatics Integration Support Contract (BISC), Stanford University, September 4-5

Oct. 2013 Training and Strategy for ImmPort Data Submitters, Rho Federal Systems Division, Chapel Hill, NC, October 9-10

June 2014 Protein Ontology Workshop, Georgetown University, DC, June 18-19

Ontology and Imaging Informatics; Third Clinical and Translational Science Ontology Workshop, University at Buffalo, NY, June 23-25

Sep 2014 Information Artifact Ontologies Workshop, co-located with Formal Ontology in Information Systems 2014, Rio de Janeiro, September 22

Oct	2014	MedDRA and Ontology, Technical Workshop, International Conference on Biomedical Ontology (ICBO), Houston, October 7
May	2015	The Role of Ontology in Big Cancer Data, National Cancer Institute, Bethesda, MD, May 12-13
Sep	2015	Information Meeting on Joint Doctrine Ontology, Multi-Agency Collaborative Environment (MACE) Fusion Center, Herndon, VA, September 16-17
		Ontology in Practice: Fourth Clinical and Translational Science Ontology Workshop, Charleston, SC, September 23-25 (with Jahid Obeid and William Hogan)
Nov	2015	Symposium on Military Codes of Ethics, University at Buffalo, November 2.
Feb	2016	Workshop on BFO and the Ontology of Deontic Entities, University of Florida School of Medicine, Gainesville, FL, February 17-19 (with William Hogan)
May	2016	Ontological Approaches to Sensor Data Analysis, National Center for Geographic Information and Analysis, Buffalo, NY, May 19-20 (with Ling Bian and Werner Kuhn)
Sep	2016	Clinical Terminology Shock and Awe, University at Buffalo, September 7-8 (with William Hogan)
Apr	2017	MatOnto Ontology Meetings, University at Buffalo, April 3-5.
Aug	2017	IAOA Summer Institute on Upper Ontologies, University of Toronto, August 8-11 (with Michael Grüninger, Stefano Borgo and Nicola Guarino)
Aug	2017	A Strategy for Promoting Data Interoperability Across the Enterprise. Workshop of the ASME 2017 International Design Engineering Technical Conferences (IDETC) and Computers & Information in Engineering Conference (CIE) (IDETC/CIE). Cleveland, OH, August 6
Oct	2017	Protein Ontology Consortium Workshop 2017, Bar Harbor, MN, October 11-12
		Microbiology for the CTSA: Ontological Approaches: Sixth Clinical and Translational Science Ontology Workshop, University of Michigan, Ann Arbor, October 24-25 (with Yongqun He, Amanda Hicks and William Hogan)
Jul	2018	The Industrial Ontologies Foundry (IOF) Workshop, Buffalo, NY, July 18-19
Apr	2018	Capabilities: Human and Machine, Workshop, University at Buffalo School of Engineering and Applied Sciences, April 20. Video
Sep	2018	Navy SYSCOM and DoD Ontology Workshop, Engility, Washington DC, September 18-19
Oct	2018	Relation Ontology 2018, University of Colorado, Denver, October 24-25 (with Larry Hunter and Chris Mungall)
Feb	2019	Ontology for Precision Medicine: From Genomes to Public Health, Orlando, FL February 20-21 (with William Hogan)
Oct	2019	Protein Ontology Consortium Workshop, Georgetown University Medical Center, October 23-24 (with Darren Natale)
Mar	2020	Industrial Ontologies Foundry Meeting, University at Buffalo, March 5.
Mar	2022	AI and Complex Systems in Biomedicine. Eighth Clinical and Translational Science Ontology Workshop: , Orlando, Florida, March 16-18 (with William Hogan)
May	2022	Ontology of Finance, Department of Philosophy, University at Buffalo, May 7 (with Gloria Sanso)
Sep	2022	International Conference on Biomedical Ontology (ICBO), University of Michigan, Ann Arbor, Workshop on Financial & Legal Dimensions of Healthcare, September 26 (with William Hogan).
Oct	2022	Ontology Day (Meeting of University at Buffalo and University of Toronto Ontologists), Department of Philosophy, University at Buffalo, October 24.
Feb	2023	Ontologies, AI and Electronic Health Records. 10th Clinical and Translational Science Ontology Workshop, Medical University of South Carolina, Charleston, February 23 - 24, 2023
May	2023	Basic Formal Ontology Summit Meeting, University of Buffalo, March 23-25 (with John Beverley)
Jun	2023	Enhanced Object-Based Production Conference, SAIC Rosslyn, Arlington VA, June 22-23 (with Carter-Beau Benson)
Feb	2024	2024 Industrial Digital Ecosystem Summit, Arizona State University, Tempe AZ, February 5-9 (co-organizer)

Barry Smith

PUBLICATIONS

May 6, 2024

Google scholar
PubMed
PhilPapers
Researchgate
Scholia
Semantic Scholar
Web of Science
ORnaccCID / Scopus / dblp / ResearcherID Scholia
loop

BOOKS

1. Barry Smith (ed.), *Structure and Gestalt: Philosophy and Literature in Austria-Hungary and Her Successor States*, Amsterdam: John Benjamins, 1981, x + 348pp.

Reviews:
P. M. Simons, *Conceptus*, 17 (1983), 131–134.
J. Shearmur, *Free Life*, 3/2 (1983), 16–17.
W. Stock, "Österreichische Philosophie", *Philosophischer Literaturanzeiger*, 37 (1984), 93–96.
R. Cardinal, *Explorations in Knowledge*, 2 (1985), 68–69.

2. Barry Smith (ed.), *Parts and Moments. Studies in Logic and Formal Ontology*, Munich: Philosophia, 1982, reprinted 2001, 564pp.

Reviews:
V. Muñoz Delgado, *Estudios Filosoficos*, (1982) 38, 611–613.
I. Niiniluoto, *Zentralblatt für Mathematik*, (1983) 489, 15–16.
D. P. Henry, *History and Philosophy of Logic*, (1983) 4, 228–229.
F. G. Asenjo, *Rivista Latinoamericana de Filosofía*, (1983) 9, 174–177.
U. Charpa, "Neues zur Lehre von den Ganzen und Teilen", *Philosophische Rundschau*, 1/2 (1984), 52–59.
J.M. Salanskis, "Parties, Moments et Modalités", *Critique*, 443 (1984), 290–296.
R. Sokolowski, *Review of Metaphysics*, 38 (1984), 140–142.
B. Schuwey, *Philosophy and Phenomenological Research*, 45 (1985), 474–476.
G. Berger, *Noûs*, (1986) 20, 115–121.
J. Woleński, "Czeski i momenty", *Studia Filozoficzne*, 1–2/242–243 (1986), 191–195.
D. Münch, *Philosophischer Literaturanzeiger*, 39 (1986), 272–276.
R. Casati, "Laboratorio husserliano", *Fenomenologia e scienze dell'uomo*, 2/1 (1986), 283–287.
R. Tragesser, *Husserl Studies*, 5 (1988), 169–173.
N. Hentschel, *Zeitschrift für Ganzheitsforschung*, 32 (1988), 137–139.
G. Schenk, *Wissenschaftliche Zeitschrift der Universität Halle*, 39 (1990), 116–118.

3. Wolfgang Grassl and Barry Smith (eds.), *Austrian Economics: Historical and Philosophical Background*, New York: New York University Press, London/Sydney: Croom Helm, 1986, x + 250pp. Reprint, London: Routledge, 2010.

Reviews:
A. W. Dnes, *Scottish Journal of Political Economy*, 33 (1986), 391–395.
B. J. Loasby, *Economic Journal*, 96 (1986), 1165–1166.
R. Ebeling, "The Roots of Austrian Economics", *Market Process*, 5 (1987), 20–22, repr. in S. C. Littlechild, ed., *Austrian Economics,* vol. 1, Aldershot/Brookfield VT: Edward Elgar, 38–40.
J. Walker, *Journal of Economic Studies*, 14 (1987), 67–68.
M. Rothbard, *Journal of Applied Philosophy*, 4 (1987), 248–250.
J. A. Tucker, *Austrian Economics Newsletter*, (Fall 1988), 10–11.

4. Barry Smith (ed.), *Foundations of Gestalt Theory*, Munich and Vienna: Philosophia, 1988, 495pp.

Reviews:
J. Schulte, *Lingua e Stile*, 23 (1988).
V. Fano, "Gestalt e genesi precategoriale", *Annali*, 9 (1988), 165–181.
J. L. Gardies, *Revue philosophique de la France et de l'Etranger*, 179 (1989), 119.
V. MuZoz-Delgado, *Estudios*, 46 (1990), 134–135.
C. G. Allesch, *Conceptus* 24 (1990), 106–107.
C. Porebski, *Philosophischer Literaturanzeiger*, 43 (1990), 176–178.
D. Münch, *History and Philosophy of Logic*, 11 (1990), 238–240.
C. G. Allesch, *Zeitschrift für klinische Psychopathologie und Psychotherapie*, 37 (1989), 476–477.
J. M. Salanskis, "Le concept de Gestalt et la situation contemporaine de la philosophie des sciences", *Les Etudes philosophiques*, 4 (1990), 519–536.
J. Wolenski, *Ruch Filozoficzny*, 17 (1990), 162–164.
E. and J. Dölling, *Deutsche Literaturzeitung*, 112 (1991), 189–192.

5. J. C. Nyíri and Barry Smith (eds.), *Practical Knowledge: Outlines of a Theory of Traditions and Skills*, London/Sydney/New York: Croom Helm, 1988, ix + 213pp.

Reviews:
T. Whittock, *British Journal of Aesthetics*, 29 (1989), 191–192.
F. Adams, *Canadian Philosophical Reviews*, 9, (1989), 283–285.
J. M. Heaton, *Journal of the British Society for Phenomenology*, 21 (1990), 299–300.

R. T. Allen, *Tradition and Discovery*, 17 (1990/91), 36–38.

6. Adolf Reinach, *Sämtliche Werke. Kritische Ausgabe mit Kommentar*, Band I: *Die Werke*, Teil I: *Kritische Neuausgabe (1905–1914)*, Teil II: *Nachgelassene Texte (1906–1917)*; Band II: *Kommentar und Textkritik*, Munich/Hamden/Vienna: Philosophia, 1989, critical edition with commentary by Karl Schuhmann and Barry Smith, 2 vols., xx + 848pp.

Reviews:
U. H. D., *Bibliographie de la Philosophie*, 36 (1989), 147.
M. Crespo, *Diálogo Filosófico,* 6 (1990), 274.
J. Seifert, *Prima Philosophia*, 3 (1990), 408–415.
B. Waldenfels, *Philosophische Rundschau,* 37 (1990), 348.
J. Machnacz, *Zycie katolickie*, (1990), 147–150.
V. Munoz Delgado, *Estudios*, 46 (1990), 161–162.
J. Seifert, *Philosophischer Literaturanzeiger*, 44 (1991), 24–29.
N. Duxbury, "Apriori Philosophy and Legal Ontology", *Archiv für Rechts- und Sozialphilosophie*, 77 (1991), 262–266.
P. Gorner, *Journal of the British Society for Phenomenology*, 25(3), (1994), 309-311.

7. Hans Burkhardt and Barry Smith (eds.), *Handbook of Metaphysics and Ontology*, 2 vols., Munich/Philadelphia/Vienna: Philosophia, 1991, reprinted 2001, xxv + 1,005pp.

Reviews:
J. M. Perreault, *Choice*, (April 1992), 38–39.
A. C. Grayling, *Times Literary Supplement*, (17 April 1992), 26.
S. Scharnagl, *Bayernkurier*, (24 October 1992).
Guillermo Hurtado, *Tópicos*, vol. II, núm. 3, (1992).
O. R. Scholz, *Frankfurter Allgemeine Zeitung*, (15 September 1992).
Roberto Poli, *History and Philosophy of Logic*, 24 (1992), 258–260.
James DuBois, *Review of Metaphysics*, 47 (1993), 391–392.
Roberto Poli, *Axiomathes*, 1 (1993), 140–142.
John Haldane, Philosophical Quarterly, 43 (1993), 130.
Michele Marsonet, *Epistemologia*, 16 (1993), 345–347.
M. Moors, *Tijdschrift voor Filosofie*, 56 (1994), 161–162.
Fran Mau, *Philosophischer Literaturanzeiger*, 47 (1994), 54–56.
Timothy Joseph Day, *Minds and Machines*, 5 (1995), 131–134.
Stanley Paulson, *Philosophical Books*, 44: 2 (2003), 135–153.

8. Barry Smith (ed.), *Philosophy and Political Change in Eastern Europe* (The Monist Library of Philosophy), La Salle: The Hegeler Institute, 1993, vi + 192pp.

Reviews:
D. Cross, *Small Press*, (Winter 1994/95).
A. R. Brunello, *Choice*, (December 1994).
Nebojsa Kujundzic, *Dialogue,* 36 (1997), 648–650.
T. Sunic, *CLIO*, 24 (1995), 440–443.

9. C. Eschenbach, C. Habel and B. Smith (eds.), *Topological Foundations of Cognitive Science,* Hamburg: Graduiertenkolleg Kognitionswissenschaft Hamburg, Bericht 37, November 1994.

10. Barry Smith, *Austrian Philosophy: The Legacy of Franz Brentano*, La Salle and Chicago: Open Court, 1994, xiii + 381pp. Paperback edition: 1996.

Reviews:
Terry Skeats, *Library Journal*, 119 (1 September 1994), 185.

J. Barker, *Choice*, 32 (March 1995), 1136.
Ulf Höfer, *Nachrichten. Forschungsstelle und Dokumentationszentrum für Österreichische Philosophie*, 6 (1995), 55–58.
Kurt R. Fischer, *Vienna Circle Institute Yearbook*, 3 (1995), 303–304.
S. Gandon, "La philosophie autrichienne", *Critique*, 51 (October 1995), 794–796.
David Gordon, "Why the Austrian School is Austrian", *The Mises Review,* 1:4 (1995), 18–21.
Winfried Löffler, *Kontroversen in der Philosophie*, 8 (1995), 99–107.
Susan Krantz, *Brentano Studien*, 6 (1995/96), 325-327.
Richard Beach, *Canadian Philosophical Reviews*, 16 (1996), 62–64.
Werner Diederich and Eva Picardi, *Erkenntnis*, 45 (1996), 123–127.
Francis Dunlop, *Journal of the British Society for Phenomenology*, 27 (1996), 330–332.
Sonja Rinofner-Kreidl, *Grazer* Philosophische *Studien*, 52 (1996/97), 191–220.
Robin D. Rollinger, *Journal of the History of Philosophy*, 35 (1997), 314–315.
Kelley, L. Ross, *The Proceedings of the Friesian School*, 4 (1998).
Pierre Keller, *Modern Austrian Literature*, 29 (1996), 180–184.
Gisela Kubon-Gilke, *Gestalt Theory* (1996), 157–158.
Johannes Brandl, *Philosophy and Phenomenological Research*, 57 (1997), 697–702.
Manuel Durand-Barthez, *Revue de Metaphysique et de Morale* (1999), 3, 427-428.

11. Barry Smith (ed.), *European Philosophy and the American Academy* (The Monist Library of Philosophy), La Salle: The Hegeler Institute, 1994, viii + 226pp.

Reviews:
Barry Gross, *Academic Questions*, 8 (1995), 88–93.
David C. Jacobs, *Teaching Philosophy*, 19 (1996), 306–310.

12. Barry Smith and David W. Smith (eds.), *The Cambridge Companion to Husserl*, Cambridge and New York: Cambridge University Press, 1995, x + 519pp. Reprinted 1996.

Reviews:
Michel Bourdeau, "Les nouveaux habits du Professeur Husserl", *Critique*, 593 (1996), 893–907.
Brice R. Wachterhauser, *Ethics* 107 (October 1996), 198.
J. A. Bell, *Choice* 33 (February 1996), 961.
P. Buckley, *Tijdschrift voor Filosofie*, 58 (1996), 768–769.
Paul S. MacDonald, *Philosophical Writings*, 2 (1996), 109-110.
R. P. Buckley, *Canadian Philosophical Reviews*, 16 (1996), 294–296.
Michael Inwood, *International Philosophical Quarterly* 36/4 (1996), 490–493.
Paul Gorner, *The Philosophical Quarterly*, 48 (1998), 419–422.
Wojciech Zelaniec, *Brentano Studien*, 6 (1997), 334–339.
M. J. Larrabee, *Philosophical Review*, 106 (1997), 283–286.
Guillermo E. Rosado Haddock, "Edmund Husserl: A Philosopher for all Seasons?" *Modern Logic*, 7 (1997), 380–395.
Jonathan Barnes, "Just a Swipe at Edmund", *Dialectica*, 53: 2 (1999), 151–154.

13. Balázs Mezei and Barry Smith, *The Four Phases of Philosophy* (Studien zur österreichischen Philosophie), Amsterdam / Atlanta: Rodopi (with appendix: "The Four Phases of Philosophy" by Franz Brentano, translated from the German by Balász Mezei and Barry Smith), 1999, iv + 122pp.

Reviews:
Wolfgang Huemer, *Philosophy in Review* (*Comptes rendus philosophiques*), 20 (2000), 206–209.

14. Barry Smith (ed.), *Liberal Education in a Knowledge Society*, Chicago and La Salle, IL: Open Court, 2002, x + 294 pp.

Review:
Ed Brandon, *Metapsychology*, Jan 19, 2004

15. Barry Smith (ed.), *John Searle*, Cambridge and New York: Cambridge University Press, 2003, 312 pp.

Reviews:
Constantine Sandis, *Metapsychology*, 8 (4), 2004.
Rodych, Victor, *Philosophy in Review (Comptes rendus philosophiques)*, 24(5), (2004), 365-367.
Richard De Blacquière-Clarkson, *Philosophical Writings*, 26 (2004), 75-77.
Briggs, Richard S. *Heythrop Journal: A Bimonthly Review of Philosophy and Theology*, 46(2), (2005), 270-272.
P. Madigan "John Searle", *Heythrop Journal: Quarterly Review of Philosophy and Theology* 47 (2), 2006, 335-337.

16. Aurel Kolnai, *On Disgust*, Barry Smith and Carolyn Korsmeyer (eds.), Chicago: Open Court, 2003, viii + 120 pp.

Abstract: Kolnai made a breakthrough in the phenomenology of aversion when he showed the "double intentionality" of emotions like fear, focusing on both the object of fear and the subjects' concern for his own well-being, this being one of the ways in which fear differs from disgust. In a surprising yet persuasive move, Kolnai argues that disgust is never related to inorganic or non-biological matter, and that its arousal by moral objects has an underlying similarity with its arousal by organic material: a particular combination of life and death. Kolnai gives an analytic list of various kinds of disgusting objects (which should not be read just before lunch) and shows how disgust relates to the five senses.

Review:
Francis Raven, *Journal of Aesthetics and Art Criticism,* 2004, 62 (4): 408-409.

17. Barry Smith, David Mark and Isaac Ehrlich (eds.), *The Mystery of Capital and the Construction of Social Reality*, Chicago: Open Court, 2008, xxiv + 360 pp.

Reviews:
Wolfgang Grassl, *Journal of Markets and Morality*, 11(2), 2008, 343-345.
Maksymilian Del Mar, *Dialectica*, 63(3), 2009, 365-368

18. Katherine Munn and Barry Smith (eds.), *Applied Ontology: An Introduction* (free download as e-book), Frankfurt/Lancaster: ontos/Walter de Gruyter, 2008, 342 pp.

Reviews:
Peter Simons, "Ontology Meets Ontologies: Philosophers as Healers", *Metascience*, 18(3), 2009, 469-473.
Joshua Gordon, *Education for Information*, 27(4), 2009, 231-234.
Sanfilippo E. M., *Rivista Italiana di Filosofia Analitica Junior*, 2:2 (2011), 137-40.

19. Ludger Jansen and Barry Smith (eds.), *Biomedizinische Ontologie. Wissen strukturieren für den Informatik-Einsatz* (UTB Forum), Zurich: vdf, 2008, 252 pp. As e-book (revised): Zürich: vdf, 2011.

20. Robert Arp, Barry Smith and Andrew Spear, *Building Ontologies with Basic* Formal *Ontology*, Cambridge, MA: MIT Press, August 2015, xxiv + 220pp.

Chinese translation, **基于基本形式化本体的本体构建**, Beijing: **人民卫生出版社** (People's Medical Publishing House), October 2020, translated by Yan Zhu and Yongqun He, assisted by Jie Zheng, Xiaoying Li, Xiaolin Yang.

MIT Press Scholarship Online

Abstract: In the era of "big data," science is increasingly information driven, and the potential for computers to store, manage, and integrate massive amounts of data has given rise to new disciplinary fields such as biomedical informatics. Applied ontology offers a strategy for organizing scientific information in computer-tractable form, drawing on concepts not only from computer and information science but also from linguistics, logic, and philosophy. This book provides an introduction to the field of applied ontology that is of particular relevance to bio-medicine, covering theoretical components of ontologies, best practices for ontology design, and examples of biomedical ontologies in use. After defining an ontology as a representation of the types of entities in a given domain, the book distinguishes between different kinds of ontologies and taxonomies, and shows how applied ontology draws on more traditional ideas from metaphysics. It presents the core features of the Basic Formal Ontology (BFO) now used by over 100 ontology projects throughout the world, and offers examples of domain ontologies that utilize BFO. The book also describes the Web Ontology Language (OWL), a common framework for Semantic Web technologies. Throughout, the book provides concrete recommendations for the design and construction of domain ontologies.

Reviews:
Neil Mcnaughton, Oil IT Journal, 3, 2016.
Martin Frické, *Journal of the Association for Information Science and Technology*, 68, 3 (March 2017), 801–804.

21. Jobst Landgrebe and Barry Smith, *Why Machines Will Never Rule the World: Artificial Intelligence Without Fear*, Abingdon, UK: Routledge, 2022, xii+342pp.

Reviews:
Bert Gambini "Book: AI is cool, but nowhere near human capacity, *Futurity*, Aug. 12, 2022
Ken Archer, "Why Machines Will Never Rule the World", September 14, 2022
"Computer takeover won't happen, say a scientist and philosopher", *Mind Matters*, October 4, 2022
Elkin *Journal of Knowledge Structures & Systems*, 3 (4), Oct./Dec. 2022, 38-41
Aditya Aswani, "Will AI Actually Surpass Human Intelligence?", *Less Wrong*, December 29, 2023
Fabian Nicolay, "Der Mythos von der Künstlichen Intelligenz", *Achgut*, January 14, 2023
Hawley, Jeff (2022). The robots are coming: What's happening in philosophy, *Philosophynews.com*, August 22, 2022
Ken Archer, Post, September 24, 2022
Irrlichter und Fixsterne: Matthias Matussek im Gespräch mit Jobst Landgrebe, *Matussek Kontrafunk No 15*, January 2023
Matt Duckham, Why machines will never rule the world, *The Hat Cupboard,* March 19, 2023
William J. Rapaport, "Is Artificial General Intelligence Impossible?", May 2023
Mind Matters, May 2023
Interview with Jobst Landgrebe, Reality Check Radio, May 23, 2023
Astral Codex Ten, Thomas Jefferson Snodgrass, Why Machines Will Never Rule the World, November 14, 2023, finalist in the Astral Codex Ten Book Review Contest
Reddit. Your book review (Comments on Astral Codex X). August 2023
Daniel Kelly, The Supposed Looming Specter of Artificial General Intelligence, CATT Blog, October 18, 2023
Peter Gärdenfors, Why Machines Won't Take Over the World, March 2024, originally published in Swedish as Varför AI inte kommer att ta över världen, *Sans,* 2024, 2
In Dubio, KO durch K.I.?, Interview with Jobst Landgrebe, April 21, 2024
Artificial Intelligence Will not Dominate the World, April 27, 2024

EDITED CONFERENCE PROCEEDINGS

1. Roberto Casati, Barry Smith and Graham White (eds.), *Philosophy and the Cognitive Sciences*, Vienna: Hölder-Pichler-Tempsky 1994, viii + 682pp.

2. Berit Brogaard and Barry Smith (eds.), *Rationality and Irrationality*, Vienna: öbv&hpt, 2001, 411 pp.

3. Christopher Welty and Barry Smith (eds.), *Formal Ontology in Information Systems*, New York: ACM Press, 2001, xvi + 348 pp.

4. Pierre Grenon, Christopher Menzel and Barry Smith (eds.), *Proceedings of the KI 2003 Workshop on Reference Ontologies and Application Ontologies*, Hamburg, Germany, September 16, 2003. CEUR Workshop Proceedings 94.

5. Mitsuhiro Okada and Barry Smith, *Interdisciplinary Ontology. Proceedings of the First Interdisciplinary Ontology Meeting* (Tokyo, Japan, February 26-27, 2008), Tokyo: Keio University Press, 2008.

6. Mitsuhiro Okada and Barry Smith (eds.), *Interdisciplinary Ontology. Proceedings of the Second Interdisciplinary Ontology Meeting* (Tokyo, Japan, February 28-March 1, 2009), Tokyo: Keio University Press, 2009, iv + 166 pp.

7. Barry Smith (ed.) *ICBO 2009: Proceedings of the First International Conference on Biomedical Ontology* (Buffalo, NY, July 24-26, 2009). Buffalo: National Center for Ontological Research, 2009.

8. Barry Smith, Riichiro Mizoguchi and Sumio Nakagawa (eds.), *Interdisciplinary Ontology. Proceedings of the Third Interdisciplinary Ontology Meeting* (Tokyo, Japan, February 27-28, 2010), Tokyo: Keio University Press, 2010.

9. Mitsuhiro Okada and Barry Smith (eds.), *Interdisciplinary Ontology. Proceedings of the Fifth Interdisciplinary Ontology Meeting* (Tokyo, Japan, February 23-24, 2012), Tokyo: Keio University Press, 2012, iv + 159 pp.

JOURNAL SPECIAL ISSUES

1. Barry Smith and Richard Scheuermann (eds.), *Ontologies for Clinical and Translational Research* (Special issue of the *Journal of Biomedical Informatics)*, Amsterdam: Elsevier, 2011, 176 pp.

> **Abstract:** A collection of original papers focusing on the ways in which biomedical ontologies are being used in attempts to break down the barriers between the many different sorts of information relevant to the understanding and treatment of disease, ranging from information deriving from experimental biology and model organism research to clinical trial data and information of the sort contained in electronic health records. The contributions represent both the state of the art and works in progress, and they reveal how far we still have to go if we are to reach the level of domain coverage and semantic consistency sought by those engaged in information-driven clinical and translational research.

2. Stefano Borgo, Riichiro Mizoguchi and Barry Smith (eds.) *The Ontology of Functions* (Special issue of *Applied Ontology*), Amsterdam: IOS Press, 6 (2), 2011, 64 pp.

> **Abstract:** This special issue of *Applied Ontology* is devoted to the foundation, the comparison and the application of functional theories in all areas, with particular attention to the biological and engineering domains. It includes theoretical and technical contributions related to the description, characterization, and application of functions.

3. Andreas Tolk and Barry Smith (eds.), *Command and Control Ontology* (Special issue of the *International Journal of Intelligent Defence Support Systems*), 4 (3), 2011, 98 pp.

Abstract: Intelligent defence support systems are confronted with the need to manage ever-increasing floods of data in a way that raises significant challenges because the data are described and presented using different terminologies and formats. How, on this basis, is it possible to reach a common understanding of the information content of these data among people and software agents? How is it possible to ensure that domain knowledge is reused in consistent fashion in a way that makes this information available for integration and analysis? How can we support the identification, selection, composition, and orchestration of services based on such diverse data providing homogeneous support by a service-oriented architecture? This collection is devoted to the use of ontologies to answer questions such as these.

4. Sonia Kamińska and Barry Smith (eds.), *The Philosopher Franz K* (Special issue of the *Polish Journal of Aesthetics*) 53 (2), 2019.

5. Gloria Sansò & Barry Smith (eds.), *Ontology of Finance*, Rosenberg & Sellier (forthcoming).

Abstract: One famous scene in *The Wolf of Wall Street* (2013) is the dialogue between the young Jordan Belfort (Leonardo DiCaprio) and the expert trader Mark Hanna (Matthew McConaughey). Hanna is complaining that the stock market is unpredictable; it's "fugazi … it's fairy dust. It doesn't exist. It's never landed. It is not matter. It's not on the element chart. It's not real". But the fact that something is unpredictable and non-physical does not imply that it does not exist. On the other hand, its unpredictability, non-physicality, and the fact that the stock market trend is largely determined by investors' beliefs, do make its nature difficult to grasp. This special issue of Rivista di Estetica aims to explore the financial sector from an ontological point of view. While the ontology of money has been extensively studied, few scholars have focused on the stock market and, more generally, on those entities belonging to the investment landscape. Matters are made more complicated by the fact that the financial sector is characterized by an ever-increasing use of digital technology, including software elements that trade in the market themselves. We believe that a careful study of this phenomenon may help us better to understand the role of artificial agents in the social world.

REFEREED ARTICLES IN SCHOLARLY JOURNALS

1. Barry Smith, "The Ontogenesis of Mathematical Objects", *Journal of the British Society for Phenomenology*, 6 (1975), 91–101.

Abstract: Mathematical objects are divided into (1) those which are autonomous, i.e., not dependent for their existence upon mathematicians' conscious acts, and (2) intentional objects, which are so dependent. Platonist philosophy of mathematics argues that all objects belong to group (1), Brouwer's intuitionism argues that all belong to group (2). Here we attempt to develop a dualist ontology of mathematics (implicit in the work of, e.g., Hilbert), exploiting the theories of Meinong, Husserl and Ingarden on the relations between autonomous and intentional objects. In particular we develop a phenomenology of mathematical works, which has the stratified intentional structure discovered by Ingarden in his study of the literary work.

2. Barry Smith, "Frege and Husserl: The Ontology of Reference", *Journal of the British Society for Phenomenology*, 9 (1978), 111–125.

Abstract: Analytic philosophers apply the term 'object' both to concreta and to abstracta of certain kinds. The theory of objects which this implies is shown to rest on a dichotomy between object-entities on the one hand and meaning-entities on the other, and it is suggested that the most adequate account of the latter is provided by Husserl's theory of noemata. A two-story ontology of objects and meanings (concepts, classes) is defended, and Löwenheim's work on class-representatives is cited as an indication of how the need for higher types may be obviated, even in mathematical contexts. The paper concludes with a sketch of the taxonomy of the object realm which results from the above.

3. Barry Smith, "An Essay in Formal Ontology", *Grazer Philosophische Studien*, 6 (1978), 39–62.

Abstract: This paper is both a working introduction to the realist ontological theory put forward by the Polish phenomenologist Roman Ingarden and also a development of Ingarden's views in

the light of current tendencies in analytic philosophical logic. The central theme of the paper is the ontological analysis of states of affairs, and in particular of negative states of affairs, a topic which is of some specific interest in forming a connecting link between the Brentano-Meinong-Husserl tradition to which Ingarden belonged, and the (Frege)-Russell-Wittgenstein tradition which gave rise to modern philosophical logic.

4. Barry Smith, "Law and Eschatology in Wittgenstein's Early Thought", *Inquiry*, 21 (1978), 425–441.

Abstract: The paper investigates the role played by ethical deliberation and ethical judgment in Wittgenstein's early thought in the light of twentieth-century German legal philosophy. In particular the theories of the phenomenologists Adolf Reinach, Wilhelm Schapp and Gerhart Husserl are singled out, as resting on ontologies which are structurally similar to that of the *Tractatus*. In each case it is actual and possible *Sachverhalte* which constitute the prime ontological category. The study of the relationship between the states of affairs depicted, e.g., in the sentences of a legal trial and prior fact-complexes to which these may correspond suggests one possible connecting link between the logical and ontological sections of the *Tractatus* and the ethical reflections appearing at the end. It is argued that the latter can best be understood in terms of the idea of a "last judgment" (with its associated ethical rewards and punishments) which would relate to the world as a whole as a penal trial relates to individual complexes of facts.

5. Barry Smith, "Ingarden vs. Meinong on the Logic of Fiction", *Philosophy and Phenomenological Research*, 16 (1980), 93–105.

Abstract: For Meinong, familiarly, fictional entities are not created, but rather merely discovered (or picked out) from the inexhaustible realm of Aussersein (beyond being and non-being). The phenomenologist Roman Ingarden, in contrast, offers in his *Literary Work of Art* of 1931 a constructive ontology of fiction, which views fictional objects as entities which are created by the acts of an author (as laws, for example, are created by acts of parliament). We outline the logic of fiction which is implied by Ingarden's approach, showing how it distinguishes the *properties* possessed by fictional objects (for instance of having been created by such and such an author in such and such a work) from *characteristics* (for instance of smoking a pipe, of living in Baker Street) which are merely associated with such objects.

Polish translation as: "Ingarden versus Meinong o logice fikcji", in Z. Muszyński (ed.), *Z badań nad prawdą i poznaniem*, Lublin: Wydawnictwo UMC-S (1998), 283–296.

6. Barry Smith, "Logic, Form and Matter", *Proceedings of the Aristotelian Society*, *Supplementary Volume* 55 (1981), 47–63.

Abstract: It is argued on the basis of ideas derived from Wittgenstein's *Tractatus* and Husserl's *Logical Investigations* that the formal comprehends more than the logical. More specifically: that there exist certain formal-ontological constants (part, whole, overlapping, etc.) which do not fall within the province of logic. A two-dimensional directly depicting language is developed for the representation of the constants of formal ontology, and means are provided for the extension of this language to enable the representation of certain materially necessary relations. The paper concludes with a discussion of the relationship between formal logic, formal ontology and mathematics.

7. Barry Smith, "Osztrák és magyar filozófia: Wittgenstein és Pauler logikájáról", *Magyar Filozófiai Szemle* (1981), 139–144.

8. Barry Smith and Kevin Mulligan, "Framework for Formal Ontology", *Topoi*, 3 (1983), 73–85.

Abstract: We draw on the distinction first expounded by Husserl between formal logic and formal ontology. The former concerns itself with (formal) meaning-structures; the latter with formal structures amongst objects and their parts. The paper attempts to show how, when formal ontological considerations are brought into play, contemporary extensionalist theories of part and whole, and above all the mereology of Leniewski, can be generalised to embrace not only relations between concrete objects and object-pieces, but also relations between what we

shall call dependent parts or moments. A two-dimensional formal language is canvassed for the resultant ontological theory, a language which owes more to the tradition of Euler, Boole and Venn than to the quantifier-centred languages which have predominated amongst analytic philosophers since the time of Frege and Russell. Analytic philosophical arguments against moments, and against the entire project of a formal ontology, are considered and rejected.

9. Barry Smith, "Weininger und Wittgenstein", in B. F. McGuinness and A. Gargani (eds.), *Wittgenstein and Contemporary Philosophy* (*Teoria*, 5), Pisa: ETS (1984), 156–165.

Abstract: The paper seeks to show how Weininger's interpretations of Kant and Schopenhauer help us to understand some of the peculiar reflections on the will, on happiness and unhappiness, and on the problems of life, which are to be found in Wittgenstein's *Notebooks*. It seeks to explain, above all, why Wittgenstein should wish to reject the basic ethical axiom of "love thy neighbor." There follows a sketch of one possible Kantian interpretation of the *Tractatus* along Weiningerian lines. The conclusion is drawn, however, that, while in the *Notebooks* many of Weininger's views are still accepted, by the time of the *Tractatus* Wittgenstein has moved to a position in which a thinker like Weininger must be conceived as propounding so much more "ethical nonsense." Wittgenstein adopts in the *Tractatus* a wholly new conception of the ethical, a form of logical individualism or quietism.

Romanian translation in *Revista de filosofie,* 49, (2002), 233-246.

10. Barry Smith, "Acta cum fundamentis in re", *Dialectica*, 38 (1984), 157–178.

Abstract: The paper defends a theory of mind according to which certain sorts of acts are 'real material relations' and compares this theory to causal theories of reference and perception. All mental acts are dependent for their existence upon the subject (person, organism) whose acts they are. Relational acts are dependent also on intended objects in the world. The relational theory thus implies a rejection of the Cartesian thesis to the effect that we could in principle have exactly the same thoughts even though the objects of these thoughts did not exist. It implies thereby also a rejection of Husserlian phenomenology. Husserl's earlier work on the formal ontology of part, whole and dependence nevertheless provides a framework which can allow a precise formulation of the relational theory.

11. Barry Smith, "Ten Conditions on a Theory of Speech Acts", *Theoretical Linguistics*, 11 (1984), 311–330.

Abstract: It is now generally recognized that figures such as Reid, Peirce, and Reinach formulated theories of speech acts avant la lettre of Austin and Searle, in Reid and Reinach's cases under the heading 'theory of social acts'. Here we address the question as to what conditions would have to be satisfied for such theories to count as 'theories of speech acts' in the now familiar sense.

12. Kevin Mulligan, Peter M. Simons and Barry Smith, "Truth-Makers", *Philosophy and Phenomenological Research*, 44 (1984), 287–321.

Abstract: A realist theory of truth for a class of sentences holds that there are entities in virtue of which these sentences are true or false. We call such entities 'truthmakers' and contend that those for a wide range of sentences about the real world are moments (dependent particulars). Since moments are unfamiliar, we provide a definition and a brief philosophical history, anchoring them in our ontology by showing that they are objects of perception. The core of our theory is the account of truthmaking for atomic sentences, in which we expose a pervasive 'dogma of logical form', which says that atomic sentences cannot have more than one truthmaker. In contrast to this, we uphold the mutual independence of logical and ontological complexity, and the authors outline formal principles of truthmaking taking account of both kinds of complexity. We conclude by suggesting how to overcome the problem of negation faced by an account of truth in keeping with Wittgenstein's *Tractatus*.

Reprinted in Jean-Maurice Monnoyer, *Metaphysics and Truthmakers*, Frankfurt/Lancaster/New Brunswik: Ontos, 9-50.

Reprinted in E. J. Lowe and A. Rami (eds.), *Truth and Truth-Making*, Chesham: Acumen (2009), 59-86.

German translation as: "Wahrmacher", in L. Bruno Puntel (ed.), *Der Wahrheitsbegriff. Neue Explikationsversuche* (a collection of readings on modern theories of truth), Darmstadt: Wissenschaftliche Buchgesellschaft (1987), 210–255.

Als zu Beginn des Jahrhunderts der Realismus wieder ernst genommen wurde, gab es viele Philosophen, die sich mit der Ontologie der Wahrheit befaßten. Unabhängig von der Bestimmung der Wahrheit als Korrespondenzbeziehung wollten sie herausfinden, inwieweit zur Erklärung der Wahrheit von Sätzen besondere Entitäten herangezogen werden müssen. Einige dieser Entitäten, so zum Beispiel Bolzanos 'Sätze an sich', Freges 'Gedanken' oder die 'propositions' von Russell und Moore, wurden als Träger der Eigenschaften Wahrheit und Falschheit aufgefaßt. Einige Philosophen jedoch, wie Russell, Wittgenstein im ›Tractatus‹ und Husserl in den ›Logischen Untersuchungen‹, argumentierten, zusätzlich zu den Wahrheitsträgern bzw. an ihrer Stelle müßten Entitäten angenommen werden, auf Grund deren Sätze und/oder 'Propositionen' wahr sind. Solchen Entitäten gab man verschiedene Namen, insbesondere 'fact', 'Tatsache', 'state of affairs' und 'Sachverhalt'. 1 Wir wollen einer Entscheidung über die Angebrachtheit dieser Ausdrücke nicht vorgreifen und daher zunächst eine neutralere Terminologie verwenden: Alle Entitäten, die für diese zweite Rolle in Frage kommen, wollen wir 'Wahrmacher' nennen.

French translation as "Vérifacteurs", *Études de philosophie*, no. 9-10, 2008-2011 (published August 2011), translated by B. Langlet and J.-F. Rosecchi, 104-138.

Lors du renouveau réaliste des premières années de ce siècle, des philosophes de divers horizons s'impliquèrent dans la recherche d'une ontologie de la vérité. Que le point de vue de la vérité-correspondance ait été retenu ou non, ils s'y intéressèrent dans la mesure où il était requis de supposer l'existence d'entités jouant un rôle pour rendre compte de la vérité des phrases. Certaines de ces entités, comme les *Sätze an sich* de Bolzano, les *Gedanken* de Frege, ou les *Propositions* de Russell et Moore, étaient conçues comme porteurs des propriétés de vérité et de fausseté. Cependant, quelques penseurs comme Russell, Wittgenstein dans le *Tractatus* ou Husserl dans les *Recherches logiques*, arguèrent qu'en plus ou à la place de ces porteurs de vérité, il fallait supposer l'existence de certaines entités en vertu desquelles les phrases ou les propositions sont vraies. Plusieurs noms ont été utilisés pour désigner ces entités, comme « *fait* », « *Sachverhalt* », et « *état de choses* ». Afin de ne pas préjuger de la pertinence de ces termes, nous allons employer une terminologie plus neutre et appeler *vérifacteurs* toutes les entités candidates pour ce rôle.

13. Barry Smith, "De la modification de la sensibilité: l'esthétique de l'Ecole de Graz", *Revue d'Esthétique*, 9 (1985), 19–37.

14. Barry Smith, "Ontologische Aspekte der Husserlschen Phänomenologie", *Husserl Studies*, 3 (1986), 115–130.

Abstract: A study of the background of Husserl's early thinking in the perceptual psychology of Carl Stumpf and of the implications of Stumpfian ideas for an understanding of Husserl's phenomenology. Other topics treated include the ontology of part, whole and dependence; gestalt theory; and Husserl's notion of the synthetic a priori.

15. Barry Smith, "The Substitution Theory of Art", *Grazer Philosophische Studien*, 25/26 (1986), 533–557.

Abstract: In perceptual experience we are directed towards objects in a way which establishes a real relation between a mental act and its target. In reading works of fiction we enjoy experiences which manifest certain internal similarities to such relational acts, but which lack objects. The substitution theory of art attempts to provide a reason why we seek out such experiences and the artifacts which they generate. Briefly, we seek out works of art because we enjoy the physiology and the phenomenology of, for example, the experience of love or mountain climbing, and works of art serve as props for the promotion of substitutes for the corresponding genuine feelings. Art arose, or came to be separated out from other, related phenomena, through the discovery that the experience of substitute emotions can be pleasurable.

Italian translation as: "La teoria sostituzionale dell'arte", in E. Pulcini (ed.), *Teorie delle passioni* (Supplementi di Topoi), 3 (1989), 186–209.

16. Kevin Mulligan and Barry Smith, "A Relational Theory of the Act", *Topoi*, 5/2 (1986), 115–130.

Abstract: The paper defends a view of perceptual acts as real relations of a subject to an object. To make this view coherent, a theory of different types of relations is developed, resting on ideas on formal ontology put forward by Husserl in his *Logical Investigations* and on the theory of relations sketched in Smith's "Acta cum fundamentis in re". The theory is applied to the notion of a Cambridge change, which proves to have an unforeseen relevance to our understanding of perception.

17. Kevin Mulligan and Barry Smith, "Husserl's Logical Investigations", *Grazer Philosophische Studien*, 27 (1986), 199–207.

Abstract: The magisterial analyses of logic and meaning advanced in Husserl's *Logical Investigations* of 1900/01 have for a number of reasons been neglected by analytical philosophers in subsequent decades. This state of affairs has to do, in part, with the history of the editions and translations of Husserl's writings. Findlay's readable but imperfect translation appeared seventy years after the work itself was first published, and the editors and translators and expositors of Husserl's works have reflected the prevailing philosophical atmosphere on the Continent by concentration their energies on Husserl's later writings. Now, however, over eighty years after the appearance of Husserl's one true masterpiece, a critical edition of the work is at last available in completed form. We here analyze the structure and content of this new edition, published as part of the Husserliana series by the Husserl Archive in Louvain.

18. Kevin Mulligan and Barry Smith, "A Husserlian Theory of Indexicality", in *Grazer Philosophische Studien*, 28 (1986), 133–163.

Abstract: It is well known that Husserl's *Logical Investigations* contain the beginnings of an account of the meanings of indexical expressions, expressions whose meanings depend essentially on some sort of explicit or implicit pointing or indication [*Anzeigen*], and therefore on some contribution by the surroundings of speaker and hearer. Husserl in fact speaks explicitly of 'occasional expressions', that is of expressions like 'this' and 'that' whose meanings depend on features of the occasion of use, but it is possible to gauge the full implications of his explicit remarks on the problem of indexical or occasional meanings only if these are read in conjunction with what he says elsewhere in the Investigations, especially on the subject of perceptual judgments and proper names. Moreover, Husserl's deliberations on indication, perception and naming, as also what he has to say on demonstrative pronouns, spatial and temporal adverbs and tenses, must themselves be understood – like everything else in this work – as applications of a very general theory of meaning and of structure or dependence. In what follows we shall set out Husserl's account of indexicality and develop it in various ways. Unlike Husserl himself – who retrospectively described his own account as an 'act of violence' – we are strongly of the opinion that this effort is worthwhile.

19. Barry Smith, "The Substance of Brentano's Ontology", *Topoi*, 6/1 (1987), 39–49.

Abstract: This paper is a study of Brentano's ontology, and more specifically of his theory of substance and accident as put forward toward the end of his life in the materials collected together as the *Kategorienlehre* or *Theory of Categories*. Here Brentano presents an auditious (re-)interpretation of Aristotle's theory of substance and accidence. We show that on the Brentano initially defends, it is space which serves as the single substance upon which all other entities depend as accidents of space. In an appendix, however, Brentano puts forward an even more radical suggestion, inspired by the physics of Kelvin. According to this final view, space itself is an accident of a deeper substance: the present time.

20. Barry Smith, "The Ontology of Epistemology", *Reports on Philosophy*, 11 (1987), 57–66.

Abstract: Ingarden's puzzle is: how can we come to know what is essentially involved in an act of knowing? As starting point he takes what he holds to be a particular good candidate example of such an act, namely an act of perceiving an apple. Here we have act and object standing in a certain first-level relation to each other. We now in a second level act of reflection, make this

first-level relation into an object, and strive to apprehend this object as an instantiation of the essence knowledge. But how, on this basis, could we ever establish that we had indeed grasped this essence, and that this is indeed the appropriate essence? Surely, through some third-level act of reflection on this second-level act. We expound from an ontological point of view Ingarden's idea as to how this regress can be avoided.

Polish translation as: "Ontologia epistemologii", in W. Strozewski and A. Wegrzecki (eds.), *W Kregu Filozofii Romana Ingardena*, Warsaw/Cracow: PWN, 1995, 111–119.

21. Barry Smith, "Zalai Béla és a tiszta lét Metafizikája", *Magyar Filozófiai Szemle* (1987/3), 584–593.

Abstract: Between 1910 und 1915 the Hungarian philosoper Der ungarische Philosoph Béla Zalai (1882-1915) developed his "comparative metaphysics of systems", which had a significant influence on both the young Georg Lukács and also on Karl Mannheim. Through an analysis of Zalai's approach to metaphysics, we show how he served to mediate between the realist Austrian philosophy of Meinong and of the early Husserl on the one side, and the German (idealistic, Kantian) philosophy then dominant in Hungary.

German version: "Bela Zalai und die Metaphysik des reinen Seins", *Brentano Studien*, 5 (1994), 59–68.

22. Karl Schuhmann and Barry Smith, "Questions: An Essay in Daubertian Phenomenology", *Philosophy and Phenomenological Research*, 47 (1987), 353–384.

Abstract: This is a historical study of the logical, psychological and linguistic dimensions of the act of questioning, with special reference to the work of the Munich school of phenomenology and of E. Husserl. The essay is a contribution to recent work on anticipations by the Munich school of the theory of speech acts.

23. Barry Smith, "The Soul and Its Parts: A Study in Aristotle and Brentano", *Brentano–Studien*, 1 (1988), 75–88.

Abstract: The piece of wax takes on the form of the seal; but this occurs in a way that is largely indifferent to the particular constitution of the seal. Similarly, Aristotle says, 'the sense is affected by what is coloured or flavoured or sounding, but it is indifferent as to what in each case the substance is'. We show that Brentano takes this Aristotelian account of the relation between sense and its objects as the basis for his theory of mind in the *Psychology from an Empirical Standpoint*.

24. Barry Smith, "The Primacy of Place: An Investigation in Brentanian Ontology", *Topoi*, 8 (1989), 43–51.

Abstract: In his later writings Brentano defended a peculiar doctrine to the effect that the substances of the material world are three-dimensional places. The paper presents the psychological origins of this view and shows how the issue as to the nature of substance can throw light not only on Brentanian and Aristotelian ontology but also on a spectrum of views ranging from Quine, Kotarbinski and Lesniewski to Twardowski and Meinong.

25. Barry Smith, "Logic and the *Sachverhalt*", *The Monist*, 72 (1989), 52–69.

Abstract: Logic is often conceived as a science of propositions, or of relations between propositions. There is an alternative view, however, defended by Meinong, Pfänder, Reinach and others, which sees logic as a science of "Sachverhalte" or states of affairs. A consideration of this view, which was defended especially by thinkers within the tradition of Brentano, throws new light on the problems of intentionality and of mental content. It throws light also on the development of logic in Poland. Here the influence of Brentano's student Kasimir Twardowski is especially important, and the paper concludes with a new interpretation of Tarski's work on truth against the background of Twardowski's thinking.

Revised version in: L. Albertazzi, M. Libardi and R. Poli (eds.), *The School of Franz Brentano*, Dordrecht/Boston/Lancaster: Kluwer (1996), 323–341.

Italian translation as: "Dalla psicologia del giudizio all'ontologia dello stato di cose" in *Discipline Filosofiche*, 7: 2 (1997), 7–28.

26. Barry Smith, "On the Origins of Analytic Philosophy", *Grazer Philosophische Studien*, 35 (1989), 153–173.

Abstract: Analytic philosophers have until recently been reluctant to pursue historical investigations into the Central European roots of their own philosophical tradition. The most recent book by Michael Dummett, however, entitled *Origins of Analytic Philosophy*, shows how fruitful such investigations can be, not only as a means of coming to see familiar philosophical problems in a new light, but also as a means of clarifying what, precisely, 'analytic philosophy' might mean. As Dummett points out, the newly fashionable habit of referring to analytic philosophy as 'Anglo-American' leads to a 'grave historical distortion'. If, he says, we take into account the historical context in which analytic philosophy developed, then such philosophy 'could at least as well be called "Anglo-Austrian"' (p. 7). We here show the implications of this assertion for a more adequate understanding of the relations between analytic and Continental philosophy.

27. Barry Smith, "Aristotle, Menger, Mises: An Essay in the Metaphysics of Economics", *History of Political Economy*, Annual Supplement to vol. 22 (1990), 263–288; published simultaneously in B. Caldwell (ed.), *Carl Menger and His Economic Legacy*, Durham and London: Duke University Press, 1990).

Abstract: There are, familiarly, a range of distinct and competing accounts of the methodological underpinnings of Menger's work. These include Leibnizian, Kantian, Millian, and even Popperian readings; but they include also readings of an Aristotelian sort. I argue tha the historical situation in which Menger found himself points to the inevitability of the Aristotelian reading and that this reading fits also very naturally to the text of Menger's works. At the same time I will explain why the diversity of interpretations is not, however, entirely surprising. Menger broke new ground in economic theory in part by fashioning new linguistic instruments not easily open to unambiguous interpretation.

Reprinted in: E. Younkins (ed.), *Philosophers of Capitalism: Menger, Mises, Rand, and Beyond*, New York: Lexington Books, 2005, 199-222.

Reprinted in: *The Methodology of Carl Menger: A Symposium on the Philosophical Foundations of Austrian Economics*, London: Department of History and Philosophy of Science, Kings College, 1990.

28. Karl Schuhmann and Barry Smith, "Elements of Speech Act Theory in the Work of Thomas Reid", *History of Philosophy Quarterly*, 7 (1990), 47–66.

Abstract: Historical research has recently made it clear that, prior to Austin and Searle, the phenomenologist Adolf Reinach (1884-1917) developed a full-fledged theory of speech acts under the heading of what he called "social acts". He we consider a second instance of a speech act theory *avant la lettre*, which is to be found in the common sense philosophy of Thomas Reid (1710-1796). Reid's s work, in contrast to that of Reinach, lacks both a unified approach and the detailed analyses of pertinent examples. But his writings leave no doubt that he is acutely aware of the very problems concerning language structure and use out of which contemporary speech act theory has evolved and that he goes a good way towards solving these problems in the spirit of the modern theory.

29. Barry Smith, "Textual Deference", *American Philosophical Quarterly*, 28 (1991), 1–13.

Abstract: Works of philosophy written in English have spawned a massive secondary literature dealing with ideas, problems or arguments. But they have almost never given rise to works of 'commentary' in the strict sense, a genre which is however a dominant literary form not only in the Confucian, Vedantic, Islamic, Jewish and Scholastic traditions, but also in relation to more recent German-language philosophy. Yet Anglo-Saxon philosophers have themselves embraced the commentary form when dealing with Greek or Latin philosophers outside their own tradition.

The paper seeks to establish the reasons for this peculiar asymmetry by examining those factors which might be conducive to the growth of a commentary literature in a given culture.

Danish translation as: "Textlig Œrbødighed", *Kritik*, 116 (1995), 89–99.

Italian translation as: "Deferenza testuale", *Divus Thomas*, 24/3 (1999), 92–116.

Russian translation as: "Проблема перевода", *Logos* 5 (2000), 124–139.

30. Barry Smith, "German Philosophy: Language and Style", *Topoi*, 10 (1991), 155–161.

Abstract: The paper addresses the apparent asymmetry as between German and English philosophical texts, turning on the fact that translations from the former into the latter language are typically much more easily obtained than in the reverse direction. A range of factors are shown to be involved, both stylistic and sociological. Most important, however, is a difference in the conception of what philosophy is in the two cultures.

31. Barry Smith, "La verità trionfa: Da T. G. Masaryk a Jan Patočka", *Discipline Filosofiche*, 2 (1991), 207–227.

Abstract: Thomas Garrigue Masaryk, later founder and President of the Republic of Czechoslovakia, studied philosophy in the University of Vienna from 1872 to 1876, where he came under the powerful influence of Franz Brentano. We survey the role of Brentano's philosophy, and especially of his ethics, in Masaryk's life and work.

German version as: "Von T. G. Masaryk bis Jan Patočka. Eine philosophische Skizze", in J. Zumr and T. Binder (eds.), *T. G. Masaryk und die Brentano-Schule*, Graz/Prague: Czech Academy of Sciences (1993), 94–110.

32. Karl Schuhmann and Barry Smith, "Neo-Kantianism and Phenomenology: The Case of Emil Lask and Johannes Daubert", *Kant-Studien*, 82 (1991), 303–318.

Abstract: Johannes Daubert he was an acknowledged leader, and in some respects the founder, of the early phenomenological movement, and was considered – as much by its members as by Husserl himself – the most brilliant member of the group. In Daubert's unpublished writings we find a series of reflections on Lask, and on Neo-Kantianism, which form the subject-matter of this paper. They range over topics such as the ontology of the '*Sachverhalt*' or state of affairs, truthvalues (*Wahrheitswerte*) and the value of truth, negative judgments and the copula, and the relation between perception and judgment.

33. Barry Smith, "Zum Wesen des Common Sense: Aristoteles und die naive Physik", *Zeitschrift für philosophische Forschung*, 46 (1992), 508–525.

Abstract: The paper relates classical treatments of physics and metaphysics to contemporary work on common sense in the field of artificial intelligence (J. Hobbs, P. Hayes, *et al*.). It defends the universality (and truth) of certain basic principles of common-sense physics and shows why these basic principles must leave certain issues undetermined.

Revised version as: "Räumliche Entitäten: Örter, Löcher, Grenzen", in L. Jansen and B. Smith (eds.), *Biomedizinische Ontologie. Philosophie – Lebenswissenschaften – Informationstechnik* (UTB Forum), Zurich: vdf, 2008, 113-126.

34. Barry Smith, "The Soul and Its Parts, II: Varieties of Inexistence", *Brentano-Studien*, 4 (1992/93), 35–51.

Abstract: From the point of view of Brentano's philosophy, contemporary philosophy of mind presupposes an over-crude theory of the internal structures of mental acts and states and of the corresponding types of parts, unity and dependence. We here describe Brentano's own account of the part-whole structures obtaining in the mental sphere, and show how it opens up new possibilities for mereological investigation. One feature of Brentano's view is that the

objects of experience are themselves parts of mind, so that there is a sense in which for him (as e.g. for Leibniz) ontology is a proper part of rational or descriptive psychology.

Romanian translation in: *Revista de Filosofie*, 49(3-4), (2002), 233-246.

35. Barry Smith, "Putting the World Back into Semantics", *Grazer Philosophische Studien*, 44 (1993), 91–109.

Abstract: To what in reality do true logically simple sentences with empirical content correspond? Two extreme positions can be distinguished in this regard: 'Great Fact' theories, such as are defended by Davidson; and trope-theories, which see such sentences being made true simply by those events or states to which the relevant main verbs correspond. A position midway between these two extremes is defended, one according to which sentences of the given sort are made true by what are called 'dependence structures', or in other words by certain complex concrete portions of reality between the parts of which relations of dependence are defined. Principles governing such dependence-structures are laid down, principles of an ontologically motivated sort which serve as basis for a "topological semantics" conceived as an alternative to standard set-theoretic approaches to semantics of the Tarskian sort. These principles are then used to resolve certain puzzles generated by the (semantically motivated) theory of events put forward by Davidson.

Reprinted in Peer F. Bundgaard and Frederik Stjernfelt (eds.), *Semiotics* (Critical Concepts in Linguistics Series), London: Routledge (2010).

Russian translation in: *Ophyr*, n.d.

36. Barry Smith, "An Essay on Material Necessity", P. Hanson and B. Hunter (eds.), *Return of the A Priori* (*Canadian Journal of Philosophy,* Supplementary Volume 18), (1993), 301–322.

Abstract: Where Humeans rule out the possibility of material or non-logical necessity, and thus of any associated knowledge *a priori*, the German legal philosopher Adolf Reinach defends the existence of a wide class of material necessities falling within the domain of what can be known *a priori,* for example in fields such as color and shape, rational psychology, law and economics. Categories such as promise or claim or obligation are, in Reinach's view, exist as nodes in a system of necessary relations, so that anyone who has experience of relevant instances of these categories is implicitly aware also of a corresponding family of relations to certain other categories – as for example that every promise implies a mutually correlated claim and obligation.

Midway between the two extremes of Hume and Reinach stands Searle, who accepts necessary relations of the mentioned sorts, but sees them as human creations, following from 'constitutive rules' analogous to the rules of chess. We seek to demonstrate that Searle does not occupy a stable and acceptable half-way house between Hume and Reinach; that he, too, if he is to do justice to the very constitutive rules which form the center of his approach, must on pain of circularity embrace something like the Reinachian position.

37. Karl Schuhmann and Barry Smith, "Two Idealisms: Lask and Husserl", *Kant-Studien*, 83 (1993), 448–466.

Abstract: Neo-Kantianism is common conceived as a philosophy 'from above', excelling in speculative constructions – as opposed to the attitude of patient description which is exemplified by the phenomenological turn 'to the things themselves'. When we study the work of Emil Lask in its relation to that of Husserl and the phenomenologists, however, and when we examine the influences moving in both directions, then we discover that this idea of a radical opposition is misconceived. Lask himself was influenced especially by Husserl's *Logical Investigations*, and Husserl, especially in his later writings, was in some respects closer to Kant than were the Neo-Kantians. The contrast between the two philosophers can be illustrated by looking at their view of the objects of judgment; for Lask, as for Kant, judgment can relate to the thing as such only in an indirect way. The world of judgment is a collection of 'imitations holding a secondary position'. It is cut apart from the plain world of real things by what Lask calls a 'chasm of artificiality and imagery'. For Husserl, in contrast, the object of judgment is a '*Sachverhalt*' or state of affairs, something ontologically 'positive' in the sense that it is an entity in its own right and does not point beyond itself in the manner of a mere sign or proxy for something else.

Polish translation as: "Dwa oblicza idealizmu: Lask a Husserl", in A. J. Norasa and D. Kuboka (eds.), *Miedzy kantyzmem a neokantyzmem*, Katowice: Wydawnictwo Uniwersyteto Slaskiego (2002), 130–156.

38. Barry Smith and Roberto Casati, "Naive Physics: An Essay in Ontology", *Philosophical Psychology*, 7/2 (1994), 225–244.

Abstract: The project of a naive physics has been the subject of attention in recent years above all in the artificial intelligence field, in connection with work on common-sense reasoning, perceptual representation and robotics. The idea of a theory of the common-sense world is however much older than this, having its roots not least in the work of phenomenologists and Gestalt psychologists such as Köhler, Husserl, Schapp and Gibson. This paper seeks to show how contemporary naive physicists can profit from a knowledge of these historical roots of their discipline, which are shown to imply above all a critique of the set-theory-based models of reality typically presupposed by contemporary work in common-sense ontology.

French version: "La physique naïve: un essai d'ontologie", *Intellectica*, 17 (1993), 173–197.

Polish translation: "Naive Fizyka: Esej w ontologii", *Science Blog*, December 2018.

39. Barry Smith, "Zur Kognition räumlicher Grenzen: Eine mereotopologische Untersuchung", *Kognitionswissenschaft*, 4 (1995), 177–184.

Abstract: The perception of spatial bodies is at least in part a perception of bodily boundaries or surfaces. The usual mathematical conception of boundaries as abstract constructions is, however, of little use for cognitive science purposes. The essay therefore seeks a more adequate conception of the ontology of boundaries building on ideas in Aristotle and Brentano on what we may call the coincidence of boundaries. It presents a formal theory of boundaries and of the continua to which they belong, of a sort which allows a resolution of certain Zeno-style paradoxes. The theory proves to be applicable not only in the cognitive science field but also in regard to problems relating to the ontology of geographical and geopolitical boundaries.

40. Barry Smith, "Formal Ontology, Common Sense, and Cognitive Science", *International Journal of Human-Computer Studies*, 43 (1995), 641–667.

Abstract: Common sense is on the one hand a certain set of processes of natural cognition – of speaking, reasoning, seeing, and so on. On the other hand common sense is a system of beliefs (of folk physics, folk psychology and so on). Over against both of these is the world of common sense, the world of objects to which the processes of natural cognition and the corresponding belief-contents standardly relate. What are the structures of this world? How does the scientific treatment of this world relate to traditional and contemporary metaphysics and formal ontology? Can we embrace a thesis of common-sense realism to the effect that the world of common sense exists uniquely? Or must we adopt instead a position of cultural relativism which would assign distinct worlds of common sense to each group and epoch? The present paper draws on recent work in computer science (especially in the fields of naive and qualitative physics), in perceptual and developmental psychology, and in cognitive anthropology, in order to consider in a new light these and related questions and to draw conclusions for the methodology and philosophical foundations of the cognitive sciences.

Condensed version in: *AI*IA Notizie*. *Periodico dell'Associazione Italiana per l'Intelligenze Artificiale*, 7 (1994), 11–18.

Italian translation as: "L'ontologia del senso commune", in E. Agazzi (ed.), *Valore e Limiti del Senso Comune*, Milan: FrancoAngeli (2004), 261–284.

41. Barry Smith, "More Things in Heaven and Earth", *Grazer Philosophische Studien*, 50 (1995), 187–201.

Abstract: Philosophers in the field of analytic metaphysics have begun gradually to come to terms with the fact that there are entities in a range of categories not dreamt of in the set-theory and predicate-logic-based ontologies of their forefathers. Examples of such "entia

minora" would include: boundaries, places, events, states holes, shadows, individual colour- and tone-instances (tropes), together with combinations of these and associated simple and complex universal species or essences, states of affairs, judgment-contents, and myriad abstract structures of the sorts which are studied by the mathematical sciences. How, as hunter-gatherer ontologists, are we to bring order into this vast array? How are we to gauge the ontological merits of given candidate entities, and how are we to understand their relation to entities of more humdrum sorts? Meinong, it turns out, offers a very simple answer to all of these questions.

42. Barry Smith, "The Structures of the Commonsense World", *Acta Philosophica Fennica*, 58 (1995), 290–317.

Abstract: The paper seeks to show how the world of everyday human cognition might be treated as an object of ontological investigation in its own right. The paper is influenced by work on affordances and prototypicality of psychologists such as Gibson and Rosch, by work on cognitive universals of the anthropologist Robin Horton, and by work of Patrick Hayes and others on 'naive' or 'qualitative physics'. It defends a thesis to the effect that there is, at the heart of common sense, a theoretical core of true propositions pertaining to mesoscopic objects, and that the latter are to be understood as relating mereologically to the objects studied by physical science.

Preprinted in: S. Poggi (ed.), *Gestalt Psychology. Its Origins, Foundations and Influence*, Florence: Olschky (1994), 209–232.

Italian translation as: "Le strutture del mondo del senso commune", in *Iride* (Florence), 9 (1992), 22–44. Partially reprinted as "Ontologia ecologia" in M. Ferraris (ed.), *Ontologia*, Naples: Guida (2003), 146–151.

German translation as: "Die Struktur der Common-Sense Welt", *Logos,* N. F. 1 (1994), 422–449.

Russian translation

43. Barry Smith, "Mereotopology: A Theory of Parts and Boundaries", *Data and Knowledge Engineering*, 20 (1996), 287–303.

Abstract: The paper is a contribution to formal ontology. It seeks to use topological means in order to derive ontological laws pertaining to the boundaries and interiors of wholes, to relations of contact and connectedness, to the concepts of surface, point, neighbourhood, and so on. The basis of the theory is mereology, the formal theory of part and whole, a theory which is shown to have a number of advantages, for ontological purposes, over standard treatments of topology in set-theoretic terms. One central goal of the paper is to provide a rigorous formulation of Brentano's thesis to the effect that a boundary can exist as a matter of necessity only as part of a whole of higher dimension which it is the boundary of. It concludes with a brief survey of current applications of mereotopology in areas such as natural-language analysis, geographic information systems, machine vision, naive physics, and database and knowledge engineering.

44. Barry Smith, "On Substances, Accidents and Universals: In Defence of a Constituent Ontology", *Philosophical Papers*, 26 (1997), 105–127.

Abstract: The essay constructs an ontological theory designed to capture the categories instantiated in those portions or levels of reality which are captured in our common sense conceptual scheme. It takes as its starting point an Aristotelian ontology of "substances" and "accidents", which are treated via the instruments of mereology and topology. The theory recognizes not only individual parts of substances and accidents, including the internal and external boundaries of these, but also universal parts, such as the "humanity" which is an essential part of both Tom and Dick, and also "individual relations", such as Tom's promise to Dick, or their current handshake.

Russian translation

45. Barry Smith, "Ontologie des Mesokosmos: Soziale Objekte und Umwelten", *Zeitschrift für philosophische Forschung,* 52 (1998), 521–540.

Abstract: Erst in neuester Zeit haben sich analytische Philosophen vorbehaltlos dem Bereich der Metaphysik gewidmet. Unter den interessantesten Ergebnissen dieser ‚analytischen Metaphysik' ist John Searles neues Buch zur Ontologie der sozialen Gegenstände (Die Konstruktion der gesellschaftlichen Wirklichkeit. Zur Ontologie sozialer Tatsachen, Hamburg: Rowohlt, 1997). Was sind Staaten, Gemeinschaften, Gesetze? Nach Searle sind diese Gegenstände Korrelate einer ‚kollektiven Intentionalität'. Searle vertritt m.a.W. eine kognitive Theorie von sozialen Gegenständen. Ein Problem bei einer solchen Theorie ist, daß wir Analogien zu bestimmten sozialen Gebilden auch bei Tieren begegnen, die den begrifflichen Apparat einer kollektiven Intentionalität nicht besitzen. Um dieses Problem zu umgehen, liegt es nahe, die biologischen Lehren von tierischen Umwelten, die etwa durch von Uexküll entwickelt wurden, auszunutzen. Von Uexkülls Umweltlehre ist jedoch eine Art organische Monadologie: jedes Tier, jeder Mensch, ist in seiner eigenen spezifischen Umwelt beheimatet, und es wird also schwer verständlich, wie das Verhalten zwischen Tieren überhaupt möglich ist. Der vorliegende Beitrag bietet eine Lösung dieses Problems, durch die wir auch eine verbesserte Auffassung der Ontologie sozialer Gegenstände überhaupt gewinnen. Als Grundlage dieser Auffassung dient die realistische Theorie menschlicher Umwelten, die in der ökologischen Psychologie J. J. Gibsons und Roger Barkers entwickelt wurde.

46. Barry Smith, "Boundaries: A Brentanian Theory", *Brentano-Studien* 8 (1998/99), 107–114.

Abstract: We outline Brentano's theory of boundaries, for instance between two neighboring subregions within a larger region of space. Does every such pair of regions contain points in common where they meet? Or is the boundary at which they meet somehow pointless? On Brentano's view, two subregions such do not overlap; rather, along the line where they meet there are two sets of points which are not identical but rather spatially coincident. We outline Brentano's theory of coincidence, and show how he uses it to resolve a number of Zeno-like paradoxes.

47. Barry Smith, "Truthmaker Realism", *Australasian Journal of Philosophy*, 77 (3) (1999), 274–291.

Abstract: We take as our starting point a thesis to the effect that, at least for true judgments of many varieties, there are parts of reality which make such judgments true. We argue that two distinct components are involved in this truthmaker relation. On the one hand is the relation of *necessitation,* which holds between an object *x* and a judgment *p* when the existence of *x* entails the truth of *p*. On the other hand is the dual notion of *projection*, which holds between a judgment *p* and an object *x* when the truth of *p* entails the existence of *x*. A truthmaker for a judgment *p* is then a necessitator for *p* which satisfies the further constraint that it is part of *p*'s projection. We offer a formal theory of the truthmaker relation thus defined, exploiting ontological tools of basic mereology and the theory of dependence. We then apply the theory to a range of problems connected with generic expressions, ellipsis, vagueness, and indexical and perceptual judgments.

48. Barry Smith and Achille Varzi, "The Niche", *Nous*, 33:2 (1999), 198–222.

Abstract: The categories of object and attribute, substance and accident, continuant and occurrent, have long enjoyed a dominant position in the history of metaphysics. The concept of niche (environment, setting, habitat), on the other hand, has been almost entirely neglected, in spite of the wide application of this and similar concepts in a variety of disciplines, from evolutionary biology to context-based semantics. The paper presents a theory of the niche, a theory of *objects in their settings*. It defends a view of niches as special sorts of parts of reality and builds upon existing work exploiting the resources of mereology (or the theory of part and whole) as an instrument of realist ontology. The theory will be illustrated above all by means of simple biological examples, but the concept of niche should be understood as being, like concepts such as part, boundary and location, a formal concept, one that is applicable in principle to a wide range of different domains.

Extended abstract published as: "Mereology, Topology, Ecology: A Formal Theory of Organism-Niche Relations", in J. Cachro and K. Kijania-Placek (eds.), *11th International Congress of Logic, Methodology and Philosophy of Science. Volume of Abstracts*, Cracow: Jagiellonian University (1999), p. 351.

Polish translation as: "Nisza," *Filozofia Nauki*, 8: 3/4 (2000), 5–30.

49. Barry Smith and David Mark, "Ontology with Human Subjects Testing: An Empirical Investigation of Geographic Categories", *American Journal of Economics and Sociology*, 58: 2 (April 1999), 245–272.

Abstract: Ontology, since Aristotle, has been conceived as a sort of highly general physics, a science of the types of entities in reality, of the objects, properties, categories and relations which make up the world. At the same time ontology has been for some two thousand years a speculative enterprise. It has rested methodologically on introspection and on the construction and analysis of elaborate world-models and of abstract formal-ontological theories. In the work of Quine and others this ontological theorizing in abstract fashion about the world was supplemented by the study, based on the use of logical methods, of the ontological commitments or presuppositions embodied in scientific theories. In recent years both types of ontological study have found application in the world of information systems, for example in the construction of frameworks for knowledge representation and in database design and translation. As ontology is in this way drawn closer to the domain of real-world applications, the question arises as to whether it is possible to use empirical methods in studying ontological theories. More specifically: can we use empirical methods to test the ontological theories embodied in human cognition? We set forth the outlines of a framework for the formulation and testing of such theories as they relate to the specific domain of geographic objects and categories.

50. Barry Smith and Achille Varzi, "Fiat and Bona Fide Boundaries", *Philosophy and Phenomenological Research,* 60: 2 (March 2000), 401–420.

Abstract: We argue that the basic typology of spatial boundaries involves an opposition between bona fide (or physical) boundaries on the one hand, and fiat boundaries on the other, the latter being exemplified especially by boundaries induced through human demarcation, for example in the geographic realm. The classical metaphysical problems connected with the notions of adjacency, contact, separation and division can be resolved in an intuitive way by recognizing this two-sorted ontology of boundaries. Bona fide boundaries yield a notion of contact that is effectively modeled by classical topology; the analogue of contact involving fiat boundaries calls, however, for a different account, based on the intuition that fiat boundaries do not support the open/closed distinction on which classical topology is based. In the presence of this two-sorted ontology it then transpires that mereotopology—topology erected on a mereological basis—is more than a trivial formal variant of classical point-set topology.

Revised version of Barry Smith and Achille Varzi, "The Formal Ontology of Boundaries", *Electronic Journal of Analytic Philosophy*, 5: 5 (1997).

Russian translation by Alexey Shukhov: "Онтология границ", *Общество философскихисследований и разработок* (online publication), 2001.

51. Barry Smith, "Les objets sociaux," *Philosophiques,* 26/2 (1999), 315–347.

Abstract: One reason for the renewed interest in Austrian philosophy, and especially in the work of Brentano and his followers, turns on the fact that analytic philosophers have become once again interested in the traditional problems of metaphysics. It was Brentano, Husserl, and the philosophers and psychologists whom they influenced, who drew attention to the thorny problem of intentionality, the problem of giving an account of the relation between acts and objects or, more generally, between the psychological environments of cognitive subjects and the different sorts of external (physical, geographical, social) environments which they inhabit. The present essay addresses this environmental version of the problem of intentionality. It draws not only on the work of Husserl and Scheler but also on the Gestalt psychological writings of Kurt Koffka and Kurt Lewin. It considers the influential subjective idealist theory of animal environments put forward by J. von Uexküll and contrasts this with a realist theory of organism-environment interaction based on the work of the ecological psychologists J. J. Gibson and Roger Barker. This realist theory is then exploited as a basis for an ontology of social objects of a range of different sorts.

English version

Russian version

52. Werner Ceusters, Ignace Desimpel, Barry Smith and Stefan Schulz, "Using Cross-Lingual Information to Cope with Underspecification in Formal Ontologies", *Studies in Health Technology and Informatics*, 95 (2003), 391–396.

Abstract: Description logics and other formal devices are frequently used as means for preventing or detecting mistakes in ontologies. Some of these devices are also capable of inferring the existence of inter-concept relationships that have not been explicitly entered into an ontology. A prerequisite, however, is that this information can be derived from those formal definitions of concepts and relationships which are included within the ontology. In this paper, we present a novel algorithm that is able to suggest relationships among existing concepts in a formal ontology that are not derivable from such formal definitions. The algorithm exploits cross-lingual information that is implicitly present in the collection of terms used in various languages to denote the concepts and relationships at issue. By using a specific experimental design, we are able to quantify the impact of cross-lingual information in coping with underspecification in formal ontologies.

53. Barry Smith and John Searle, "The Construction of Social Reality: An Exchange", *American Journal of Economics and Sociology,* 62: 2 (2003), 285-309.

Abstract: Part 1 of this exchange consists in a critique by Smith of Searle's *The Construction of Social Reality* focusing on Searle's use of the formula 'X *counts as* Y in context C'. Smith argues that this formula works well for social objects such as dollar bills and presidents where the corresponding X terms (pieces of paper, human beings) are easy to identify. In cases such as debts and prices and money in a banks computers, however, the formula fails, because these are cases of what he calls 'free-standing Y terms', since there is here no X which can *count as* the corresponding Y. In his response in Part 2, Searle argues that Smith's critique rests on three misunderstandings: 1. in wrongly presupposing that Searle is trying to analyze the nature of what he calls "social objects", rather than of social facts; 2. in thinking that the *counts as* formula is intended as a definition, rather than as a mere mnemonic; and 3. in neglecting the naturalism of Searle's account.

Reprinted in David Koepsell and Laurence S. Moss (eds.), *John Searle's Ideas about Social Reality: Extensions, Criticisms, and Reconstructions*, Oxford: Wiley-Blackwell (2003).

French translation as: "L'ontologie de la realité sociale", in P. Livet and R. Ogien (eds.), *L'Enquête ontologique, du mode de l'existence des objets sociaux*, Paris: Editions EHESS (2000), 185–208.

54. Barry Smith, "Philosophie, Politik und wissenschaftliche Weltauffassung: Zur Frage der Philosophie in Österreich und Deutschland", *Grazer Philosophische Studien* 58/59 (2000), 241–262.

Abstract: One of the most remarkable philosophical phenomena of the last 20 years is the rise of so-called 'Continental Philosophy' (C.P.), a creation above all of the North American university. Lectures under the heading of 'Continental Philosophy' are offered every year in Anglo-Saxon universities to many thousands of philosophy students, a practice which appears questionable not least for the reason that the lectures in question deal not with philosophy in Continental Europe as a whole, but rather only with a certain narrow segment of Franco-German philosophy, in which Heidegger seems to serve as the sole fixed point. Around him are assembled a progression of Paris-based thinkers expounding progressively more nonsensical claims concerning the 'end' of philosophy (or of the 'modern', of 'the author', of 'man', of 'identity', and so forth). In all of this the later Husserl is sometimes taken into account as C.P.-precursor, his teacher Franz Brentano however not at all. Other prominent German philosophers of the 20th century such as Ernst Cassirer or Nicolai Hartmann are likewise totally ignored, and so also are French philosophers in the tradition of Poincaré, Bergson or Gilson, as well as Polish, Scandinavian or Czech philosophers. The essay offers an explanation of these peculiar facts, which has to do with the different roles of politics and science in the different parts of Europe.

55. Barry Smith, "The Chinese Rune argument", *Philosophical Explorations*, 4 (2), 2001, 70-75, with Searle's response, 75–77.

> **Abstract:** Searle's tool for understanding culture, law and society is the opposition between brute reality and institutional reality, or in other words between: observer-independent features of the world, such as force, mass and gravitational attraction, and observer-relative features of the world, such as money, property, marriage and government. The question posed here is: under which of these two headings do moral concepts fall? This is an important question because there are moral facts – for example pertaining to guilt and responsibility – which hover uncomfortably close to the boundary between the observer-relative and the observer-independent. By means of a thought experiment involving an imagined Chinese society in which guilt is determined by the random throwing of sticks, I seek to show that moral concepts threaten the foundations of Searle's philosophy of social reality.

56. Barry Smith and Berit Brogaard, "Living High and Letting Die", *Philosophy*, 76 (2001), 435–442 (published under the pseudonym Nicola Bourbaki).

> **Abstract:** You wake up one morning in a hospital operating theater and learn that a glitch in the hospital's computer has brought it about that a tiny radio has been attached to your stomach. The radio is transmitting to an unconscious violinist who has been found to have a rare and fatal kidney ailment in virtue of which his brain is no longer able to send signals to his kidneys. If you remove the radio, the violinist will die. But never mind, it is only for nine months. By then he will have recovered from his ailment, and the radio can safely be removed. Are you morally obliged to agree to this situation?

57. Barry Smith and David M. Mark, "Geographical Categories: An Ontological Investigation", *International Journal of Geographical Information Science*, 15: 7 (2001), 591–612.

> **Abstract:** This paper reports the results of a series of experiments designed to establish how non-expert subjects conceptualize geospatial phenomena. Subjects were asked to give examples of geographical categories in response to a series of differently phrased elicitations. The results yield an ontology of geographical categories—a catalogue of the prime geospatial concepts and categories shared in common by human subjects independently of their exposure to scientific geography. When combined with nouns such as feature and object, the adjective geographic elicited almost exclusively elements of the physical environment of geographical scale or size, such as mountain, lake and river. The phrase things that could be portrayed on a map, on the other hand, produced many geographical scale artefacts (roads, cities, etc.) and fiat objects (states, countries, etc.), as well as some physical feature types. These data reveal considerable mismatch as between the meanings assigned to the terms 'geography' and 'geographic' by scientific geographers and by ordinary subjects, so that scientific geographers are not in fact studying geographical phenomena as such phenomena are conceptualized by naive subjects. The data suggest, rather, a special role in determining the subject-matter of scientific geography for the concept of what can be portrayed on a map. This work has implications for work on usability and interoperability in geographical information science, and it throws light also on subtle and hitherto unexplored ways in which ontological terms such as 'object', 'entity' and 'feature' interact with geographical concepts.
>
> Reprinted in: Peter Fisher (ed.), *Classics from the International Journal of Geographical Information Science*, London: Taylor and Francis, 2006, 481–506, with Postscript.

58. Barry Smith, "Fiat Objects", *Topoi*, 20: 2 (September 2001), 131–148.

> **Abstract:** Extended entities have boundaries of two different sorts: those that do, and those that do not correspond to physical discontinuities. Call the first sort (coastlines, the surface of your nose) bona fide boundaries; and the second (the boundary of Montana, the boundary separating your upper from your lower torso) fiat boundaries. Fiat boundaries are found especially in the geographic realm, but are involved wherever language carves out portions of reality in ways which do not reflect physical discontinuities. These ideas are applied to the treatment of cognitive categorization, of the semantics of vagueness, of Quine's indeterminacy thesis, and of standard ontological problems such as Tibbles' tail.

Italian translation as: "Oggetti Fiat", *Rivista di Estetica,* 20/2 (2002), 58–87.

59. Barry Smith and Leonardo Zaibert, "The Metaphysics of Real Estate", *Topoi*, 20: 2 (September 2001), 161–172.

Abstract: The parceling of land into real estate is more than a simple geometrical affair. Real estate is a historical product of interaction between human beings, political, legal and economic institutions, and the physical environment. And while many authors, from Jeremy Bentham to Hernando de Soto, have drawn attention to the ontological (metaphysical) aspect of property in general, no comprehensive analysis of landed property has been attempted. The paper presents such an analysis and shows how landed property differs from other types of property in a way which implies a special role for political and economic philosophy of property rights in land.

Chinese translation as "房地产的形而上学" in Francesco Di Iorio and Jun Hu (eds.), 能动性与社会动力学——经济学哲学与社会科学哲学论文集 (*Agency and Social Dynamics: Essays in the Philosophy of Economics and the Social Sciences*, Beijing: Nankai University Press, December 2021, 164-185.

60. Barry Smith, "Husserlian Ecology", *Human Ontology* (Kyoto), 7 (2001), 9–24.

Abstract: While Husserl sought to find room in his later writings for the surrounding world of human practical experience, and while similar efforts were made also by later phenomenologists such as Heidegger, and Sartre, and Merleau-Ponty, in none of these authors do we find sustained attempts to grapple with the interactions between the world of human thought, feeling and action on the one hand and the surrounding environment as this is described by physics and biology on the other. Some attempts were made in this regard by Gestalt psychologists such as Wertheimer, Köhler, Koffka, and Lewin, and Koffka and Lewin in their turn influenced two American psychologists J. J. Gibson and Roger Barker, both of whom (independently) conceived their work under the banner of 'ecological psychology.' It is against this background that the term 'Husserlian ecology' is to be understood in what follows.

Japanese translation, 25-41.

61. Barry Smith, "Truthmaker Realism: Response to Gregory", *Australasian Journal of Philosophy*, 80 (2) (2002), 231–234.

Abstract: Standard definitions of the truthmaker relation in terms of necessitation fail. This is because there exist malignant necessitators (every contingent object is a malignant necessitator for every necessary truth). In my "Truthmaker Realism" (*Australasian Journal of Philosophy*, 77, 1999) I show that these standard definitions can be repaired by adding a second factor, in some ways the dual of necessitation, which I call 'projection'. Projection imposes on the relation between truths and truthmakers the additional requirement of relevance or aboutness. In his "Smith on Truthmakers" (Australasian Journal of Philosophy, 79, 2001), Dominic Gregory attempts to show that this attempt to prune the abundance of malignant necessitators fails. His argument reveals the existence of some unclarities in the prose commentary to the formal theory of my original paper. Here, however, I show that it does not undermine this formal theory itself.

62. Barry Smith and Achille Varzi, "Surrounding Space: The Ontology of Organism-Environment Relations", *Theory in Biosciences*, 121 (2002), 139–162.

Abstract: The history of evolution is a history of development from less to more complex organisms. This growth in complexity of organisms goes hand in hand with a concurrent growth in complexity of environments and of organism-environment relations. It is a concern with this latter aspect of evolutionary development that motivates the present paper. We begin by outlining a theory of organism-environment relations. We then show that the theory can be applied to a range of different sorts of cases, both biological and non-biological, in which objects are lodged or housed within specific environments, or niches. Biological science is interested in types—for example in genotypes, phenotypes and environment types—and in regularities that can serve as the basis for the formulation of laws or general principles. Types, however, can exist only through their corresponding tokens. Our theory of token environments is meant to plug this gap and to provide a first step towards a general theory of causally relevant spatial volumes.

63. Barry Smith and Berit Brogaard, "Quantum Mereotopology", *Annals of Mathematics and Artificial Intelligence*, 35/1–2 (2002), 153–175.

Abstract: Mereotopology is an extension of mereology (the formal theory of part-whole relations) which includes also relations of boundary, countinuity and contact. Mereotopology faces problems when its methods are applied to objects which lose and gain parts yet preserve their identities over time. We offer a new solution to these problems, based on a theory of partitions of reality of finite grain. This theory is extended to a theory of coarse- and fine-grained histories (or finite sequences of partitions evolving over time), drawing on machinery developed within the framework of the so-called 'consistent histories' interpretation of quantum mechanics.

Shorter version in: *Spatial and Temporal Granularity. Papers from the AAAI Workshop* (AAAI Technical Report WS-00-08), Menlo Park: AAAI Press (2000), 25–31.

64. Barry Smith and Berit Brogaard, "A Unified Theory of Truth and Reference", *Logique et Analyse,* No. 169-170 (2000, published 2003), 49–93.

Abstract: The truthmaker theory rests on the thesis that the link between a true judgment and that in the world to which it corresponds is not a one-to-one but rather a one-to-many relation. An analogous thesis in relation to the link between a singular term and that in the world to which it refers is already widely accepted. This is the thesis to the effect that singular reference is marked by vagueness of a sort that is best understood in supervaluationist terms. In what follows we show that the supervaluationist approach to singular reference, when wedded to the truthmaker idea, yields a framework of surprising power, which offers a uniform set of solutions to a range of problems regarding identity, reference and knowledge, problems which have hitherto been dealt with on an ad hoc basis.

French translation: "Une théorie unifiée de la vérité et de la référence" in J. M. Monnoyer (ed.), *La Structure du Monde: Objets, Propriétés, États du choses*, Paris: Vrin (2004), 141–184.

Russian translation

65. Barry Smith and David M. Mark, "Do Mountains Exist? Towards an Ontology of Landforms", *Environment and Planning B* (*Planning and Design*), 30(3) (2003), 411–427.

Abstract: Do mountains exist? The answer to this question is surely: yes. In fact, 'mountain' is the example of a kind of geographic feature or thing most commonly cited by English speakers (Mark, *et al*., 1999; Smith and Mark 2001), and this result may hold across many languages and cultures. But whether they are considered as individuals (tokens) or as kinds (types), mountains do not exist in quite the same unequivocal sense as do such prototypical everyday objects as chairs or people.

66. Barry Smith and Berit Brogaard, "Sixteen Days", *The Journal of Medicine and Philosophy*, 28 (2003), 45–78.

Abstract: When does a human being begin to exist? We argue that it is possible, through a combination of biological fact and philosophical analysis, to provide a definitive answer to this question. We lay down a set of conditions for being a human being, and we determine when, in the course of normal fetal development, these conditions are first satisfied. Issues dealt with along the way include: modes of substance-formation, twinning, the nature of the intra-uterine environment, and the nature of the relation between fetus and mother.

German translation as: "Sechzehn Tage: Wann beginnt ein menschliches Leben?", in G. Imaguire and Christine Schneider (eds.), *Untersuchungen zur Ontologie*, Munich: Philosophia, 2006, 3–40.

Revised version as "Die Ontologie des Embryos", in L. Jansen and B. Smith (eds.), *Biomedizinische Ontologie. Philosophie – Lebenswissenschaften - Informationstechnik* (UTB Forum), Zurich: vdf, 2008, 199-228.

67. Thomas Bittner and Barry Smith "Vague Reference and Approximating Judgements", *Spatial Cognition and Computation*, 3: 2 (2003), 137–156.

> **Abstract:** We propose a new account of vagueness and approximation in terms of the theory of granular partitions. We distinguish different kinds of crisp and non-crisp granular partitions and we describe the relations between them, concentrating especially on spatial examples. We describe the practice whereby subjects use regular grid-like reference partitions as a means for tempering the vagueness of their judgments, and we demonstrate how the theory of reference partitions can yield a natural account of this practice, which is referred to in the literature as 'approximation'.

Russian translation

68. Pierre Grenon and Barry Smith, "SNAP and SPAN: Towards Dynamic Spatial Ontology", *Spatial Cognition and Computation*, 4: 1 (March 2004), 69–103.

> **Abstract:** We propose a modular ontology of the dynamic features of reality. This amounts, on the one hand, to a purely spatial ontology supporting snapshot views of the world at successive instants of time and, on the other hand, to a purely spatiotemporal ontology of change and process. We argue that dynamic spatial ontology must combine these two distinct types of inventory of the entities and relationships in reality, and we provide characterizations of spatiotemporal reasoning in the light of the interconnections between them.

69. Barry Smith and Anand Kumar, "Controlled Vocabularies in Bioinformatics: A Case Study in the Gene Ontology", *BIOSILICO: Drug Discovery Today*, 2 (2004), 246–252.

> **Abstract:** The automatic integration of information resources in the life sciences is one of the most challenging goals facing biomedical informatics today. Controlled vocabularies have played an important role in realizing this goal, by making it possible to draw together information from heterogeneous sources secure in the knowledge that the same terms will also represent the same entities on all occasions of use. One of the most impressive achievements in this regard is the Gene Ontology (GO), which is rapidly acquiring the status of a de facto standard in the field of gene and gene product annotations and whose methodology has been much intimated in attempts to develop controlled vocabularies for shared use in different domains of biology. As the GO Consortium has recognized, however, its controlled vocabulary is as currently constituted marked by a number of problematic features which are characteristic of much recent work in bioinformatics and which are destined to raise increasingly serious obstacles to the automatic integration of biomedical information in the future. Here we survey some of these problematic features, focusing especially on issues of compositionality and syntactic regimentation.

70. Thomas Bittner, Maureen Donnelly and Barry Smith, "Endurants and Perdurants in Directly Depicting Ontologies", *AI Communications*, 13: 4 (2004), 247–258.

> **Abstract:** We propose an ontological theory that is powerful enough to describe both complex spatio-temporal processes and the enduring entities that participate therein. For this purpose we introduce the notion a directly depicting ontology. Directly depicting ontologies are based on relatively simple languages and fall into two major categories: ontologies of type SPAN and ontologies of type SNAP. These represent two complementary perspectives on reality and employ distinct though compatible systems of categories. A SNAP (snapshot) ontology comprehends enduring entities such as organisms, geographic features, or qualities as they exist at some given moment of time. A SPAN ontology comprehends perduring entities such as processes and their parts and aggregates as they unfold themselves through some temporal interval. We give an axiomatic account of the theory of directly depicting ontologies and of the core parts of the metaontological fragment within which they are stembedded.

71. Jean-Luc Verschelde, Mariana Casella Dos Santos, Tom Deray, Barry Smith and Werner Ceusters, "Ontology-Assisted Database Integration to Support Natural Language Processing and Biomedical Data-Mining", *Journal of Integrative Bioinformatics*, 1 (2004), 1-10. Reprinted in: *Yearbook of Bioinformatics* (2004), 39–48.

> **Abstract:** Successful biomedical data mining and information extraction require a complete picture of biological phenomena such as genes, biological processes and diseases as these exist

on different levels of granularity. To realize this goal, several freely available heterogeneous databases as well as proprietary structured datasets have to be integrated into a single global customizable scheme. We will present a tool to integrate different biological data sources by mapping them to a proprietary biomedical ontology that has been developed for the purposes of making computers understand medical natural language.

72. Barry Smith and Pierre Grenon, "The Cornucopia of Formal-Ontological Relations", *Dialectica* 58: 3 (2004), 279–296.

Abstract: We present a new method for generating typologies of formal-ontological relations. The guiding idea is that formal relations are those sorts of relations which hold between entities which are constituents of distinct ontologies. We provide examples of ontologies (in the spirit of Zemach's classic "Four Ontologies" of 1970), and show how these can be used to give a rich typology of formal relations in a way which also throws light on the opposition between three and four-dimensionalism.

73. Anand Kumar, Barry Smith and Daniel Novotny, "Biomedical Informatics and Granularity", *Comparative and Functional Genomics*, 5 (2004), 501–508. PMC2447428

Abstract: An explicit formal ontological representation of entities existing at multiple levels of granularity is an urgent requirement for biomedical information processing. We discuss some fundamental principles which can form a basis for such a representation. We also comment on some of the implicit treatments of granularity in currently available ontologies and terminologies (GO, FMA, SNOMED CT).

74. Barry Smith and Bert R. E. Klagges, "Philosophie und biomedizinische Forschung", *Allgemeine Zeitschrift für Philosophie*, 30: 1 (2005), 5–26.

Abstract: The pathbreaking scientific advances of recent years call for a new philosophical consideration of the fundamental categories of biology and its neighboring disciplines. Above all, the new information technologies used in biomedical research, and the necessity to master the continuously growing flood of data that is associated therewith, demand a profound and systematic reflection on the systematization and classification of biological data. This, however, demands robust theories of basic concepts such as kind, species, part, whole, function, process, fragment, sequence, expression, boundary, locus, environment, system, and so on. Concepts which belong to the implicit stock of knowledge of every biologist. They amount to a dimension of biological reality which remains constant in the course of biological evolution and whose theoretical treatment requires contemporary analogues of the tools developed in traditional Aristotelian metaphysics. To provide the necessary theories and definitions is a task for philosophy, which is thus called upon to play an important role as intermediary between biology and informatics.

Revised version in L. Jansen and B. Smith (eds.), *Biomedizinische Ontologie. Philosophie – Lebenswissenschaften - Informationstechnik* (UTB Forum), Zurich: vdf, 2008, 17-30.

English version as "Bioinformatics and Philosophy", in K. Munn and B. Smith (eds.), *Applied Ontology: An Introduction*, Frankfurt/Lancaster: ontos, 2008, 17-30.

75. Barry Smith, Werner Ceusters, Bert Klagges, Jacob Köhler, Anand Kumar, Jane Lomax, Chris Mungall, Fabian Neuhaus, Alan Rector and Cornelius Rosse, "Relations in Biomedical Ontologies", *Genome Biology* (2005), 6 (5), R46. PMC1175958

Abstract: To enhance the treatment of relations in biomedical ontologies we advance a methodology for providing consistent and unambiguous formal definitions of the relational expressions used in such ontologies in a way designed to assist developers and users in avoiding errors in coding and annotation. The resulting Relation Ontology can promote interoperability of ontologies and support new types of automated reasoning about the spatial and temporal dimensions of biological and medical phenomena.

76. Werner Ceusters, Barry Smith and Louis Goldberg, "A Terminological and Ontological Analysis of the NCI Thesaurus", *Methods of Information in Medicine*, 44 (2005), 498–507.

> **Abstract:** *Objective*: The National Cancer Institute Thesausus is described by its authors as "a biomedical vocabulary that provides consistent, unambiguous codes and definitions for concepts used in cancer research" and which "exhibits ontology-like properties in its construction and use". We performed a qualitative analysis of the Thesaurus in order to assess its conformity with principles of good practice in terminology and ontology design. *Materials and methods*: We used both the on-line browsable version of the Thesaurus and its OWL-representation (version 04.08b, released on August 2, 2004), measuring each in light of the requirements put forward in relevant ISO terminology standards and in light of ontological principles advanced in the recent literature. *Results*: We found many mistakes and inconsistencies with respect to the term-formation principles used, the underlying knowledge representation system, and missing or inappropriately assigned verbal and formal definitions. *Conclusion*: Version 04.08b of the NCI Thesaurus suffers from the same broad range of problems that have been observed in other biomedical terminologies. For its further development, we recommend the use of a more principled approach that allows the Thesaurus to be tested not just for internal consistency but also for its degree of correspondence to that part of reality which it is designed to represent.

77. Barry Smith, Werner Ceusters, Anand Kumar and Cornelius Rosse, "On Carcinomas and Other Pathological Entities", *Comparative and Functional Genomics*, vol. 6, issue 7/8, 2005, 379–387. PMC2447494

> **Abstract:** Tumors, abscesses, cysts, scars, fractures are familiar types of what we shall call pathological continuant entities. The instances of such types exist always in or on anatomical structures, which thereby become transformed into pathological anatomical structures of corresponding types: a fractured tibia, a blistered thumb, a carcinomatous colon. In previous work on biomedical ontologies we showed how the provision of formal definitions for relations such as is_a, part_of and transformation_of can facilitate the integration of such ontologies in ways which have the potential to support new kinds of automated reasoning. We here extend this approach to the treatment of pathologies, focusing especially on those pathological continuant entities which arise when organs become affected by carcinomas. Includes a classification of biomedical entities which revises the classification provided in Rosse, *et al*.

78. Berit Brogaard and Barry Smith, "On Luck, Responsibility and the Meaning of Life", *Philosophical Papers*¸ 34(3), 2005, 443–458.

> **Abstract:** A life we view as an ordered sequence of actions and events of a special kind. We then defend the thesis that a *meaningful* life is a life upon which some sort of valuable pattern has been imposed—a pattern which relates not merely to what goes on inside the person's head, but which involves also, in serious ways, the person having an effect upon the world. Meaningfulness is then a special kind of value which a human life can bear. More specifically, it is a kind of intrinsic value – something that we value for its own sake. We then argue that it is crucial that, if such an imposed shape or pattern is to contribute to meaningfulness, then it must be the result of the person's own efforts and of his or her own decisions.

79. Ingvar Johansson, Barry Smith, Katherine Munn, Nikoloz Tsikolia, Kathleen Elsner, Dominikus Ernst, and Dirk Siebert, "Functional Anatomy: A Taxonomic Proposal", *Acta Biotheoretica*, 53(3), 2005, 153–166.

> **Abstract:** It is argued that medical science requires a classificatory system that (a) puts functions in the taxonomic center and (b) does justice ontologically to the difference between the processes which are the realizations of functions and the objects which are their bearers. We propose formulae for constructing such a system and describe some of its benefits. The arguments are general enough to be of interest to all the life sciences.

80. Jonathan Simon, James Fielding and Barry Smith, "Formal Ontology for Natural Language Processing and the Integration of Biomedical Databases", *International Journal of Medical Informatics,* 75 (3-4), 2006, 224-231.

Abstract: The central hypothesis of the collaboration between Language and Computing (L&C) and the Institute for Formal Ontology and Medical Information Science (IFOMIS) is that the methodology and conceptual rigor of a philosophically inspired formal ontology greatly benefits application ontologies. To this end r®, L&C's ontology, which is designed to integrate and reason across various external databases simultaneously, has been submitted to the conceptual demands of IFOMIS's Basic Formal Ontology (BFO). With this project we aim to move beyond the level of controlled vocabularies to yield an ontology with the ability to support reasoning applications. Our general procedure has been the implementation of a meta-ontological definition space in which the definitions of all the concepts and relations in LinKBase® are standardized in a framework of first-order logic. In this paper we describe how this standardization has already led to an improvement in the LinKBase® structure that allows for a greater degree of internal coherence than ever before possible. We then show the use of this philosophical standardization for the purpose of mapping external databases to one another, using LinKBase® as translation hub, with a greater degree of success than possible hitherto. We demonstrate how this offers a genuine advance over other application ontologies that have not submitted themselves to the demands of philosophical scrutiny. LinKBase® is one of the world's largest applications-oriented medical domain ontologies, and BFO is one of the world's first philosophically driven reference ontologies. The collaboration of the two thus initiates a new phase in the quest to solve the so-called "Tower of Babel".

81. Anand Kumar, Barry Smith, Domenica Pisanelli, Aldo Gangemi and Mario Stefanelli, "Clinical Guidelines as Plans: An Ontological Theory", *Methods of Information in Medicine*, 45 (2), 2006, 204-210.

Abstract: *Objective*: Clinical guidelines are special types of plans realized by collective agents. We provide an ontological theory of such plans that is designed to support the construction of a framework in which guideline-based information systems can be employed in the management of workflow in health care organizations. *Method*: The framework we propose allows us to represent in formal terms how clinical guidelines are realized through the actions of individuals organized into teams. We provide various levels of implementation representing different levels of conformity on the part of health care organizations. *Result*: Implementations built in conformity with our framework are marked by two dimensions of flexibility that are designed to make them more likely to be accepted by health care professionals than are standard guideline-based management systems. They do justice to the fact (1) that responsibilities within a health care organization are widely shared, and (2) that health care professionals may on different occasions be noncompliant with guidelines for a variety of well justified reasons. *Conclusion*: The advantage of the framework lies in its built-in flexibility, its sensitivity to clinical context, and its ability to use inference tools based on a robust ontology. One disadvantage lies in the complication of its implementation.

82. Anand Kumar, Yum Lina Yip, Barry Smith and Pierre Grenon, "Bridging the Gap between Medical and Bioinformatics: An Ontological Case Study in Colon Carcinoma", *Computers in Biology and Medicine* 2006; 36, (7-8): 694-711.

Abstract: Ontological principles are needed in order to bridge the gap between medical and biological information in a robust and computable fashion. This is essential in order to draw inferences across the levels of granularity which span medicine and biology, an example of which include the understanding of the roles of tumor markers in the development and progress of carcinoma. Such information integration is also important for the integration of genomics information with the information contained in the electronic patient records in such a way that real time conclusions can be drawn. In this paper we describe a large multi-granular datasource built by using ontological principles and focusing on the case of colon carcinoma.

83. Barry Smith, "From Concepts to Clinical Reality: An Essay on the Benchmarking of Biomedical Terminologies", *Journal of Biomedical Informatics*, 2006; 39(3): 288-298.

Abstract: It is only by fixing on agreed meanings of terms in biomedical terminologies that we will be in a position to achieve that accumulation and integration of knowledge that is indispensable to progress at the frontiers of biomedicine. Standardly, the goal of fixing meanings is seen as being realized through the alignment of terms on what are called 'concepts'. Part I

addresses three versions of the concept-based approach – by Cimino, by Wüster, and by Campbell and associates – and surveys some of the problems to which they give rise, all of which have to do with a failure to anchor the terms in terminologies to corresponding referents in reality. Part II outlines a new, realist solution to this anchorage problem, which sees terminology construction as being motivated by the goal of alignment not on concepts but on the universals (kinds, types) in reality and thereby also on the corresponding instances (individuals, tokens). We outline the realist approach, and show how on its basis we can provide a benchmark of correctness for terminologies which will at the same time allow a new type of integration of terminologies and electronic health records. We conclude by outlining ways in which the framework thus defined might be exploited for purposes of diagnostic decision-support.

Revised version as "New Desiderata for Biomedical Terminologies", in K. Munn and B. Smith (eds.), *Applied Ontology: An Introduction*, Frankfurt/Lancaster: ontos, 2008, 83-109.

84. Christiane Fellbaum, Udo Hahn and Barry Smith, "Towards New Information Resources for Public Health – From WordNet to Medical WordNet", *Journal of Biomedical Informatics*, 2006; 39(3): 321-332.

Abstract: In the last two decades, WORDNET has evolved as the most comprehensive computational lexicon of general English. In this article, we discuss its potential for supporting the creation of an entirely new kind of information resource for public health, viz. MEDICAL WORDNET. This resource is not to be conceived merely as a lexical extension of the original WORDNET to medical terminology; indeed, there is already a considerable degree of overlap between WORDNET and the vocabulary of medicine. Instead, we propose a new type of repository, consisting of three large collections of (1) medically relevant word forms, structured along the lines of the existing Princeton WORDNET; (2) medically validated propositions, referred to here as medical facts, which will constitute what we shall call MEDICAL FACTNET; and (3) propositions reflecting laypersons' medical beliefs, which will constitute what we shall call the MEDICAL BELIEFNET. We introduce a methodology for setting up the MEDICAL WORDNET. We then turn to the discussion of research challenges that have to be met in order to build this new type of information resource.

85. Werner Ceusters and Barry Smith, "Strategies for Referent Tracking in Electronic Health Records", *Journal of Biomedical Informatics*, 2006; 39(3): 362-378.

Abstract: The goal of referent tracking is to create an ever-growing pool of data relating to the entities existing in concrete spatiotemporal reality. In the context of Electronic Healthcare Records (EHRs) the relevant concrete entities are not only particular patients but also their parts, diseases, therapies, lesions, and so forth, insofar as these are salient to diagnosis and treatment. Within a referent tracking system, all such entities are referred to directly and explicitly, something which cannot be achieved when familiar concept-based systems are used in what is called "clinical coding". In this paper we describe the components of a referent tracking system in an informal way and we outline the procedures that would have to be followed by healthcare personnel in using such a system. We argue that the referent tracking paradigm can be introduced with only minor – though nevertheless ontologically important – technical changes to existing EHR infrastructures, but that it will require a radically different mindset on the part of those involved in clinical coding and terminology development from that which has prevailed hitherto.

86. Rubin DL, Lewis SE, Mungall CJ, Misra S, Westerfield M, Ashburner M, Sim I, Chute CG, Solbrig H, Storey MA, Smith B, Richter JD, Noy NF and Musen MA, "National Center for Biomedical Ontology: Advancing Biomedicine through Structured Organization of Scientific Knowledge", *Omics: A Journal of Integrative Biology*, 10(2), 2006, 185-198.

Abstract: The National Center for Biomedical Ontology is a consortium that comprises leading informaticians, biologists, clinicians, and ontologists, funded by the National Institutes of Health (NIH) Roadmap, to develop innovative technology and methods that allow scientists to record, manage, and disseminate biomedical information and knowledge in machine-processable form.

The goals of the Center are (1) to help unify the divergent and isolated efforts in ontology development by promoting high quality open-source, standards-based tools to create, manage, and use ontologies, (2) to create new software tools so that scientists can use ontologies to annotate and analyze biomedical data, (3) to provide a national resource for the ongoing evaluation, integration, and evolution of biomedical ontologies and associated tools and theories in the context of driving biomedical projects.

87. Patricia L. Whetzel, Ryan R. Brinkman, Helen C. Causton, Liju Fan, Jennifer Fostel, Gilberto Fragoso, Mervi Heiskanen, Tina Hernandez-Boussard, Norman Morrison, Helen Parkinson, Philippe Rocca-Serra, Susanna-Assunta Sansone, Daniel Schober, Barry Smith, Robert Stevens, Chris Stoeckert, Chris F. Taylor, Joe White, "Development of FuGO – An Ontology for Functional Genomics Experiments", *Omics: A Journal of Integrative Biology*, 10(2), 2006, 199-204. PMC2783628

Abstract: The development of the Functional Genomics Experiment Ontology (FuGO) is a collaborative, international effort which will provide a resource for annotating functional genomics experiments, including the study design, protocols and instrumentation used, the data generated and the types of analysis performed on the data. FuGO will contain terms that are both universal to functional genomics experiments and those that are domain specific. In this way, the ontology will serve as the 'semantic glue' to provide a common understanding of data across these disparate data sources. In addition, FuGO will reference out to existing mature ontologies in order to avoid the need to duplicate these resources, but in such a way as to enable their ease of use in annotation. This project is in the beginning stages of development and the paper will describe the efforts to initiate the project, the scope and organization of the project, the work accomplished to date and the challenges encountered as well as describe future plans.

88. Jacob Köhler, Katherine Munn, Alexander Rüegg, Andre Skusa, Barry Smith, "Quality Control for Terms and Definitions in Ontologies and Taxonomies", *BMC Bioinformatics*, 2006, 7: 212, PMC1482721

Abstract: Ontologies and taxonomies are among the most important computational resources formolecular biology and bioinformatics. A series of recent papers has shown that the Gene Ontology (GO), the most prominent taxonomic resource in these fields, is marked by flaws of certain characteristic types, which flow from a failure to address basic ontological principles. As yet, no methods have been proposed which would allow ontology curators to pinpoint flawed terms or definitions in ontologies in a systematic way. We present computational methods that automatically identify terms and definitions which are defined in a circular or unintelligible way. We further demonstrate the potential of these methods by applying them to isolate a subset of 6001 problematic GO terms. By automatically aligning GO with other ontologies and taxonomies we were able to propose alternative synonyms and definitions for some of these problematic terms. This allows us to demonstrate that these other resources do not contain definitions superior to those supplied by GO. Our methods provide reliable indications of the quality of terms and definitions in ontologies and taxonomies. Further, they are well suited to assist ontology curators in drawing their attention to those terms that are ill-defined. We have further shown the limitations of ontology mapping and alignment in assisting ontology curators in rectifying problems, thus pointing to the need for manual curation.

89. Kevin Mulligan, Peter Simons and Barry Smith, "What's Wrong with Contemporary Philosophy?", *Topoi*, 25 (1-2), 2006, 63-67.

Abstract: Abstract Philosophy in the West divides into three parts: Analytic Philosophy (AP), Continental Philosophy (CP), and History of Philosophy (HP). But all three parts are in a bad way. AP is sceptical about the claim that philosophy can be a science, and hence is uninterested in the real world. CP is never pursued in a properly theoretical way, and its practice is tailor-made for particular political and ethical conclusions. HP is mostly developed on a regionalist basis: what is studied is determined by the nation or culture to which a philosopher belongs, rather than by the objective value of that philosopher's work. Progress in philosophy can only be attained by avoiding these pitfalls.

Finnish translation as "Mikä nykyfilosofiassa on vialla?", *niin & näin*, 1 (2014), 69-74 (published with commentary by Tuomas E. Tahko (76-78), Pauliina Remes (80-82) and Susanna Lindberg (85-90).

Portuguese translation as "Ce se întâmplă cu filosofia contemporană?", *Rivista de filosofie*, 62 (6), 2015, 759-765.

90. Leo Obrst, Patrick Cassidy, Steve Ray, Barry Smith, Dagobert Soergel, Matthew West and Peter Yim, "The 2006 Upper Ontology Summit Joint Communiqué", *Applied Ontology*, 1 (2), 2006, 203-211.

Abstract: On March 14-15, 2006, at the US National Institute of Standards and Technology (NIST) in Gaithersburg, MD there took place the first Upper Ontology Summit (UOS). This was a convening of custodians of several prominent upper ontologies, key technology participants, and interested other parties, with the purpose of finding a means to relate the different ontologies to each other. The result is reflected in a joint communiqué, directed to the larger ontology community and the general public, and expressing a joint intent to build bridges among the existing upper ontologies in ways designed to increase and rationalize their utilization and to enhance their semantic interoperability.

91. Olivier Bodenreider, Barry Smith, Anand Kumar, Anita Burgun, "Investigating Subsumption in SNOMED CT: An Exploration into Large Description Logic-Based Biomedical Terminologies", *Artificial Intelligence in Medicine*, 2007, 39, 183-195. PMC2442845

Abstract: Formalisms based on one or other flavor of Description Logic (DL) are sometimes put forward as helping to ensure that terminologies and controlled vocabularies comply with sound ontological principles. The objective of this paper is to study the degree to which one DL-based biomedical terminology (SNOMED CT) does indeed comply with such principles. We defined seven ontological principles (for example: each class must have at least one parent, each class must differ from its parent) and examined the properties of SNOMED CT classes with respect to these principles. Our major results are: 31% of these classes have a single child; 27% have multiple parents; 51% do not exhibit any differentiae between the description of the parent and that of the child. The applications of this study to quality assurance for ontologies are discussed and suggestions are made for dealing with the phenomenon of multiple inheritance. The advantages and limitations of our approach are also discussed.

92. Werner Ceusters and Barry Smith, "Referent Tracking for Treatment Optimisation in Schizophrenic Patients: A Case Study in Applying Philosophical Ontology to Diagnostic Algorithms", *Journal of Web Semantics*, 2006; (4)3, 229-236. PMC203705415

Abstract: The IPAP Schizophrenia Algorithm was originally designed in the form of a flow chart to help physicians optimise the treatment of schizophrenic patients in within a framework of guideline-based medicine. We take this algorithm as our starting point in investigating how artifacts of this sort can benefit from the facilities of high-quality ontologies. The IPAP algorithm exists thus far only in a form suitable for use by human beings. We draw on the resources of Basic Formal Ontology (BFO) in order to show how such an algorithm can be enhanced in such a way that it can be used in Semantic Web and related applications. We found that BFO provides a framework that is able to capture in a rigorous way all the types of entities represented in the IPAP schizophrenia algorithm in way which yields a computational tool that can be used by software agents to perform monitoring and control of schizophrenic patients. We discuss the issues involved in building an application ontology for this purpose, issues which are important for any Semantic Web application in the life science and healthcare domains.

Long version with supplementary data.

93. Werner Ceusters and Barry Smith "Referent Tracking for Digital Rights Management," *International Journal of Metadata, Semantics and Ontologies*, 2(1), 2007, 45-53.

Abstract: Digital Rights Management covers the description, identification, trading, protection, monitoring and tracking of all forms of rights over both tangible and intangible assets, including management of relationships between rights holders in a digital environment. The Digital Object Identifier (DOI) system provides a framework for the persistent identification of content in its broadest interpretation. Although the system has been very well designed to manage object identifiers, some important questions related to the assignment of identifiers are left open. The paradigm of a referent tracking system (RTS) recently advanced in the healthcare and life sciences environment is able to fill these gaps. This is demonstrated by pointing out inconsistencies in the DOI models and by showing how they can be corrected using an RTS.

94. Werner Ceusters, Peter Elkin and Barry Smith, "Negative Findings in Electronic Health Records and Biomedical Ontologies: A Realist Approach", *International Journal of Medical* Informatics 2007; 76: 326-333. PMC2211452.

Abstract: A substantial fraction of the observations made by clinicians and entered into patient records are expressed by means of negation or by using terms which contain negative qualifiers (as in "absence of pulse" or "surgical procedure not performed"). This seems at first sight to present problems for ontologies, terminologies and data repositories that adhere to a realist view and thus reject any reference to putative non-existing entities. Basic Formal Ontology (BFO) and Referent Tracking (RT) are examples of such paradigms. The purpose of the research here described was to test a proposal to capture negative findings in electronic health record systems based on BFO and RT. *Methods*: We analysed a series of negative findings encountered in 748 sentences taken from 41 patient charts. We classified the phenomena described in terms of the various top-level categories and relations defined in BFO, taking into account the role of negation in the corresponding descriptions. We also studied terms from SNOMED-CT containing one or other form of negation. We then explored ways to represent the described phenomena by means of the types of representational units available to realist ontologies such as BFO. *Results*: We introduced a new family of 'lacks' relations into the OBO Relation Ontology in terms of which we were able to accommodate nearly all occurrences of negative findings in the sample studied.

95. Barry Smith, Michael Ashburner, Cornelius Rosse, Jonathan Bard, William Bug, Werner Ceusters, Louis J. Goldberg, Karen Eilbeck, Amelia Ireland, Christopher J Mungall, The OBI Consortium, Neocles Leontis, Philippe Rocca-Serra, Alan Ruttenberg, Susanna-Assunta Sansone, Richard H Scheuermann, Nigam Shah, Patricia L. Whetzel, Suzanna Lewis, "The OBO Foundry: Coordinated Evolution of Ontologies to Support Biomedical Data Integration", *Nature Biotechnology*, 25 (11), November 2007, 1251-1255. PMC2814061

Abstract: The value of any kind of data is greatly enhanced when it exists in a form that allows it to be integrated with other data. One approach to integration is through the annotation of multiple bodies of data using common controlled vocabularies or 'ontologies'. Unfortunately, the very success of this approach has led to a proliferation of ontologies which itself creates obstacles to integration. The Open Biomedical Ontologies (OBO) consortium has set in train a strategy to overcome this problem. Existing OBO ontologies, including the Gene Ontology, are undergoing a process of coordinated reform and new ontologies being created on the basis of an evolving set of shared principles governing ontology development. The result is an expanding family of ontologies designed to be interoperable, logically well-formed, and to incorporate accurate representations of biological reality. We describe the OBO Foundry initiative, and provide guidelines for those who might wish to become involved.

96. Darren A. Natale, Cecilia N. Arighi, Winona Barker, Judith Blake, Ti-Cheng Chang, Zhangzhi Hu, Hongfang Liu, Barry Smith, and Cathy H. Wu, "Framework for a Protein Ontology", *BMC Bioinformatics*, Nov. 2007, 8(Suppl. 9): S1. PMC2217659

Abstract: Biomedical ontologies are emerging as critical tools in genomic and proteomic research, where complex data in disparate resources need to be integrated. A number of ontologies describe properties that can be attributed to proteins. For example, protein functions are described by the Gene Ontology (GO) and human diseases by SNOMED CT or ICD10. There is, however, a gap in the current set of ontologies—one that describes the protein entities

themselves and their relationships. We have designed the PRotein Ontology (PRO) to facilitate protein annotation and to guide new experiments. The components of PRO extend from the classification of proteins on the basis of evolutionary relationships to the representation of the multiple protein forms of a gene (products generated by genetic variation, alternative splicing, proteolytic cleavage, and other post-translational modifications). PRO will allow the specification of relationships between PRO, GO and other ontologies in the OBO Foundry. Here we describe the initial development of PRO, illustrated using human and mouse proteins involved in the transforming growth factor-beta and bone morphogenetic protein signaling pathways (http://pir.georgetown.edu/pro).

97. Chris F Taylor, Dawn Field, Susanna-Assunta Sansone, Rolf Apweiler, Michael Ashburner, Catherine A Ball, Pierre-Alain Binz, Alvis Brazma, Ryan Brinkman, Eric W Deutsch, Oliver Fiehn, Jennifer Fostel, Peter Ghazal, Graeme Grimes, Nigel W Hardy, Henning Hermjakob, Randall K Julian, Jr., Matthew Kane, Eugene Kolker, Martin Kuiper, Nicholas Le Novère, Jim Leebens-Mack, Suzanna E Lewis, Ruth McNally, Alexander Mehrle, Norman Morrison, John Quackenbush, Donald G Robertson, Philippe Rocca-Serra, Barry Smith, Jason Snape, Peter Sterk, Stefan Wiemann, "Promoting Coherent Minimum Reporting Requirements for Biological and Biomedical Investigations: The MIBBI Project", *Nature Biotechnology,* 26 (2008), 889-896. PMC2771753

Abstract: Throughout the biological and biomedical sciences there is a growing need for, prescriptive 'minimum information' (MI) checklists specifying the key information to include when reporting experimental results are beginning to find favor with experimentalists, analysts, publishers and funders alike. Such checklists aim to ensure that methods, data, analyses and results are described to a level sufficient to support the unambiguous interpretation, sophisticated search, reanalysis and experimental corroboration and reuse of data sets, facilitating the extraction of maximum value from data sets them. However, such 'minimum information' MI checklists are usually developed independently by groups working within representatives of particular biologically- or technologically-delineated domains. Consequently, an overview of the full range of checklists can be difficult to establish without intensive searching, and even tracking thetheir individual evolution of single checklists may be a non-trivial exercise. Checklists are also inevitably partially redundant when measured one against another, and where they overlap is far from straightforward. Furthermore, conflicts in scope and arbitrary decisions on wording and sub-structuring make integration difficult. This presents inhibit their use in combination. Overall, these issues present significant difficulties for the users of checklists, especially those in areas such as systems biology, who routinely combine information from multiple biological domains and technology platforms. To address all of the above, we present MIBBI (Minimum Information for Biological and Biomedical Investigations); a web-based communal resource for such checklists, designed to act as a 'one-stop shop' for those exploring the range of extant checklist projects, and to foster collaborative, integrative development and ultimately promote gradual integration of checklists.

98. David P. Hill, Barry Smith, Monica S. McAndrews-Hill, Judith A. Blake, "Gene Ontology Annotations: What they mean and where they come from", *BMC Bioinformatics*, 2008; 9(Suppl 5): S2. PMC2367625

Abstract: The computational genomics community has come increasingly to rely on the methodology of creating annotations of scientific literature using terms from controlled structured vocabularies such as the Gene Ontology (GO). We here address the question of what such annotations signify and of how they are created by working biologists. Our goal is to promote a better understanding of how the results of experiments are captured in annotations in the hope that this will lead to better representations of biological reality through both the annotation process and ontology development, and in more informed use of the GO resources by experimental scientists.

99. David Koepsell, Robert Arp, Jennifer Fostel and Barry Smith, "Creating a Controlled Vocabulary for the Ethics of Human Research: Towards a Biomedical Ethics

Ontology", *Journal of Empirical Research on Human Research Ethics*, Vol. 4, No. 1, 2009, 43-58. PMC2725426

> **Abstract:** Ontologies describe reality in specific domains in ways that can bridge various disciplines and languages. They allow easier access and integration of information that is collected by different groups. Ontologies are currently used in the biomedical sciences, geography, and law. A Biomedical Ethics Ontology would benefit members of ethics committees who deal with protocols and consent forms spanning numerous fields of inquiry. There already exists the Ontology for Biomedical Investigations (OBI); the proposed BMEO would interoperate with OBI, creating a powerful information tool. We define a domain ontology and begin to construct a BMEO, focused on the process of evaluating human research protocols. Finally, we show how our BMEO can have practical applications for ethics committees. This paper describes ongoing research and a strategy for its broader continuation and cooperation.

100. Thomas Bittner, Maureen Donnelly and Barry Smith, "A Spatio-Temporal Ontology for Geographic Information Integration", *International Journal for Geographical Information Science,* 23 (6), 2009, 765-798.

> **Abstract:** This paper presents an axiomatic formalization of a theory of top-level relations between three categories of entities: individuals, universals, and collections. We deal with a variety of relations between entities in these categories, including the sub-universal relation among universals and the parthood relation among individuals, as well as cross-categorial relations such as instantiation and membership. We show that an adequate understanding of the formal properties of such relations – in particular their behavior with respect to time – is critical for geographic information processing. The axiomatic theory is developed using Isabelle, a computational system for implementing logical formalisms. All proofs are computer verified and the computational representation of the theory is available online.

101. Daniel Schober, Barry Smith, Suzanna E Lewis, Waclaw Kusnierczyk, Jane Lomax, Chris Mungall, Chris F Taylor, Philippe Rocca-Serra and Susanna-Assunta Sansone, "Survey-based naming conventions for use in OBO Foundry ontology development", *BMC Bioinformatics*, 2009 (June), 10:125. PMC2684543

> **Abstract:** A wide variety of ontologies relevant to the biological and medical domains are available through the OBO Foundry portal, and integration of these ontologies is extremely desirable. However, heterogeneities in naming conventions pose serious obstacles to such integration. We summarize a review of existing naming conventions and highlight certain disadvantages with respect to their general applicability in the biological domain. We also present the results of a survey carried out to establish which naming conventions are currently employed by OBO Foundry ontologies and to determine what their special requirements regarding the naming of entities might be. Lastly, we propose an initial set of typographic, syntactic and semantic conventions for labelling classes in OBO Foundry ontologies.

102. Cecilia Arighi, Hongfang Liu, Darren Natale, Winona Barker, Harold Drabkin, Zhangzhi Hu, Judith Blake, Barry Smith and Cathy Wu, "TGF-beta Signaling Proteins and the Protein Ontology", *BMC Bioinformatics*, 10: Art. No. S3 Suppl. 5, May 16 2009. PMC2679403

> **Abstract:** The Protein Ontology (PRO) is designed as a formal and principled Open Biomedical Ontologies (OBO) Foundry ontology for proteins. The components of PRO extend from a classification of proteins on the basis of evolutionary relationships at the homeomorphic level to the representation of the multiple protein forms of a gene, including those resulting from alternative splicing, cleavage and/or post-translational modifications. Focusing specifically on the TGF-beta signaling proteins, we describe the building, curation, usage and dissemination of the Protein Ontology.

103. Anna M. Masci, Cecilia N. Arighi, Alexander D. Diehl, Anne E. Lieberman, Chris Mungall, Richard H. Scheuermann, Barry Smith and Lindsay G. Cowell, "An improved ontological representation of dendritic cells as a paradigm for all cell types", *BMC Bioinformatics*, February 2009, 10:70. PMC2662812

Abstract: The Cell Ontology (CL) is designed to provide a standardized representation of cell types for data annotation. Currently, the CL employs multiple is_a relations, defining cell types in terms of histological, functional, and lineage properties, and the majority of definitions are written with sufficient generality to hold across multiple species. This approach limits the CL's utility for cross-species data integration. To address this problem, we developed a method for the ontological representation of cells and applied this method to develop a dendritic cell ontology (DC-CL). DC-CL subtypes are delineated on the basis of surface protein expression, systematically including both species-general and species-specific types and optimizing DC-CL for the analysis of flow cytometry data. This approach brings benefits in the form of increased accuracy, support for reasoning, and interoperability with other ontology resources.

104. Barry Smith, "Toward a Realistic Science of Environments", *Ecological Psychology,* 2009, 21 (2), April-June, 121-130.

Abstract: The perceptual psychologist J. J. Gibson embraces a radically externalistic view of mind and action. We have, for Gibson, not a Cartesian mind or soul, with its interior theater of contents and the consequent problem of explaining how this mind or soul and its psychological environment can succeed in grasping physical objects external to itself. Rather, we have a perceiving, acting organism, whose perceptions and actions are always already tuned to the parts and moments, the things and surfaces, of its external environment. We describe how on this basis Gibson sought to develop a realist science of environments which will be 'consistent with physics, mechanics, optics, acoustics, and chemistry'.

105. Holger Stenzhorn, Stefan Schulz, Martin Boeker and Barry Smith, "Adapting Clinical Ontologies in Real-World Environments", *Journal of Universal Computer Science*, 14 (22), 2009, 3767-3780. PMC2853050

Abstract: The desideratum of semantic interoperability has been intensively discussed in medical informatics circles in recent years. Originally, experts assumed that this issue could be sufficiently addressed by insisting simply on the application of shared clinical terminologies or clinical information models. However, the use of the term 'ontology' has been steadily increasing more recently. We discuss criteria for distinguishing clinical ontologies from clinical terminologies and information models. Then, we briefly present the role clinical ontologies play in two multicentric research projects. Finally, we discuss the interactions between these different kinds of knowledge representation artifacts and the stakeholders involved in developing interoperational real-world clinical applications. We provide ontology engineering examples from two EU-funded projects.

106. Stefan Schulz, Holger Stenzhorn, Martin Boekers and Barry Smith, "Strengths and Limitations of Formal Ontologies in the Biomedical Domain", *Electronic Journal of Communication, Information and Innovation in Health* (Special Issue on Ontologies, Semantic Web and Health), 3 (1), 2009, 31-45. PMC2904529

Abstract: We propose a typology of representational artifacts for health care and life sciences domains and associate this typology with different kinds of formal ontology and logic, drawing conclusions as to the strengths and limitations for ontology in a description logics framework. The four types of domain representation we consider are: (i) lexico-semantic representation, (ii) representation of types of entities, (iii) representations of background knowledge, and (iv) representation of individuals. We advocate a clear distinction of the four kinds of representation in order to provide a more rational basis for using ontologies and related artifacts to advance integration of data and enhance interoperability of associated reasoning systems. We highlight the fact that only a minor portion of scientifically relevant facts in a domain such as biomedicine can be adequately represented by formal ontologies as long as the latter are conceived as representations of entity types. In particular, the attempt to encode default or probabilistic knowledge using ontologies so conceived is prone to produce unintended, erroneous models.

Portuguese translation as "Vantagens e limitações das ontologias formais na área biomedical", *Reciis: Revista Electronica de Comunicacao Informacao, Inovacao em Saude*, March 2009, March 2009, Vol. 3, N 1, 33-48.

107. Gunnar O. Klein and Barry Smith, "Concept Systems and Ontologies: Recommendations for Basic Terminology", *Transactions of the Japanese Society for Artificial Intelligence*, 25, 2010, 433-441. PMC3034144.

Abstract: This essay concerns the problems surrounding the use of the term 'concept' in current ontology and terminology research. It is based on the constructive dialogue between realist ontology on the one hand and the world of formal standardization of health informatics on the other, but its conclusions are not restricted to the domain of medicine. The term "concept" is one of the most misused in literature and documentation of technical standards in the computer and information technology domains. In this paper we propose to use the term "concept" in the context of producing defined professional terminologies with one specific and consistent meaning, which we then propose for adoption as the agreed meaning of the term in future terminological research, and specifically in the development of formal terminologies to be used in computer systems. We also discuss and propose new definitions of a set of cognate terms. We describe the relations governing the realm of concepts, and compare these to the richer and more complex set of relations obtaining between entities in the real world. On this basis we also summarize an associated terminology for ontologies as representations of the real world and a partial mapping between the world of concepts and the world of reality.

Japanese translation in *Journal of the Japanese Society for Artificial Intelligence*, 25 (3), 2010, 317-325.

108. David R. Karp, Nishanth Marthandan, Steven G. E. Marsh, Chul Ahn, Frank C. Arnett, Lindsay Cowell, David S. DeLuca, Alexander D. Diehl, Raymond Dunivin, Karen Eilbeck, Michael Feolo, Paula A. Guidry, Wolfgang Helmberg, Suzanna Lewis, Maureen D. Mayes, Chris Mungall, Darren A. Natale, Bjoern Peters, Effie Petersdorf, John D. Reveille, Barry Smith, Glenys Thomson, Matthew J. Waller, Richard H. Scheuermann, "Novel Sequence Feature Variant Type Analysis of the HLA Genetic Association in Systemic Sclerosis", *Human Molecular Genetics*, 2010 Feb 15;19(4):707-19. PMC2807365

Abstract: Significant associations have been found between specific human leukocyte antigen (HLA) alleles and organ transplant rejection, autoimmune disease development, and the response to infection. Traditional searches for disease associations have conventionally measured risk associated with the presence of individual HLA alleles. However, given the high level of HLA polymorphism, the pattern of amino acid variability, and the fact that most of the HLA variation occurs at functionally important sites, it may be that a combination of variable amino acid sites shared by several alleles (shared epitopes) are better descriptors of the actual causative genetic variants. Here we describe a novel approach to genetic association analysis in which genes/proteins are broken down into smaller sequence features and then variant types defined for each feature, allowing for independent analysis of disease association with each sequence feature variant type. We have used this approach to analyze a cohort of systemic sclerosis patients and show that a sequence feature composed of specific amino acid residues in peptide binding pockets 4 and 7 of HLA-DRB1 explains much of the molecular determinant of risk for systemic sclerosis.

109. Barry Smith and Mathias Brochhausen, "Putting Biomedical Ontologies to Work", *Methods of Information in Medicine*, 49 (2), 135-40. (Published September 2010) PMC3116518

Abstract: Biomedical ontologies exist to serve integration of clinical and experimental data, and it is critical to their success that they be put to widespread use in the annotation of data. How, then, can ontologies achieve the sort of user-friendliness, reliability, cost-effectiveness, and breadth of coverage that is necessary to ensure extensive usage? Methods: Our focus here is on two different sets of answers to these questions that have been proposed, on the one hand in medicine, by the SNOMED CT community, and on the other hand in biology, by the OBO Foundry. We address more specifically the issue as to how adherence to certain development principles can advance the usability and effectiveness of an ontology or terminology resource, for example by allowing more accurate maintenance, more reliable application, and more

efficient interoperation with other ontologies and information resources. Results: SNOMED CT and the OBO Foundry differ considerably in their general approach. Nevertheless, a general trend towards more formal rigor and cross-domain interoperability can be seen in both and we argue that this trend should be accepted by all similar initiatives in the future. Conclusions: Future efforts in ontology development have to address the need for harmonization and integration of ontologies across disciplinary borders, and for this, coherent formalization of ontologies is a prerequisite.

German version as "Biomedizinische Ontologien für die Praxis", *European Journal for Biomedical Informatics*, 1 (2009).

110. Jiye Ai, Barry Smith, and David Wong, "Saliva Ontology: An ontology-based framework for a Salivaomics Knowledge Base", *BMC Bioinformatics*, (2010) 11:302. PMC2898059

Abstract: The Salivaomics Knowledge Base (SKB) is designed to serve as a computational infrastructure that can permit global exploration and utilization of data and information relevant to salivaomics. SKB is created by aligning (1) the saliva biomarker discovery and validation resources at UCLA with (2) the ontology resources developed by the OBO (Open Biomedical Ontologies) Foundry, including a new Saliva Ontology (SALO). We define the Saliva Ontology (SALO) as a consensus-based controlled vocabulary of terms and relations dedicated to the salivaomics domain and to saliva-related diagnostics following the principles of the OBO (Open Biomedical Ontologies) Foundry. The Saliva Ontology is an ongoing exploratory initiative. The ontology will be used to facilitate salivaomics data retrieval and integration across multiple fields of research together with data analysis and data mining. The ontology will be tested through its ability to serve the annotation ('tagging') of a representative corpus of salivaomics research literature that is to be incorporated into the SKB.

111. Barry Smith and Werner Ceusters, "Ontological Realism as a Methodology for Coordinated Evolution of Scientific Ontologies", *Applied Ontology*, 5 (2010), 139–188. PMC3104413

Abstract: Since 2002 we have been testing and refining a methodology for ontology development that is now being used by multiple groups of researchers in different life science domains. Gary Merrill, in a recent paper in this journal, describes some of the reasons why this methodology has been found attractive by researchers in the biological and biomedical sciences. At the same time he assails the methodology on philosophical grounds, focusing specifically on our recommendation that ontologies developed for scientific purposes should be constructed in such a way that their terms are seen as referring to what we call universals or types in reality. As we show, Merrill's critique is of little relevance to the success of our realist project, since it not only reveals no actual errors in our work but also criticizes views on universals that we do not in fact hold. However, it nonetheless provides us with a valuable opportunity to clarify the realist methodology, and to show how some of its principles are being applied, especially within the framework of the OBO (Open Biomedical Ontologies) Foundry initiative.

112. Werner Ceusters and Barry Smith, "Foundations for a Realist Ontology of Mental Disease", *Journal of Biomedical Semantics*, 2010, 1:10, 1-23. PMC3017014

Abstract: While classifications of mental disorders have existed for over one hundred years, it still remains unspecified what terms such as 'mental disorder', 'disease' and 'illness' might actually denote. While ontologies have been called in aid to address this shortfall since the GALEN project of the early 1990s, most attempts thus far have sought to provide a formal description of the structure of some pre-existing terminology or classification, rather than of the corresponding structures and processes on the side of the patient. We here present a view of mental disease that is based on ontological realism and which follows the principles embodied in Basic Formal Ontology (BFO) and in the application of BFO in the Ontology of General Medical Science (OGMS). We analyzed statements about what counts as a mental disease provided (1) in the research agenda for the DSM-V, and (2) in Pies' model. The results were used to assess whether the representational units of BFO and OGMS were adequate as foundations for a formal representation of the entities in reality that these statements attempt to describe. We then analyzed the representational units specific to mental disease and provided corresponding

definitions. Our key contributions lie in the identification of confusions and conflations in the existing terminology of mental disease and in providing what we believe is a framework for the sort of clear and unambiguous reference to entities on the side of the patient that is needed in order to avoid these confusions in the future.

113. Albert Goldfain, Barry Smith and Lindsay G. Cowell, "Towards an Ontological Representation of Resistance: The Case of MRSA", *Journal of Biomedical Informatics*, 2011 (Feb.), 44:1, 35-41. PMC2930208.

Abstract: This paper addresses a family of issues surrounding the biological phenomenon of resistance and its representation in realist ontologies. The treatments of resistance terms in various existing ontologies are examined and found to be either overly narrow, internally inconsistent, or otherwise problematic. We propose a more coherent characterization of resistance in terms of what we shall call blocking dispositions, which are collections of mutually coordinated dispositions which are of such a sort that they cannot undergo simultaneous realization within a single bearer. A definition of 'protective resistance' is proposed for use in the Infectious Disease Ontology (IDO) and we show how this definition can be used to characterize the antibiotic resistance in Methicillin-Resistant Staphylococcus aureus (MRSA). The ontological relations between entities in our MRSA case study are used alongside a series of logical inference rules to illustrate logical reasoning about resistance. A description logic representation of blocking dispositions is also provided. We demonstrate that our characterization of resistance is sufficiently general to cover two other cases of resistance in the infectious disease domain involving HIV and malaria.

114. Pierre Grenon and Barry Smith, "Foundations of an Ontology of Philosophy", *Synthese*, 2011, 182 (2), 185-204.

Abstract: We describe an ontology of philosophy that is designed to help navigation through philosophical literature, including literature in the form of encyclopedia articles and textbooks and in both printed and digital forms. The ontology is designed also to serve integration and structuring of data pertaining to the philosophical literature, and in the long term also to support reasoning about the provenance and contents of such literature, by providing a representation of the philosophical domain that is orientated around what philosophical literature is about.

Preprint version

115. Werner Ceusters, Maria Capolupo, Georges De Moor, Jos Devlies, Barry Smith, "An Evolutionary Approach to Realism-Based Adverse Event Representations", *Methods of Information in Medicine*, 50 (1): 62-73, 2011. PMC2829617

Abstract: Background: Part of the ReMINE project involved the creation of an ontology enabling computer-assisted decision support for optimal adverse event management. Objectives: The ontology had to satisfy the following requirements: (1) to be able to account for the distinct and context-dependent ways in which authoritative sources define the term 'adverse event', (2) to allow the identification of relevant RAPS information on the basis of the disease history of a patient as documented in electronic health records, and (3) to be compatible with present and future ontologies developed under the OBO Foundry framework. *Methods*: We used as feeder ontologies the Basic Formal Ontology, the Foundational Model of Anatomy, the Ontology of General Medical Science, the Information Artifact Ontology and the Ontology of Mental Health. We further used relations defined according to the pattern set forth in the OBO Relation Ontology. In light of the use of the ontology for the representation of adverse events that actually occurred and therefore are registered in a database, we also applied the principles of Referent Tracking. *Results*: We merged the upper portions of the feeder ontologies and introduced 22 additional representational units of which 13 are generally applicable in biomedicine and 9 in the adverse event context. We provided for each representational unit a textual definition that can be translated into equivalent formal definitions. Conclusion: The resulting ontology satisfies all requirements set forth. Merging the existing ontologies, although all designed under the OBO Foundry principles, brought new insight into what the representational units of such ontologies actually denote.

116. Darren A. Natale, Cecilia N. Arighi, Winona C. Barker, Judith A. Blake, Carol J. Bult, Michael Caudy, Harold J. Drabkin, Peter D'Eustachio, Alexei V. Evsikov,

Hongzhan Huang, Jules Nchoutmboube, Natalia V. Roberts, Barry Smith, Jian Zhang, Cathy H. Wu, "The Protein Ontology: A Structured Representation of Protein Forms and Complexes", *Nucleic Acids Research* 2011, 39 (Database Issue), D539-545. PMC3013777

> **Abstract:** The Protein Ontology (PRO) provides a formal, logically-based classification of specific protein classes including structured representations of protein isoforms, variants and modified forms. Initially focused on proteins found in human, mouse and Escherichia coli, PRO now includes representations of protein complexes. The PRO Consortium works in concert with the developers of other biomedical ontologies and protein knowledge bases to provide the ability to formally organize and integrate representations of precise protein forms so as to enhance accessibility to results of protein research. PRO (http://pir.georgetown.edu/pro) is part of the Open Biomedical Ontologies (OBO) Foundry.

117. Carol J. Bult, Harold Drabkin, Alexei Evsikov, Darren Natale, Cecilia Arighi, Natalia Roberts, Alan Ruttenberg, Peter D'Eustachio, Barry Smith, Judith A. Blake, Cathy Wu, "The Representation of Protein Complexes in the Protein Ontology (PRO)", *BMC Bioinformatics*, September 2011, 12:371. PMC3189193

> **Abstract:** Representing species-specific proteins and protein complexes in ontologies that are both human- and machine-readable facilitates the retrieval, analysis, and interpretation of genome-scale data sets. Although existing protein-centric informatics resources provide the biomedical research community with well-curated compendia of protein sequence and structure, these resources lack formal ontological representations of the relationships among the proteins themselves. The Protein Ontology (PRO) Consortium is filling this informatics resource gap by developing ontological representations and relationships among proteins and their variants and modified forms. Because proteins are often functional only as members of stable protein complexes, the PRO Consortium, in collaboration with existing protein and pathway databases, has launched a new initiative to implement logical and consistent representation of protein complexes. We describe here how the PRO Consortium is meeting the challenge of representing species-specific protein complexes, how protein complex representation in PRO supports annotation of protein complexes and comparative biology, and how PRO is being integrated into existing community bioinformatics resources. Conclusion: PRO is a unique database resource for species-specific protein complexes. PRO facilitates robust annotation of variations in composition and function contexts for protein complexes within and between species.

118. Mark A. Musen, Natalya F. Noy, Nigam H. Shah, Patricia L. Whetzel, Christopher G. Chute, Margaret-Anne Story, Barry Smith, and the NCBO team, "The National Center for Biomedical Ontology", *Journal of the American Medical Informatics Association*, 19 (2), 2012, 190-195. PMC3277625

> **Abstract:** The National Center for Biomedical Ontology is now in its seventh year. The goals of this National Center for Biomedical Computing are to: create and maintain a repository of biomedical ontologies and terminologies; build tools and web services to enable the use of ontologies and terminologies in clinical and translational research; educate their trainees and the scientific community broadly about biomedical ontology and ontology-based technology and best practices; and collaborate with a variety of groups who develop and use ontologies and terminologies in biomedicine. The centerpiece of the National Center for Biomedical Ontology is a web-based resource known as BioPortal. BioPortal makes available for research in computationally useful forms more than 270 of the world's biomedical ontologies and terminologies, and supports a wide range of web services that enable investigators to use the ontologies to annotate and retrieve data, to generate value sets and special-purpose lexicons, and to perform advanced analytics on a wide range of biomedical data.

119. Barry Smith, "How to Do Things with Documents", *Rivista di Estetica*, 50 (2012), 179-198.

> **Abstract:** This essay is a contribution to social ontology, drawing on the work of John Searle and of Hernando de Soto. At the center of the argument is the proposition advanced by de Soto in his *Mystery of Capital* to the effect that many of the entities which structure our contemporary social reality are entities which exist in virtue of the fact that there are (paper or digital)

documents which support their existence. I here develop de Soto's argument further, focusing specifically on the ontological problems raised by a family of new types of social phenomena – exemplified most dramatically in the domain of finance for example in the form of what are called 'structured investment vehicles' – made possible as a result of the employment of computer technology in entity creation. I address also Searle's most recent work on social ontology, and conclude with an appendix on the theory of documentality advanced by Maurizio Ferraris.

120. Jiye Ai, Barry Smith and David Wong, "Bioinformatics Advances in Saliva Diagnostics", *International Journal of Oral Science*, (2012) 4, 85–87. PMC3412667

Abstract: A knowledge base to retrieve, integrate and analyze multiple data types collected from saliva samples promises to transform healthcare. Saliva is ideally suited to non-invasive detection and monitoring of disease. However, the absence of a free resource that cross-references disease-based changes in the levels of biomolecules has hamstrung progress in identifying biomarkers of specific illnesses. To address this issue, a team led by Ji-Ye Ai and David Wong at the University of California in Los Angeles are spearheading the creation of the Salivaomics Knowledge Base (SKB), a data management system and web resource to facilitate the discovery of saliva biomarkers using systems biology. The researchers first defined a common and structured vocabulary to describe the diverse data types; now, they are creating a common interface to integrate protein, RNA and metabolite data from multiple independent databases.

121. Ramona L. Walls, Balaji Athreya, Laurel Cooper, Justin Elser, Maria A. Gandolfo, Pankaj Jaiswal, Christopher J. Mungall, Justin Preece, Stefan A. Rensing, Barry Smith, Dennis W. Stevenson, "Ontologies as Integrative Tools for Plant Science", *American Journal of Botany*, 99(8): 1–13, 2012. PMC3492881

Abstract: Bio-ontologies are essential tools for accessing and analyzing the rapidly growing pool of plant genomic and phenomic data. Ontologies provide structured vocabularies to support consistent aggregation of data and a semantic framework for automated analyses and reasoning. They are a key component of the Semantic Web. This paper provides background on what bio-ontologies are, why they are relevant to botany, and the principles of ontology development. It includes an overview of ontologies and related resources that are relevant to plant science, with a detailed description of the Plant Ontology (PO). We discuss the challenges of building an ontology that covers all green plants (Viridiplantae). Key results: Ontologies can advance plant science in four keys areas: 1. comparative genetics, genomics, phenomics, and development, 2. taxonomy and systematics, 3. semantic applications and 4. education. Conclusions: Bio-ontologies offer a flexible framework for comparative plant biology, based on common botanical understanding. As genomic and phenomic data become available for more species, we anticipate that the annotation of data with ontology terms will become less centralized, while at the same time, the need for cross-species queries will become more common, causing more researchers in plant science to turn to ontologies.

122. Barry Smith, "Classifying Processes: An Essay in Applied Ontology", *Ratio*, 25:4 (2012), 463-488. PMC 3718480

Abstract: We begin by describing recent developments in the burgeoning discipline of applied ontology, focusing especially on the ways ontologies are providing a means for the consistent representation of scientific data. We then introduce Basic Formal Ontology (BFO), a top-level ontology that is serving as domain-neutral framework for the development of lower level ontologies in many specialist disciplines, above all in biology and medicine. BFO is a bicategorial ontology, embracing both three-dimensionalist (continuant) and four-dimensionalist (occurrent) perspectives within a single framework. We examine how BFO-conformant domain ontologies can deal with the consistent representation of scientific data deriving from the measurement of processes of different types, and we outline on this basis the first steps of an approach to the classification of such processes within the BFO framework.

Reprinted in D. Oderberg (ed.), *Classifying Reality*, Oxford: Wiley-Blackwell, 2013, 101-126.

123. Barry Smith, Tatiana Malyuta, David Salmen, William Mandrick, Kesny Parent, Shouvik Bardhan, Jamie Johnson, "Ontology for the Intelligence Analyst", *CrossTalk: The Journal of Defense Software Engineering*, November/December 2012, 18-25.

> **Abstract:** As available intelligence data and information expand in both quantity and variety, new techniques must be deployed for search and analytics. One technique involves the semantic enhancement of data through the creation of what are called 'ontologies' or 'controlled vocabularies.' When multiple different bodies of heterogeneous data are tagged by means of terms from common ontologies, then these data become linked together in ways which allow more effective retrieval and integration. We describe a simple case study to show how these benefits are being achieved, and we describe our strategy for developing a suite of ontologies to serve the needs of the war-fighter in the ever more complex battlespace environments of the future.

124. Laurel Cooper, Ramona L. Walls, Justin Elser, Maria A. Gandolfo, Dennis W. Stevenson, Barry Smith, Justin Preece, Balaji Athreya, Christopher J. Mungall, Stefan Rensing, Manuel Hiss, Daniel Lang, Ralf Reski, Tanya Z. Berardini, Donghui Li, Eva Huala, Mary Schaeffer, Naama Menda, Elizabeth Arnaud, Rosemary Shrestha, Yukiko Yamazaki, Pankaj Jaiswal, "The Plant Ontology as a Tool for Comparative Plant Anatomy and Genomic Analyses", *Plant and Cell Physiology*, 54 (2) (Database Issue), Feb. 2013, 1-23 (PMC3583023)

> **Abstract:** The Plant Ontology (PO; http://www.plantontology.org/) is a publicly-available, collaborative effort to develop and maintain a controlled, structured vocabulary ("ontology") of terms to describe plant anatomy, morphology and the stages of plant development. The goals of the PO are to link (annotate) gene expression and phenotype data to plant structures and stages of plant development, using the data model adopted by the Gene Ontology. From its original design covering only rice, maize and *Arabidopsis*, the scope of the PO has been expanded to include all green plants. The PO was the first multi-species anatomy ontology developed for the annotation of genes and phenotypes. Also, to our knowledge, it was one of the first biological ontologies that provides translations (via synonyms) in non-English languages such as Japanese and Spanish. There are about 2.2 million annotations linking PO terms to over 110,000 unique data objects representing genes or gene models, proteins, RNAs, germplasm and Quantitative Traits Loci (QTLs) from 22 plant species. In this paper, we focus on the *plant anatomical entity* branch of the PO, describing the organizing principles, resources available to users, and examples of how the PO is integrated into other plant genomics databases and web portals. We also provide two examples of comparative analyses, demonstrating how the ontology structure and PO-annotated data can be used to discover the patterns of expression of the *LEAFY (LFY*) and terpene synthase (*TPS*) gene homologs.

125. Darren A. Natale, Cecilia N. Arighi, Judith A. Blake, Carol J. Bult, Karen R. Christie, Julie Cowart, Peter D'Eustachio, Alexander D. Diehl, Harold J. Drabkin, Olivia Helfer, Hongzhan Huang, Anna Maria Masci, Jia Ren, Natalia V. Roberts, Karen Ross, Alan Ruttenberg, Veronica Shamovsky, Barry Smith, Meher Shruti Yerramalla, Jian Zhang, Aisha AlJanahi, Irem Celen, Cynthia Gan, Mengxi Lv, Emily Schuster-Lezell, Cathy H. Wu, "Protein Ontology: a controlled structured network of protein entities", *Nucleic Acids Research*, 2013, 42(1): D415-21.

> **Abstract:** The Protein Ontology (PRO) formally defines protein entities and explicitly represents their major forms and interrelations. Protein entities represented in PRO corresponding to single amino acid chains are categorized by level of specificity into family, gene, sequence and modification metaclasses, and there is a separate metaclass for protein complexes. All metaclasses also have organism-specific derivatives. PRO complements established sequence databases such as UniProtKB, and interoperates with other biomedical and biological ontologies such as the Gene Ontology (GO). PRO relates to UniProtKB in that PRO's organism-specific classes of proteins encoded by a specific gene correspond to entities documented in UniProtKB entries. PRO relates to the GO in that PRO's representations of organism-specific protein complexes are subclasses of the organism-agnostic protein complex terms in the GO Cellular Component Ontology. The past few years have seen growth and changes to the PRO, as well as

new points of access to the data and new applications of PRO in immunology and proteomics. Here we describe some of these developments.

126. Pier Luigi Buttigieg, Norman Morrison, Barry Smith, Christopher J Mungall, Suzanna E Lewis and the ENVO Consortium, "The Environment Ontology: Contextualizing Biological and Biomedical Entities", *Journal of Biomedical Semantics* 2013, 4:43.

Abstract: As biological and biomedical research increasingly reference the environmental context of the biological entities under study, the need for formalisation and standardisation of environment descriptors is growing. The Environment Ontology (ENVO; www.environmentontology.org) is a community-led, open project which seeks to provide an ontology for specifying a wide range of environments relevant to multiple life science disciplines and, through an open participation model, to accommodate the terminological requirements of all those needing to annotate data using ontology classes. This paper summarises ENVO's motivation, content, structure, adoption, and governance approach.

127. Mark Jensen, Alexander P. Cox, Naveed Chaudhry, Marcus Ng, Donat Sule, William Duncan, Patrick Ray, Bianca Weinstock-Guttman, Barry Smith, Alan Ruttenberg, Kinga Szigeti, Alexander D. Diehl, "The Neurological Disease Ontology", *Journal of Biomedical Semantics*, 2013, 4:42.

Abstract: We are developing the Neurological Disease Ontology (ND) to provide a framework to enable representation of aspects of neurological diseases that are relevant to their treatment and study. ND is a representational tool that addresses the need for unambiguous annotation, storage, and retrieval of data associated with the treatment and study of neurological diseases. ND is being developed in compliance with the Open Biomedical Ontology Foundry principles and builds upon the paradigm established by the Ontology for General Medical Science (OGMS) for the representation of entities in the domain of disease and medical practice. Initial applications of ND will include the annotation and analysis of large data sets and patient records for Alzheimer's disease, multiple sclerosis, and stroke.

128. Schiffman E., Ohrbach R., Truelove E., Look J., Anderson G., Goulet J.-P., List T., Svensson P., Gonzalez Y., Lobbezoo F., Michelotti A., Brooks S.L., Ceusters W., Drangsholt M., Ettlin D., Gaul C., Goldberg L., Haythornthwaite J., Hollender L., Jensen R., John M.T., deLaat A., deLeeuw R., Maixner W., van der Meulen M., Murray G.M., Nixdorf D.R., Palla S., Petersson A., Pionchon P., Smith B., Visscher C.M., Zakrzewska J., Dworkin S.F., "Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: Recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group," *Journal of Oral and Facial Pain and Headache*, 28 (2014), 6–27.

Abstract: *Aims*: The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) Axis I diagnostic algorithms were demonstrated to be reliable but below target sensitivity and specificity. Empirical data supported Axis I algorithm revisions that were valid. Axis II instruments were shown to be both reliable and valid. An international consensus workshop was convened to obtain recommendations and finalization of new Axis I diagnostic algorithms and new Axis II instruments. *Methods*: A comprehensive search of published TMD diagnostic literature was followed by review and consensus via a formal structured process by a panel of experts for revision of the RDC/TMD. Results: The recommended Diagnostic Criteria for TMD (DC/TMD) Axis I protocol includes both a valid screener for pain diagnoses and valid criteria for the most common pain-related TMDs and for one intra-articular disorder. The Axis II protocol retains selected RDC/TMD screening instruments augmented with new instruments to better assess the interactions between pain and psychosocial functioning. A comprehensive classification system is also presented. Conclusion: The recommended evidence-based DC/TMD protocol is appropriate for use in both the clinical and research settings. Simple Axis I and II screening tests augmented by validated Axis I and Axis II instruments allow for identification of simple to complex TMD patients.

129. R. L. Walls, J. Deck, R. Guralnick, S. Baskauf, R. Beaman, S. Blum, S. Bowers, P. L. Buttigieg, N. Davies, D. Endresen, M. A. Gandolfo, R. Hanner, A. Janning, L. Krishtalka, A. Matsunaga, P. Midford, N. Morrison, É. Ó Tuama, M. Schildhauer, B. Smith, B. J. Stucky, A. Thomer, J. Wieczorek, J. Whitacre, and J. Wooley, "Semantics in Support of Biodiversity Knowledge Discovery: An Introduction to the Biological Collections Ontology and Related Ontologies", *PLoS One*, March 3, 2014, 10.1371/journal.pone.0089606 (PMC3940615)

Abstract: The study of biodiversity spans many disciplines and includes data pertaining to species distributions and abundances, genetic sequences, trait measurements, and ecological niches, complemented by information on collection and measurement protocols. A review of the current landscape of metadata standards and ontologies in biodiversity science suggests that existing standards such as the Darwin Core terminology are inadequate for describing biodiversity data in a semantically meaningful and computationally useful way. Existing ontologies, such as the Gene Ontology and others in the Open Biological and Biomedical Ontologies (OBO) Foundry library, provide a semantic structure but lack many of the necessary terms to describe biodiversity data in all its dimensions. In this paper, we describe the motivation for and ongoing development of a new Biological Collections Ontology, the Environment Ontology, and the Population and Community Ontology. These ontologies share the aim of improving data aggregation and integration across the biodiversity domain and can be used to describe physical samples and sampling processes (for example, collection, extraction, and preservation techniques), as well as biodiversity observations that involve no physical sampling. Together they encompass studies of: 1) individual organisms, including voucher specimens from ecological studies and museum specimens, 2) bulk or environmental samples (e.g., gut contents, soil, water) that include DNA, other molecules, and potentially many organisms, especially microbes, and 3) survey-based ecological observations. We discuss how these ontologies can be applied to biodiversity use cases that span genetic, organismal, and ecosystem levels of organization. We argue that if adopted as a standard and rigorously applied and enriched by the biodiversity community, these ontologies would significantly reduce barriers to data discovery, integration, and exchange among biodiversity resources and researchers.

130. David Koepsell and Barry Smith, "Beyond Paper", *The Monist*, 97 (2), April 2014, 222–235.

Abstract: The authors outline the way in which documents as social objects have evolved from their earliest forms to the electronic documents of the present day. They note that while certain features have remained consistent, processes regarding document authentication are seriously complicated by the easy reproducibility of digital entities. The authors argue that electronic documents also raise significant questions concerning the theory of 'documentality' advanced by Maurizio Ferraris, especially given the fact that interactive documents seem to blur the distinctions between the static documents (or 'inscriptions') which form Ferraris's starting point, and dynamic software processes. The authors argue further that the Ferraris view as applied to legal documents is flawed because of the fact that courts may treat contractual obligations as enduring even in spite of a complete absence of enduring inscriptions. Finally, the authors note that traces in brains, another important family of inscriptions (as Ferraris conceives them), differ significantly from genuinely documentary inscriptions by their lack of public inspectability.

131. Janna Hastings, Gwen Alexandra Frishkoff, Barry Smith, Mark Jensen, Russell A Poldrack, Jane Lomax, Anita Bandrowski, Fahim T. Imam, Jessica A Turner and Maryann E Martone, "Interdisciplinary perspectives on the development, integration and application of cognitive ontologies", *Frontiers in Neuroinformatics*, 8:62, 2014.

Abstract: We discuss recent progress in the development of cognitive ontologies and summarize three challenges in the coordinated development and application of these resources. Challenge 1 is to adopt a standardized definition for cognitive processes. We describe three possibilities and recommend one that is consistent with the standard view in cognitive and biomedical sciences. Challenge 2 is harmonization. Gaps and conflicts in representation must be resolved so that these resources can be combined for mark-up and interpretation of multi-modal data. Finally, Challenge 3 is to test the utility of these resources for large-scale annotation of

data, search and query, and knowledge discovery and integration. As term definitions are tested and revised, harmonization should enable coordinated updates across ontologies. However, the true test of these definitions will be in their community-wide adoption which will test whether they support valid inferences about psychological and neuroscientific data.

Polish translation as: "Interdyscyplinarne perspektywy rozwoju, integracji i zastosowań ontologii poznawczych", *Avant*, 8(3), 2016, 101-117.

132. Yongqun He, Sirarat Sarntivijai, Yu Lin, Zuoshuang Xiang, Abra Guo, Shelley Zhang, Desikan Jagannathan, Luca Toldo, Cui Tao and Barry Smith, "OAE: The Ontology of Adverse Events", *Journal of Biomedical Semantics*, July 2014, 5:29.

Abstract: A medical intervention is a medical procedure or application intended to relieve or prevent illness or injury. Examples of medical interventions include vaccination and drug administration. After a medical intervention, adverse events (AEs) may occur which lie outside the intended consequences of the intervention. The representation and analysis of AEs are critical to the improvement of public health. The Ontology of Adverse Events (OAE) has been developed to standardize and integrate data relating to AEs and to support computer-assisted reasoning over such data. OAE has over 3,000 terms with unique identifiers, including terms imported from existing ontologies and more than 1,800 OAE-specific terms. In OAE, the term 'adverse event' denotes a pathological bodily process in a patient that occurs after a medical intervention. Causal adverse events are defined as those events that are causal consequences of a medical intervention. OAE has been used in the analysis of both vaccine and drug adverse event data, for example, using the influenze vaccine data extracted from the Vaccine Adverse Event Reporting System (VAERS)

133. Andrew R. Deans, Suzanna E. Lewis, Eva Huala, Sallvatore S. Anzaldo, Michael Ashburner, James P. Balhoff, David C. Blackburn, Judith A. Blake, J. Gordon Burleigh, Bruno Chanet, Laurel D. Cooper, Mélanie Courtot, Sándor Csösz, Hong Cui, Wasila Dahdul, Sandip Das, T. Alexander Dececchi, Agnes Dettai, Rui Diogo, Robert E. Druzinsky, Michel Dumontier, Nico M. Franz, Frank Friedrich, George V. Gkoutos, Melissa Haendel, Luke J. Harmon, Terry F. Hayamizu, Yongqun He, Heather M. Hines, Nizar Ibrahim, Laura M. Jackson, Pankaj Jaiswal, Christina James-Zorn, Sebastian Köhler, Guillaume Lecointre, Hilmar Lapp, Carolyn J. Lawrence, Nicolas Le Novère, John G. Lundberg, James Macklin, Austin R. Mast, Peter E. Midford, István Mikó, Christopher J. Mungall, Anika Oellrich, David Osumi-Sutherland, Helen Parkinson, Martín J. Ramírez, Stefan Richter, Peter N. Robinson, Alan Ruttenberg, Katja S. Schulz, Erik Segerdell, Katja C. Seltmann, Michael J. Sharkey, Aaron D. Smith, Barry Smith, Chelsea D. Specht, R. Burke Squires, Robert W. Thacker, Anne Thessen, Jose Fernandez-Triana, Mauno Vihinen, Peter D. Vize, Lars Vogt, Christine E. Wall, Ramona L. Walls, Monte Westerfeld, Robert A. Wharton, Christian S. Wirkner, James B. Woolley, Matthew J. Yoder, Aaron M. Zorn, Paula Mabee, "Finding Our Way through Phenotypes", *PLoS Biology*, January 2015, 13 (1).

Abstract: Despite a large and multifaceted effort to understand the vast landscape of phenotypic data, their current form inhibits productive data analysis. The lack of a community-wide, consensus-based, human- and machine-interpretable language for describing phenotypes and their genomic and environmental contexts is perhaps the most pressing scientific bottleneck to integration across many key fields in biology, including genomics, systems biology, development, medicine, evolution, ecology, and systematics. Here we survey the current phenomics landscape, including data resources and handling, and the progress that has been made to accurately capture relevant data descriptions for phenotypes. We present an example of the kind of integration across domains that computable phenotypes would enable, and we call upon the broader biology community, publishers, and relevant funding agencies to support efforts to surmount today's data barriers and facilitate analytical reproducibility.

134. Cecilia Arighi, Veronica Shamovsky, Anna Maria Masci, Alan Ruttenberg, Barry Smith, Darren A Natale, Cathy Wu, Peter D'Eustachio ,"Toll-Like Receptor signaling

in vertebrates: Testing the integration of protein, complex, and pathway data in the Protein Ontology framework", *PLoS One*, April 2015, PONE-D-14-45784R2.

> **Abstract:** The Protein Ontology (PRO) supports annotation of species-specific protein complexes in an ontology framework that relates them both to their components and to species-independent families of complexes. Here, we describe extensions of this ontology framework to link complexes to their subcellular locations, molecular functions, and roles in biological processes as defined by the Gene Ontology, using terms from the Relation Ontology. To demonstrate the feasibility of this approach we have annotated the early events of innate immune signaling mediated by Toll-Like Receptor 3 and 4 complexes in human, mouse, and chicken. The resulting ontology has allowed us to identify species-specific gaps in experimental data and possible functional differences between species, and employ structural and functional relationships inferred from the ontology to suggest plausible resolutions of these discrepancies and gaps.

135. Barry Smith, Sivaram Arabandi, Mathias Brochhausen, Michael Calhoun, Paolo Ciccarese, Scott Doyle, Bernard Gibaud, Ilya Goldberg, Charles E. Kahn, Jr., James Overton, John Tomaszewski, Metin Gurcan, "Biomedical Imaging Ontologies: A Survey and Proposal for Future Work", *Journal of Pathology Informatics*, 2015, 6:37. PMC4485195

> **Abstract:** Ontology is one strategy for promoting interoperability of heterogeneous data through consistent tagging. An ontology is a controlled structured vocabulary consisting of general terms (such as 'cell' or 'image' or 'tissue' or 'microscope') that form the basis for such tagging. These terms are designed to represent the types of entities in the domain of reality that the ontology has been devised to capture; the terms are provided with logical definitions thereby also supporting reasoning over the tagged data. This paper provides a survey of the biomedical imaging ontologies that have been developed thus far. It outlines the challenges, particularly faced by ontologies in the fields of histopathological imaging and image analysis, and suggests a strategy for addressing these challenges in the example domain of quantitative histopathology imaging. The ultimate goal is to support multiscale understanding of disease that comes from using interoperable ontologies to integrate imaging data with clinical and genomics data.

136. Jingshan Huang, Fernando Gutierrez, Harrison J. Strachan, Dejing Dou, Weili Huang, Barry Smith, Judith A. Blake, Karen Eilbeck, Darren A. Natale, Yu Lin, Bin Wu, Nisansa de Silva, Xiaowei Wang, Zixing Liu, Glen Borchert, Mnig Tan, Alan Ruttenberg, "OmniSearch: A semantic search system based on the Ontology for MIcroRNA Target (OMIT) for microRNA-target gene interaction data", *Journal of Biomedical Semantics*, 7:24, May 4, 2016.

> **Abstract:** In recent years, sequencing technologies have enabled the identification of a wide range of non-coding RNAs (ncRNAs). Unfortunately, annotation and integration of ncRNA data has lagged behind their identification. Given the large quantity of information being obtained in this area, there emerges an urgent need to integrate what is being discovered by a broad range of relevant communities. To this end, the Non-Coding RNA Ontology (NCRO) is being developed to provide a systematically structured and precisely defined controlled vocabulary for the domain of ncRNAs, thereby facilitating the discovery, curation, analysis, exchange, and reasoning of data about structures of ncRNAs, their molecular and cellular functions, and their impacts upon phenotypes. The goal of NCRO is to serve as a common resource for annotations of diverse research in a way that will significantly enhance integrative and comparative analysis of the myriad resources currently housed in disparate sources. It is our belief that the NCRO ontology can perform an important role in the comprehensive unification of ncRNA biology and, indeed, fill a critical gap in both the Open Biological and Biomedical Ontologies (OBO) Library and the National Center for Biomedical Ontology (NCBO) BioPortal. Our initial focus is on the ontological representation of small regulatory ncRNAs, which we see as the first step in providing a resource for the annotation of data about all forms of ncRNAs. The NCRO ontology is free and open to all users, accessible at: http://purl.obolibrary.org/obo/ncro.owl.

137. Anita Bandrowski, Ryan Brinkman, Mathias Brochhausen, Matthew H. Brush, Bill Bug†, Marcus C. Chibucos, Kevin Clancy, Mélanie Courtot, Dirk Derom, Michel Dumontier, Liju Fan, Jennifer Fostel, Gilberto Fragoso, Frank Gibson, Alejandra Gonzalez-Beltran, Melissa A. Haendel, Yongqun He, Mervi Heiskanen, Tina Hernandez-Boussard, Mark Jensen, Yu Lin, Allyson L. Lister,Phillip Lord, James Malone, Elisabetta Manduchi, Monnie McGee, Norman Morrison, James A. Overton, Helen Parkinson, Bjoern Peters, Philippe Rocca-Serra, Alan Ruttenberg, Susanna-Assunta Sansone, Richard H. Scheuermann, Daniel Schober, Barry Smith, Larisa N. Soldatova, Christian J. Stoeckert Jr., Chris F. Taylor, Carlo Torniai, Jessica A. Turner, Randi Vita, Patricia L. Whetzel, Jie Zheng. "The Ontology for Biomedical Investigations", *PLoS ONE*, 11(4): e0154556, April 29, 2016.

Abstract: The Ontology for Biomedical Investigations (OBI) is an ontology that provides terms with precisely defined meanings to describe all aspects of how investigations in the biological and medical domains are conducted. OBI re-uses ontologies that provide a representation of biomedical knowledge from the Open Biological and Biomedical Ontologies (OBO) project and adds the ability to describe how this knowledge was derived. We here describe the state of OBI and several applications that are using it, such as adding semantic expressivity to existing databases, building data entry forms, and enabling interoperability between knowledge resources. OBI covers all phases of the investigation process, such as planning, execution and reporting. It represents information and material entities that participate in these processes, as well as roles and functions. Prior to OBI, it was not possible to use a single internally consistent resource that could be applied to multiple types of experiments for these applications. OBI has made this possible by creating terms for entities involved in biological and medical investigations and by importing parts of other biomedical ontologies such as GO, Chemical Entities of Biological Interest (ChEBI) and Phenotype Attribute and Trait Ontology (PATO) without altering their meaning. OBI is being used in a wide range of projects covering genomics, multi-omics, immunology, and catalogs of services. OBI has also spawned other ontologies (Information Artifact Ontology) and methods for importing parts of ontologies (Minimum information to reference an external ontology term (MIREOT)). The OBI project is an open cross-disciplinary collaborative effort, encompassing multiple research communities from around the globe. To date, OBI has created 2366 classes and 40 relations along with textual and formal definitions. The OBI Consortium maintains a web resource (http://obi-ontology.org) providing details on the people, policies, and issues being addressed in association with OBI. The currentrelease of OBI is available at http://purl.obolibrary.org/obo/obi.owl.

138. Jingshan Huang, Karen Eilbeck, Barry Smith, Judith A. Blake, Dejing Dou, Weili Huang, Darren A. Natale, Alan Ruttenberg, Jun Huan, Michael T. Zimmermann, Guoqian Jiang, Yu Lin, Bin Wu, Harrison J. Strachan, Yongqun He, Shaojie Zhang, Xiaowei Wang, Zixing Liu, Glen M. Borchert and Ming Tan, "The Non-Coding RNA Ontology (NCRO): a comprehensive resource for the unification of non-coding RNA biology", *Journal of Biomedical Semantics*, 2016, 7:24, 4 May 2016

Abstract: In recent years, sequencing technologies have enabled the identification of a wide range of non-coding RNAs (ncRNAs). Unfortunately, annotation and integration of ncRNA data has lagged behind their identification. Given the large quantity of information being obtained in this area, there emerges an urgent need to integrate what is being discovered by a broad range of relevant communities. To this end, the Non-Coding RNA Ontology (NCRO) is being developed to provide a systematically structured and precisely defined controlled vocabulary for the domain of ncRNAs, thereby facilitating the discovery, curation, analysis, exchange, and reasoning of data about structures of ncRNAs, their molecular and cellular functions, and their impacts upon phenotypes. The goal of NCRO is to serve as a common resource for annotations of diverse research in a way that will significantly enhance integrative and comparative analysis of the myriad resources currently housed in disparate sources. It is our belief that the NCRO ontology can perform an important role in the comprehensive unification of ncRNA biology and, indeed, fill a critical gap in both the Open Biological and Biomedical Ontologies (OBO) Library and the National Center for Biomedical Ontology (NCBO) BioPortal. Our initial focus is on the ontological representation of small regulatory ncRNAs, which we see as the first step in providing a resource

for the annotation of data about all forms of ncRNAs. The NCRO ontology is free and open to all users, accessible at: http://purl.obolibrary.org/obo/ncro.owl.

139. Andrew D. Spear, Werner Ceusters, Barry Smith, "Functions in Basic Formal Ontology", *Applied Ontology*, 11 (2), (2016), 103-128.

Abstract: The notion of function is indispensable to our understanding of distinctions such as that between *being broken* and *being in working order* (for artifacts) and between *being diseased* and *being healthy* (for organisms). A clear account of the ontology of functions and functioning is thus an important desideratum for any top-level ontology intended for application in domains such as engineering or medicine. The benefit of using top-level ontologies in applied ontology can only be realized when each of the categories identified and defined by a top-level ontology is integrated with the others in a coherent fashion. Basic Formal Ontology (BFO) has from the beginning included *function* as one of its categories, exploiting a version of the etiological account of function that is framed at a level of generality sufficient to accommodate both biological and artifactual functions. This account has been subjected to a series of criticisms and refinements. We here articulate BFO's account of function, provide some reasons for favoring it over competing views, and defend it against objections.

140. Jingshan Huang, Karen Eilbeck, Barry Smith, Judith A. Blake, Dejing Dou, Weili Huang, Darren A. Natale, Alan Ruttenberg, Jun Huan, Michael T. Zimmermann, Guoqian Jiang, Yu Lin, Bin Wu, Harrison Strachan, Nisansa de Silva, Mohan Vamsi Kasukurthi, Vikash Kumar Jha, Yongqun He, Shaojie Zhang, Xiaowei Wang, Zixing Liu, Glen Borchert, Ming Tan, "The Development of Non-Coding RNA Ontology", *International Journal of Data Mining and Bioinformatics*, 15 (3), June 25, 2016. DOI: 10.1504/IJDMB.2016.077072.

Abstract: Identification of non-coding RNAs (ncRNAs) has been significantly improved over the past decade. On the other hand, semantic annotation of ncRNA data is facing critical challenges due to the lack of a comprehensive ontology to serve as common data elements and data exchange standards in the field. We developed the Non-Coding RNA Ontology (NCRO) to handle this situation. By providing a formally defined ncRNA controlled vocabulary, the NCRO aims to fill a specific and highly needed niche in semantic annotation of large amounts of ncRNA biological and clinical data.

141. Jie Zheng, Marcelline R. Harris, Anna Maria Masci, Yu Lin, Alfred Hero, Barry Smith and Yongqun He, "The Ontology of Biological and Clinical Statistics (OBCS) for Standardized and Reproducible Statistical Analysis", *Journal of Biomedical Semantics*, 14 September 2016, 7(1): 53.

Abstract: Statistics play a critical role in biological and clinical research. However, most reports of scientific results in the published literature make it difficult for the reader to reproduce the statistical analyses performed in achieving those results because they provide inadequate documentation of the statistical tests and algorithms applied. The Ontology of Biological and Clinical Statistics (OBCS) is put forward here as a step towards solving this problem. The terms in OBCS cover the major types of statistical processes used in basic biological research and clinical outcome studies. OBCS is aligned with the Basic Formal Ontology (BFO) and extends the Ontology of Biomedical Investigations (OBI), an OBO (Open Biological and Biomedical Ontologies) Foundry ontology supported by over 20 research communities. We discuss two examples illustrating how the ontology is being applied. In the first (biological) use case, we describe how OBCS was applied to represent the high throughput microarray data analysis of immunological transcriptional profiles in human subjects vaccinated with an influenza vaccine. In the second (clinical outcomes) use case, we applied OBCS to represent the processing of electronic health care data to determine the associations between hospital staffing levels and patient mortality.

142. Selja Seppälä, Alan Ruttenberg, Yonatan Schreiber, Barry Smith, "Definitions in Ontologies", *Cahiers de Lexicologie*, 109, 2 (2016), 175-207.

Abstract: Definitions vary according to context of use and target audience. They must be made relevant for each context to fulfill their cognitive and linguistic goals. This involves adapting their

logical structure, type of content, and form to each context of use. We examine from these perspectives the case of definitions in ontologies.

143. Metin N. Gurcan, John Tomaszewski, James A. Overton, Scott Doyle, Alan Ruttenberg, Barry Smith, "Developing the Quantitative Histopathology Image Ontology (QHIO): A case study using the hot spot detection problem", *Journal of Biomedical Informatics*, 66 (2017) 129–135. PMC5316345

Abstract: Interoperability across data sets is a key challenge for quantitative histopathological imaging. There is a need for an ontology that can support effective merging of pathological image data with associated clinical and demographic data. To foster organized, cross-disciplinary, information-driven collaborations in the pathological imaging field, we propose to develop an ontology to represent imaging data and methods used in pathological imaging and analysis, and call it Quantitative Histopathological Imaging Ontology – QHIO. We apply QHIO to breast cancer hot-spot detection with the goal of enhancing reliability of detection by promoting the sharing of data between image analysts.

144. Darren A Natale, Cecilia N Arighi, Judith A Blake, Jonathan Bona, Chuming Chen, Sheng-Chih Chen, Karen R Christie, Julie Cowart, Peter D'Eustachio, Alexander D Diehl, Harold J Drabkin, William D Duncan, Hongzhan Huang, Jia Ren, Karen Ross, Alan Ruttenberg, Veronica Shamovsky, Barry Smith, Qinghua Wang, Jian Zhang, Abdelrahman El-Sayed, Cathy H Wu, "Protein Ontology (PRO): Enhancing and scaling up the representation of protein entities", *Nucleic Acids Research* 45 (D1), 2017, D339-D346.

Abstract: The Protein Ontology (PRO; http://purl.obolibrary.org/obo/pr) formally defines and describes taxon-specific and taxon-neutral protein-related entities in three major areas: proteins related by evolution; proteins produced from a given gene; and protein-containing complexes. PRO thus serves as a tool for referencing protein entities at any level of specificity. To enhance this ability, and to facilitate the comparison of such entities described in different resources, we developed a standardized representation of proteoforms using UniProtKB as a sequence reference and PSI-MOD as a post-translational modification reference. We illustrate its use in facilitating an alignment between PRO and Reactome protein entities. We also address issues of scalability, describing our first steps into the use of text mining to identify protein-related entities, the large-scale import of proteoform information from expert curated resources, and our ability to dynamically generate PRO terms. Web views for individual terms are now more informative about closely-related terms, including for example an interactive multiple sequence alignment. Finally, we describe recent improvement in semantic utility, with PRO now represented in OWL and as a SPARQL endpoint. These developments will further support the anticipated growth of PRO and facilitate discoverability of and allow aggregation of data relating to protein entities.

145. José M Parente de Oliveira, Barry Smith, "A visual representation of part-whole relationships in BFO-conformant ontologies", *Recent Advances in Information Systems and Technologies* (Advances in Intelligent Systems and Computing, 569), 2017, 184-194.

Abstract: In the visual representation of ontologies, in particular of part-whole relationships, it is customary to use graph theory as the representational background. We claim here that the standard graph-based approach has a number of limitations, and we propose instead a new representation of part-whole structures for ontologies, and describe the results of experiments designed to show the effectiveness of this new proposal especially as concerns reduction of visual complexity. The proposal is developed to serve visualization of ontologies conformant to the Basic Formal Ontology. But it can be used also for more general applications, particularly in the biomedical domain.

146. Selja Seppälä, Alan Ruttenberg, Barry Smith, "Guidelines for writing definitions in ontologies", *Ciência da Informação*, 46 (1), 2017, 73-88.

Abstract. Ontologies are being used increasingly to promote the reusability of scientific information by allowing heterogeneous data to be integrated under a common, normalized

representation. Definitions play a central role in the use of ontologies both by humans and by computers. Textual definitions allow ontologists and data curators to understand the intended meaning of ontology terms and to use these terms in a consistent fashion across contexts. Logical definitions allow machines to check the integrity of ontologies and reason over data annotated with ontology terms to make inferences that promote knowledge discovery. Therefore, it is important not only to include in ontologies multiple types of definitions in both formal and in natural languages, but also to ensure that these definitions meet good quality standards so they are useful. While tools such as Protégé can assist in creating well-formed logical definitions, producing good definitions in a natural language is still to a large extent a matter of human ingenuity supported at best by just a small number of general principles. For lack of more precise guidelines, definition authors are often left to their own personal devices. This paper aims to fill this gap by providing the ontology community with a set of principles and conventions to assist in definition writing, editing, and validation, by drawing on existing definition writing principles and guidelines in lexicography, terminology, and logic.

147. Sanchita Bhattacharya, Patrick Dunn, Cristel Thomas, Barry Smith, Henry Schaefer, Jieming Chen, Zicheng Hu, Kelly Zalocusky, Ravi Shankar, Shai Shen-Orr, Elizabeth Thomson, Jeff Wiser, and Atul J. Butte, "ImmPort: Toward repurposing of open access immunological assay data for translational and clinical research", *Scientific Data*, 5:180015, February 2018, DOI: 10.1038/sdata.2018.15.

Abstract: Immunology researchers are beginning to explore the possibilities of reproducibility, reuse and secondary analyses of immunology data. Open-access datasets are being applied in the validation of the methods used in the original studies, leveraging studies for meta-analysis, or generating new hypotheses. To promote these goals, the ImmPort data repository was created for the broader research community to explore the wide spectrum of clinical and basic research data and associated findings. The ImmPort ecosystem consists of four components–Private Data, Shared Data, Data Analysis, and Resources—for data archiving, dissemination, analyses, and reuse. To date, more than 300 studies have been made freely available through the Shared Data portal (immport.org/immportopen), which allows research data to be repurposed to accelerate the translation of new insights into discoveries.

148. Cooper, Laurel; Meier, Austin; Laporte, Marie; Mungall, Chris; Elser, Justin; Sinn, Brandon; Cavaliere, Dario; Carbon, Seth; Dunn, Nathan; Qu, Botong; Smith, Barry; Preece, Justin; Zhang, Eugene; Todorovic, Sinisa; Gkoutos, Georgios; Doonan, John; Stevenson, Dennis; Arnaud, Elizabeth; Jaiswal, Pankaj, "The Planteome Database: An Integrated Resource for Reference Ontologies, Plant Genomics and Phenomics", *Nucleic Acids Research,* January 2018, gkx1152, https://doi.org/10.1093/nar/gkx1152.

Abstract: The Planteome project provides a suite of reference and species-specific ontologies for plants and annotations to genes and phenotypes. Ontologies serve as common standards for semantic integration of a large and growing corpus of plant genomics, phenomics and genetics data. The reference ontologies include the Plant Ontology, Plant Trait Ontology, and the Plant Experimental Conditions Ontology developed by the Planteome project, along with the Gene Ontology, Chemical Entities of Biological Interest, Phenotype and Attribute Ontology, and others. The project also provides access to species-specific Crop Ontologies developed by various plant breeding and research communities from around the world. We provide integrated data on plant traits, phenotypes, and gene function and expression from 95 plant taxa, annotated with reference ontology terms.

148. Prodromos Kolyvakis, Alexandros Kalousis, Barry Smith and Dimitris Kiritsis, "Biomedical Ontology Alignment: An Approach Based on Representation Learning", *Journal of Biomedical Semantics*, (August 2018) 9:21.

Abstract: While representation learning techniques have shown great promise in application to a number of different NLP tasks, they have had little impact on the problem of ontology matching. Unlike past work that has focused on feature engineering, we present a novel representation learning approach that is tailored to the ontology matching task. Our approach is based on embedding ontological terms in a high-dimensional Euclidean space. This embedding

is derived on the basis of a novel phrase retrofitting strategy through which semantic similarity information becomes inscribed onto fields of pre-trained word vectors. The resulting framework also incorporates a novel outlier detection mechanism based on a denoising autoencoder that is shown to improve performance. An ontology matching system derived using the proposed framework achieved an F-score of 94% on an alignment scenario involving the Adult Mouse Anatomical Dictionary and the Foundational Model of Anatomy ontology (FMA) as targets. This compares favorably with the best performing systems on the Ontology Alignment Evaluation Initiative anatomy challenge. We performed additional experiments on aligning FMA to NCI Thesaurus and to SNOMED CT based on a reference alignment extracted from the UMLS Metathesaurus. Our system obtained overall F-scores of 93.2% and 89.2% for these experiments, thus achieving state-of-the-art results.

149. Erik Thomsen and Barry Smith, "Ontology-Based Fusion of Sensor Data and Natural Language", *Applied Ontology*, 13 (4), 2018, 295-333.

Abstract: We describe a prototype ontology-driven information system (ODIS) that exploits what we call Portion of Reality (POR) representations. The system takes both sensor data and natural language text as inputs and composes on this basis logically structured POR assertions. The goal of our prototype is to represent both natural language and sensor data within a single framework. The framework should support not only axiomatic reasoning but also computation. It should also be capable of discovering and representing new kinds of situations and thematic roles (for example roles such as agent, patient and instrument) on the basis of new compositions of existing representations. We applied our prototype in an intelligence analysis use case to test the hypothesis that a framework of this sort can produce usefully structured information from combined natural language and sensor data inputs. We further tested our hypothesis by adding an enhanced US Air Force ontology framework to our ODIS in order to (1) process a collection of sensor data, intel reports, and mission plans; (2) build composite POR representations from these data; and (3) machine analyze the fused results to infer mission threats.

150. Munira Mohd Ali, Rahul Rai, J. Neil Otte, Barry Smith, "A Product Life Cycle Ontology for Additive Manufacturing", *Computers in Industry*, 105 (2019) 191-203.

Abstract: The manufacturing industry is evolving rapidly, becoming more complex, more interconnected, and more geographically distributed. Competitive pressure and diversity of consumer demand are driving manufacturing companies to rely more and more on improved knowledge management practices. As a result, multiple software systems are being created to support the integration of data across the product life cycle. Unfortunately, these systems manifest a low degree of interoperability, and this creates problems, for instance when different enterprises or different branches of an enterprise interact. Common ontologies (consensus-based controlled vocabularies) have proved themselves in various domains as a valuable tool for solving such problems. In this paper, we present a consensus-based Additive Manufacturing Ontology (AMO) and illustrate its application in promoting re-usability in the field of dentistry product manufacturing.

151. Thomas J. Hagedorn, Barry Smith, Sundar Krishnamurty, Ian Grosse, "Interoperability of disparate engineering domain ontologies using Basic Formal Ontology", *Journal of Engineering Design*, published online: 14 June 2019, 625-654 https://doi.org/10.1080/09544828.2019.1630805.

Abstract: As engineering applications require management of ever larger volumes of data, ontologies offer the potential to capture, manage, and augment data with automated reasoning and semantic querying capability. Unfortunately, considerable barriers hinder wider deployment of ontologies in engineering. Key among these is lack of a shared top-level ontology to unify and organize disparate aspects of the field and coordinate co-development of orthogonal ontologies. As a result, many engineering ontologies are limited to their original scope, and functionally difficult to extend or interoperate. This paper demonstrates how the use of a top-level ontology, specifically the Basic Formal Ontology (BFO), greatly facilitates interoperability of multiple engineering-related ontologies. We constructed a system of formal linked ontologies by re-engineering legacy ontologies to be conformant with BFO and developing new BFO-conformant ontologies to reflect engineering design, enterprise, human factors, manufacturing, and application domain knowledge. The resulting Integrated Framework for Additively Manufactured Products (IFAMP) and knowledge instantiated in it serves as the basis for a

proposed Design with Additive Manufacturing Method, which supports the design of innovative products with semantically enhanced ideation tools and application domain knowledge. The method and its facilitation with the ontological framework are then demonstrated using a case study in medicine.

152. J. Neil Otte, Dimitris Kiritsis, Munira Binti Mohd Ali, Ruoyu Yang, Binbin Zhang, Ron Rudnicki, Rahul Rai, Barry Smith, "An ontological approach to representing the product life cycle", *Applied Ontology*, 14(2), May 2019, 155-177.

Abstract: The ability to access and share data is key to optimizing and streamlining any industrial production process. Unfortunately, the manufacturing industry is stymied by a lack of interoperability among the systems by which data are produced and managed, and this is true both within and across organizations. In this paper, we describe our work to address this problem through the creation of a suite of modular ontologies representing the product life cycle and its successive phases, from design to end of life. We call this suite the Product Life Cycle (PLC) Ontologies. The suite extends proximately from The Common Core Ontologies (CCO) used widely in defense and intelligence circles, and ultimately from the Basic Formal Ontology (BFO), which serves as top level ontology for the CCO and for some 300 further ontologies. The PLC Ontologies were developed together, but they have been factored to cover particular domains such as design, manufacturing processes, and tools. We argue that these ontologies, when used together with standard public domain alignment and browsing tools created within the context of the Semantic Web, may offer a low-cost approach to solving increasingly costly problems of data management in the manufacturing industry.

153. Ramona Lynn Walls, Laurel Cooper, Justin Lee Elser, Maria Alejandra Gandolfo, Christopher J. Mungall, Barry Smith, Dennis William Stevenson, Pankaj Jaiswal, "The Plant Ontology facilitates comparisons of plant development stages across species", *Frontiers in Plant Science*, June 4, 2019.

Abstract: The Plant Ontology (PO) is a community resource consisting of standardized terms, definitions, and logical relations describing plant structures and development stages, augmented by a large database of annotations from genomic and phenomic studies. This paper describes the structure of the ontology and the design principles we used in constructing PO terms for plant development stages. It also provides details of the methodology and rationale behind our revision and expansion of the PO to cover development stages for all plants, particularly the land plants (bryophytes through angiosperms). As a case study to illustrate the general approach, we examine variation in gene expression across embryo development stages in Arabidopsis and maize, demonstrating how the PO can be used to compare patterns of expression across stages and in developmentally different species. Although many genes appear to be active throughout embryo development, we identified a small set of uniquely expressed genes for each stage of embryo development and also between the two species. Evaluating the different sets of genes expressed during embryo development in Arabidopsis or maize may inform future studies of the divergent developmental pathways observed in monocotyledonous versus dicotyledonous species. The PO and its annotation database (http://www.planteome.org) make plant data for any species more discoverable and accessible through common formats, thus providing support for applications in plant pathology, image analysis, and comparative development and evolution.

154. Yongqun He, Haihe Wang, Jie Zheng, Daniel P. Beiting, Anna Maria Masci, Hong Yu, Kaiyong Liu, Jianmin Wu, Jeffrey L. Curtis, Barry Smith, Alexander V. Alekseyenko, Jihad S. Obeid, "OHMI: The Ontology of Host-Microbiome Interactions", *Journal of Biomedical Semantics*, 10: 25 (2019). doi: 10.1186/s13326-019-0217-1.

Abstract: Host-microbiome interactions (HMIs) are critical for the modulation of biological processes and are associated with several diseases, and extensive HMI studies have generated large amounts of data. We propose that the logical representation of the knowledge derived from these data and the standardized representation of experimental variables and processes can foster integration of data and reproducibility of experiments and thereby further HMI knowledge discovery. A community-based Ontology of Host-Microbiome Interactions (OHMI) was developed following the OBO Foundry principles. OHMI leverages established ontologies to create logically structured representations of microbiomes, microbial taxonomy, host species,

host anatomical entities, and HMIs under different conditions and associated study protocols and types of data analysis and experimental results.

155. Yongqun He, Hong Yu, Edison Ong, Yang Wang, Yingtong Liu, Anthony Huffman, Hsin-hui Huang, John Beverley, Junguk Hur, Xiaolin Yang, Luonan Chen, Gilbert S. Omenn, Brian Athey, Barry Smith, "CIDO, a community-based ontology for coronavirus disease knowledge and data integration, sharing, and analysis", *Scientific Data*, June 2020, 7(181).

Ontologies, as the term is used in informatics, are structured vocabularies comprised of human- and computer-interpretable terms and relations that represent entities and relationships. Within informatics fields, ontologies play an important role in knowledge and data standardization, representation, integration, sharing and analysis. They have also become a foundation of artificial intelligence (AI) research. In what follows, we outline the Coronavirus Infectious Disease Ontology (CIDO), which covers multiple areas in the domain of coronavirus diseases, including etiology, transmission, epidemiology, pathogenesis, diagnosis, prevention, and treatment. We emphasize CIDO development relevant to COVID-19.

156. Barry Smith, Olimpia Giuliana Loddo & Giuseppe Lorini, "On credentials", *Journal of Social Ontology* 6:1 (2020), 47-67.

Abstract: Credentials play an important role in all modern societies, but the analysis of their nature and function has thus far been neglected by social philosophers. We present a view according to which the function of credentials is certify the identity and the institutional status (including the rights) of individuals. More importantly, credentials enable rights-holders to exercise their rights, so that for a particular right to be exercisable the right-holder should possess, carry and sometimes, show to an authority a document of a specific kind. Driving licenses, identity cards, passports, boarding passes, library passes, credit cards, ATM cards, health insurance cards are all examples of credentials in this sense. Credentials have in every case a bearer, and the bearer should be able to carry them easily on his or her person. Credentials should also be inspectable – not least because credentials can be forged. The authors analyse several historical and contemporary examples of credentials, focusing on the credentials carried by the pilgrims of the Way of Saint James.

Italian translation as "Le credenziali: parole, disegni e poteri deontici", *Teoria e Critica della Regolazione Sociale*, 1 (20), 2020, 59-73.

157. Linda Elmhadhbi, Mohamed-Hedi Karray, Bernard Archimède, J. Neil Otte, Barry Smith, "PROMES: An ontology-based messaging service for semantically interoperable information exchange during disaster response", *Journal of Contingencies and Crisis Management,* 29 September 2020, 28 (3), 324-338.

Abstract: Disaster response requires the cooperation of multiple emergency responder organizations (EROs). However, after-action reports relating to large-scale disasters identity communication difficulties among EROs as a major hindrance to collaboration. On the one hand, the use of two-radio communication, based on multiple orthogonal frequencies and uneven coverage, has been shown to degrade inter-organization communication. On the other hand, because they reflect different areas of expertise, EROs use differing terminologies, which are difficult to reconcile. These issues lead to ambiguities, misunderstandings, and inefficient exchange of data and information among those involved, which can impede the response process and slow decision making. We, therefore, hypothesize that promoting semantic interoperability across ERO information systems might improve information exchange among stakeholders and thereby allow a more coherent response to the disaster. We propose an ontology-based messaging service on the basis of the Emergency Data Exchange Language (EDXL) standards. The parties involved will continue to use the terminologies to which they are accustomed, but the system will resolve inconsistencies and thereby enhance mutual understanding among EROs by ensuring semantic translation of the exchanged information. The evaluation of the semantic translation demonstrated the effectiveness and accuracy of the proposed service.

158. David Limbaugh, Jobst Landgrebe, David Kasmier, Ronald Rudnicki, James Llinas and Barry Smith, "Ontology and cognitive outcomes", *Journal of Knowledge Structures and Systems*, 1:1 (2020), 3-22.

> **Abstract:** The term 'intelligence' as used in this paper refers to items of knowledge collected for the sake of assessing and maintaining national security. The intelligence community (IC) of the United States (US) is a community of organizations that collaborate in collecting and processing intelligence for the US. The IC relies on human-machine-based analytic strategies that 1) access and integrate vast amounts of information from disparate sources, 2) continuously process this information, so that, 3) a maximally comprehensive understanding of world actors and their behaviors can be developed and updated. Herein we describe an approach to utilizing outcomes-based learning (OBL) to support these efforts that is based on an ontology of the cognitive processes performed by intelligence analysts. Of particular importance to the Cognitive Process Ontology is the class Representation that is Warranted. Such a representation is descriptive in nature and deserving of trust in its veridicality. The latter is because a Representation that is Warranted is always produced by a process that was vetted (or successfully designed) to reliably produce veridical representations. As such, Representations that are Warranted are what in other contexts we might refer to as 'items of knowledge'.

159. Munira Mohd Ali, Ruoyu Yang, Binbin Zhang, Francesco Furini, Rahul Rai, J. Neil Otte & Barry Smith, "Enriching the Functionally Graded Materials (FGM) Ontology for digital manufacturing", *International Journal of Production Research*, September 2021, 59(18), 5540-5557 https://doi.org/10.1080/00207543.2020.1787534.

> **Abstract:** Functionally graded materials (FGMs) have been used in many different kinds of applications in recent years and have attracted significant research attention. However, we do not yet have a commonly accepted way of representing the various aspects of FGMs. Lack of standardised vocabulary creates obstacles to the extraction of useful information relating to pertinent aspects of different applications. A standard resource is needed for describing various elements of FGMs, including existing applications, manufacturing techniques, and material characteristics. This motivated the creation of the FGM Ontology (FGMO) in 2016. Here, we present a revised and expanded version of the FGM Ontology, which includes enrichments along four dimensions: (1) documenting recent FGMs applications; (2) reorganising the framework to incorporate an updated representation of types of manufacturing processes; (3) enriching the axioms of the ontology; and (4) importing mid-level ontologies from the Common Core Ontologies (CCO) and Product Life Cycle (PLC) Ontologies. The work is being carried out within the framework of the Industry Ontology Foundry (IOF), and the ontology is conformant to Basic Formal Ontology (BFO).

160. Jobst Landgrebe and Barry Smith, "Making AI meaningful again", *Synthese,* 198 (March 2021), 2061-2081.

> **Abstract:** Artificial intelligence (AI) research enjoyed an initial period of enthusiasm in the 1970s and 80s, but this enthusiasm was tempered by a long interlude of frustration when genuinely useful AI applications failed to be forthcoming. Today, we are experiencing once again a period of enthusiasm, fired above all by the successes of the technology of deep neural networks or deep machine learning. In this paper we draw attention to what we take to be serious problems underlying current views of artificial intelligence encouraged by these successes, especially in the domain of language processing. We then show an alternative approach to language-centric AI, in which we identify a role for philosophy.

161. Shane Babcock, John Beverley, Lindsay G. Cowell, Barry Smith, "The Infectious Disease Ontology in the age of COVID-19", *Journal of Biomedical Semantics*, 12 (13), July 8, 2021.

> **Background:** Effective response to public health emergencies, such as we are now experiencing with COVID-19, requires data sharing across multiple disciplines and data systems. Ontologies offer a powerful data sharing tool, and this holds especially for those ontologies built on the design principles of the Open Biomedical Ontologies Foundry. These principles are exemplified by the Infectious Disease Ontology (IDO), a suite of interoperable ontology modules aiming to provide coverage of all aspects of the infectious disease domain. At its center is IDO Core, a

disease- and pathogen-neutral ontology covering just those types of entities and relations that are relevant to infectious diseases generally. IDO Core is extended by disease and pathogen-specific ontology modules.

Results: To assist the integration and analysis of COVID-19 data, and viral infectious disease data more generally, we have recently developed three new IDO extensions: IDO Virus (VIDO); the Coronavirus Infectious Disease Ontology (CIDO); and an extension of CIDO focusing on COVID-19 (IDO-COVID-19). Reflecting the fact that viruses lack cellular parts, we have introduced into IDO Core the term acellular structure to cover viruses and other acellular entities studied by virologists. We now distinguish between infectious agents – organisms with an infectious disposition – and infectious structures – acellular structures with an infectious disposition. This in turn has led to various updates and refinements of IDO Core's content. We believe that our work on VIDO, CIDO, and IDO-COVID-19 can serve as a model for yielding greater conformance with ontology building best practices.

Conclusions: IDO provides a simple recipe for building new pathogen-specific ontologies in a way that allows data about novel diseases to be easily compared, along multiple dimensions, with data represented by existing disease ontologies. The IDO strategy, moreover, supports ontology coordination, providing a powerful method of data integration and sharing that allows physicians, researchers, and public health organizations to respond rapidly and efficiently to current and future public health crises.

162. Rebecca C Jackson, Nicolas Matentzoglu, James A Overton, Randi Vita, James P Balhoff, Pier Luigi Buttigieg, Seth Carbon, Melanie Courtot, Alexander D Diehl, Damion Dooley, William Duncan, Nomi L Harris, Melissa A Haendel, Suzanna E Lewis, Darren A Natale, David Osumi-Sutherland, Alan Ruttenberg, Lynn M Schriml, Barry Smith, Christian J Stoeckert, Nicole A Vasilevsky, Ramona L Walls, Jie Zheng, Christopher J Mungall, Bjoern Peters, "OBO Foundry in 2021: Operationalizing open data principles to evaluate ontologies", *Database*, 2021/10/26

Abstract: Biological ontologies are used to organize, curate, and interpret the vast quantities of data arising from biological experiments. While this works well when using a single ontology, integrating multiple ontologies can be problematic, as they are developed independently, which can lead to incompatibilities. The Open Biological and Biomedical Ontologies (OBO) Foundry was created to address this by facilitating the development, harmonization, application, and sharing of ontologies, guided by a set of overarching principles. One challenge in reaching these goals was that the OBO principles were not originally encoded in a precise fashion, and interpretation was subjective. Here we show how we have addressed this by formally encoding the OBO principles as operational rules and implementing a suite of automated validation checks and a dashboard for objectively evaluating each ontology9s compliance with each principle. This entailed a substantial effort to curate metadata across all ontologies and to coordinate with individual stakeholders. We have applied these checks across the full OBO suite of ontologies, revealing areas where individual ontologies require changes to conform to our principles. Our work demonstrates how a sizable federated community can be organized and evaluated on objective criteria that help improve overall quality and interoperability, which is vital for the sustenance of the OBO project and towards the overall goals of making data FAIR.

163. Elmhadhbi, Linda, Mohamed-Hedi Karray, Bernard Archimède, J. N. Otte, and Barry Smith, "An ontological approach to enhancing information sharing in disaster response", *Information* 12 (10), 2021: 432. https://doi.org/10.3390/info12100432

Abstract. Managing complex disaster situations is a challenging task because of the large number of actors involved and the critical nature of the events themselves. In particular, the different terminologies and technical vocabularies that are being exchanged among Emergency Responders may lead to misunderstandings. Maintaining a shared semantics for exchanged data is a major challenge. To help to overcome these issues, we elaborate a modular suite of ontologies called POLARISCO that formalizes the complex knowledge of the ERs. Such a shared vocabulary resolves inconsistent terminologies and promotes semantic interoperability among ERs. In this work, we discuss developing POLARISCO as an extension of Basic Formal Ontology and the Common Core Ontologies. We conclude by presenting a real use-case to check the efficiency and applicability of the proposed ontology.

164. Justine Flore Tchouanguem, Mohamed Hedi Karray, Bernard Kamsu Foguem, Camille Magniont, F. Henry Abanda, Barry Smith, "BFO-based ontology enhancement to promote interoperability in BIM", *Applied Ontology*, 16(4), October 2021, 1-27.

> **Abstract.** Building Information Modelling (BIM) is a process for managing construction project information in such a way as to provide a basis for enhanced decision-making and for collaboration in a construction supply chain. One impediment to the uptake of BIM is the limited interoperability of different BIM systems. To overcome this problem, a set of Industry Foundation Classes (IFC) has been proposed as a standard for the construction industry. Building on IFC, the ifcOWL ontology was developed in order to facilitate representation of building data in a consistent fashion across the Web by using the Web Ontology Language (OWL). This study presents a critical analysis of the ifcOWL ontology and of the associated interoperability issues. It shows how these issues can be resolved by using Basic Formal Ontology (ISO/IEC 21838-2) as top-level architecture. A set of competency questions is used as the basis for comparison of the original ifcOWL with the enhanced ontology, and the latter is used to align with a second ontology — the ontology for building intelligent environments (DOGONT) — in order to demonstrate the added value derived from BFO by showing how querying the enhanced ifcOWL yields useful additional information.

165. Barry Smith, "Making space: The natural, cultural, cognitive and social niches of human activity", *Cognitive Processing – International Quarterly of Cognitive Science*, 22 (supplementary issue 1):77-87 (2021).

> **Abstract:** This paper is in two parts. Part 1 examines the phenomenon of making space as a process involving one or other kind of legal decision-making, for example when a state authority authorizes the creation of a new highway along a certain route or the creation of a new park in a certain location. In cases such as this a new abstract spatial entity comes into existence – the route, the area set aside for the park – followed only later by concordant changes in physical reality. In Part 2 we show that features identified in studying this phenomenon of legal spacemaking can be detected in other spheres of human activity, for example in planning (where spacemaking is projected into the future), and in reasoning about history (where spacemaking is projected back through time). We shall see that these features display themselves in especially complex ways in our everyday use of language, and we conclude by examining the implications of this complexity for attempts to create an artificial intelligence that would enjoy a mastery of language that would be equivalent to that of human beings.

166. Linda Elmhadhbi, Mohamed-Hedi Karray, Bernard Archimède, J. Neil Otte and Barry Smith, "Ontology-driven multicriteria decision support for victim evacuation", *International Journal of Information Technology and Decision Making*, 21 (1), 2022, 243-272. https://doi.org/10.1142/S021962202150053X

> **Abstract:** In light of the complexity of unfolding disasters, the diversity of rapidly evolving events, the enormous amount of generated information, and the huge pool of casualties, emergency responders (ERs) may be overwhelmed and in consequence poor decisions may be made. In fact, the possibility of transporting the wounded victims to one of several hospitals and the dynamic changes in healthcare resource availability make the decision process more complex. To tackle this problem, we propose a multicriteria decision support service, based on the Analytic Hierarchy Process (AHP) method, that aims to avoid overcrowding and outpacing the capacity of a hospital to effectively provide the best care to victims by finding out the most appropriate hospital that meets the victims' needs. The proposed approach searches for the most appropriate healthcare institution that can effectively deal with the victims' needs by considering the availability of the needed resources in the hospital, the victim's wait time to receive the healthcare, and the transfer time that represents the hospital proximity to the disaster site. The evaluation and validation results showed that the assignment of hospitals was done successfully considering the needs of each victim and without overwhelming any single hospital.

167. Barry Smith, "The birth of ontology", *Journal of Knowledge Structures and Systems*, January 2022, 3 (1), 57-66.

Abstract. This review focuses on the *Ogdoas scholastica* by Jacob Lorhard, published in 1606. The importance of this document turns on the fact that it contains what is almost certainly the first published occurrence of the term "ontology." The body of the work consists in a series of diagrams called "diagraphs." Relevant features of these diagraphs are: 1. that they do not in fact contain the word "ontology," and 2. that Lorhard himself was not responsible for their content.

168. William Mandrick & Barry Smith "Philosophical foundations of intelligence collection and analysis: a defense of ontological realism", *Intelligence and National Security*, DOI: 10.1080/02684527.2022.2076330, vol. 38, June 2022 (online first).

Abstract: There is a common misconception across the lntelligence Community (IC) to the effect that information trapped within multiple heterogeneous data silos can be semantically integrated by the sorts of meaning-blind statistical methods employed in much of artificial intelligence (Al) and natural language processlng (NLP). This leads to the misconception that incoming data can be analysed coherently by relying exclusively on the use of statistical algorithms and thus without any shared framework for classifying what the data are about. Unfortunately, such approaches do not yield sustainable results where we are dealing with widely distributed, highly heterogeneous and often changing bodies of data. We argue here that the needed integration requires the use of what we call an lntegrating Semantic Framework (ISF), which provldes a consistent set of categories and relationships that can be reused over and over again to tag successive bodies of data in ways which foster more coherent representation and reasoning.

169. Yongqun He, Hong Yu, Anthony Huffman, Asiyah Yu Lin, Darren A. Natale, John Beverley, Ling Zheng, Yehoshua Perl, Zhigang Wang, Yingtong Liu, Edison Ong, Yang Wang, Philip Huang, Long Tran, Jinyang Du, Zalan Shah, Easheta Shah, Roshan Desai, Hsin-hui Huang, Yujia Tian, Eric Merrell, William D. Duncan, Sivaram Arabandi, Lynn M. Schriml, Jie Zheng, Anna Maria Masci, Liwei Wang, Hongfang Liu, Fatima Zohra Smaili, Robert Hoehndorf, Zoë May Pendlington, Paola Roncaglia, Xianwei Ye, Jiangan Xie, Yi-Wei Tang, Xiaolin Yang, Suyuan Peng, Luxia Zhang, Luonan Chen, Junguk Hur, Gilbert S. Omenn, Brian Athey and Barry Smith, "A comprehensive update on CIDO: the community-based Coronavirus Infectious Disease Ontology", *Journal of Biomedical Informatics*, 3, 25, October 2022.

The current COVID-19 pandemic and the previous SARS/MERS outbreaks of 2003 and 2012 have resulted in a series of major global public health crises. We argue that in the interest of developing effective and safe vaccines and drugs and to better understand coronaviruses and associated disease mechenisms it is necessary to integrate the large and exponentially growing body of heterogeneous coronavirus data. Ontologies play an important role in standard-based knowledge and data representation, integration, sharing, and analysis. Accordingly, we initiated the development of the community-based Coronavirus Infectious Disease Ontology (CIDO) in early 2020.

As an Open Biomedical Ontology (OBO) library ontology, CIDO is open source and interoperable with other existing OBO ontologies. CIDO is aligned with the Basic Formal Ontology and Viral Infectious Disease Ontology. CIDO has imported terms from over 30 OBO ontologies. For example, CIDO imports all SARS-CoV-2 protein terms from the Protein Ontology, COVID-19-related phenotype terms from the Human Phenotype Ontology, and over 100 COVID-19 terms for vaccines (both authorized and in clinical trial) from the Vaccine Ontology. CIDO systematically represents variants of SARS-CoV-2 viruses and over 300 amino acid substitutions therein, along with over 300 diagnostic kits and methods. CIDO also describes hundreds of host-coronavirus protein-protein interactions (PPIs) and the drugs that target proteins in these PPIs. CIDO has been used to model COVID-19 related phenomena in areas such as epidemiology. The scope of CIDO was evaluated by visual analysis supported by a summarization network method. CIDO has been used in various applications such as term standardization, inference, natural language processing (NLP) and clinical data integration. We have applied the amino acid variant knowledge present in CIDO to analyze differences between SARS-CoV-2 Delta and Omicron variants. CIDO's integrative host-coronavirus PPIs and drug-target knowledge has also been used to support drug repurposing for COVID-19 treatment.

CIDO represents entities and relations in the domain of coronavirus diseases with a special focus on COVID-19. It supports shared knowledge representation, data and metadata standardization and integration, and has been used in a range of applications.

170. Linda Elmhadhbi, Mohamed-Hedi Karray, Bernard Archimède, J. Neil Otte, Barry Smith, "A Semantics-Based Common Operational Command System for multiagency disaster response", *IEEE Transactions on Engineering Management*, 69(6), 3887-3901, December 2022. https://doi.org/10.1109/TEM.2020.3013109

Abstract: Disaster response is a highly collaborative and critical process that requires the involvement of multiple emergency responders (ERs), ideally working together under a unified command, to enable a rapid and effective operational response. Following the 9/11 and 11/13 terrorist attacks and the devastation of hurricanes Katrina and Rita, it is apparent that inadequate communication and a lack of interoperability among the ERs engaged on-site can adversely affect disaster response efforts. Within this context, we present a scenario-based terrorism case study to highlight the challenges of operational disaster command and response. In this article, which is based on the French emergency response doctrine, we outline a semantics-based common operational command system that is designed to guarantee an efficient information flow among ERs. Our focus is on offering to all ERs, a real-time operational picture of the situation in order to enable multilevel coordination among firefighters, police, healthcare units, public authorities, and other stakeholders. Our approach consolidates information to promote timely sharing of data among ERs. The proposed system is based on an ontology that has been developed to represent the different types of knowledge on the part of ERs, providing a shared vocabulary that covers a variety of interoperability concerns.

171. Hong Yu, Li Li, Anthony Huffman, John Beverley, Junguk Hur, Eric Merrell, Hsin-hui Huang, Yang Wang, Yingtong Liu, Edison Ong, Liang Cheng, Tao Zeng, Jingsong Zhang, Pengpai Li, Zhiping Liu, Zhigang Wang, Xiangyan Zhang, Xianwei Ye, Samuel K. Handelman, Jonathan Sexton, Kathryn Eaton, Gerry Higgins, Gilbert S. Omenn, Brian Athey, Barry Smith, Luonan Chen and Yongqun He, "A new framework for host-pathogen interaction research", *Frontiers in Immunology*, (December 2022) 13:1066733. doi: 10.3389/fimmu.2022.1066733

Abstract: COVID-19 often manifests with different outcomes in different patients, highlighting the complexity of the host-pathogen interactions involved in manifestations of the disease at the molecular and cellular levels. In this paper, we propose a set of postulates and a framework for systematically understanding complex molecular host-pathogen interaction networks. Specifically, we first propose four host-pathogen interaction (HPI) postulates as the basis for understanding molecular and cellular host-pathogen interactions and their relations to disease outcomes. These four postulates cover the evolutionary dispositions involved in HPIs, the dynamic nature of HPI outcomes, roles that HPI components may occupy leading to such outcomes, and HPI checkpoints that are critical for specific disease outcomes. Based on these postulates, an HPI Postulate and Ontology (HPIPO) framework is proposed to apply interoperable ontologies to systematically model and represent various granular details and knowledge within the scope of the HPI postulates, in a way that will support AI-ready data standardization, sharing, integration, and analysis. As a demonstration, the HPI postulates and the HPIPO framework were applied to study COVID-19 with the Coronavirus Infectious Disease Ontology (CIDO), leading to a novel approach to rational design of drug/vaccine cocktails aimed at interrupting processes occurring at critical host-coronavirus interaction checkpoints. Furthermore, the host-coronavirus protein-protein interactions (PPIs) relevant to COVID-19 were predicted and evaluated based on prior knowledge of curated PPIs and domain-domain interactions, and how such studies can be further explored with the HPI postulates and the HPIPO framework is discussed.

172. Lin AY, Arabandi S, Beale T, Duncan WD, Hicks A, Hogan WR, Jensen M, Koppel R, Martínez-Costa C, Nytrø Ø, Obeid JS. De Oliveira JP, Ruttenberg A, Seppälä S, Smith B, Soergel D, Zheng J, Schulz S, "Improving the Quality and Utility of Electronic Health Record Data through Ontologies", *Standards*, 3(3), September 15, 2023, 316-40.

The translational research community, in general, and the Clinical and Translational Science Awards (CTSA) community, in particular, share the vision of repurposing EHRs for research that will improve the quality of clinical practice. Many members of these communities are also aware that electronic health records (EHRs) suffer limitations of data becoming poorly structured, biased, and unusable out of original context. This creates obstacles to the continuity of care, utility, quality improvement, and translational research. Analogous limitations to sharing objective data in other areas of the natural sciences have been successfully overcome by developing and using common ontologies. This White Paper presents the authors' rationale for the use of ontologies with computable semantics for the improvement of clinical data quality and EHR usability formulated for researchers with a stake in clinical and translational science and who are advocates for the use of information technology in medicine but at the same time are concerned by current major shortfalls. This White Paper outlines pitfalls, opportunities, and solutions and recommends increased investment in research and development of ontologies with computable semantics for a new generation of EHRs.

173. S. Clint Dowland, Barry Smith, Matthew A. Diller, Jobst Landgrebe & William R. Hogan, "Ontology of language, with applications to demographic data", *Applied ontology,* 18(3), 239-262, 7 November 2023.

Abstract: Here we present what we believe is a novel account of what languages are, along with an axiomatically rich representation of languages and language-related data that is based on this account. We propose an account of languages as aggregates of dispositions distributed across aggregates of persons, and in doing so we address linguistic competences and the processes that realize them. This paves the way for representing additional types of language-related entities. Like demographic data of other sorts, data about languages may be of use to researchers in a number of areas, including biomedical research. Data on the languages used in clinical encounters are typically included in medical records, and capture an important factor in patient-provider interactions. Like many types of patient and demographic data, data on a person's preferred and primary languages are organized in different ways by different systems. This can be a barrier to data integration. We believe that a robust framework for representing language in general and preferred and primary language in particular – which has been lacking in ontologies thus far – can promote more successful integration of language-related data from disparate data sources.

174. John Beverley, Shane Babcock, Gustavo Carvalho, Lindsay G. Cowell, Sebastian Duesing, Yongqun He, Regina Hurley, Eric Merrell, Richard H. Scheuermann, Barry Smith, "Coordinating virus research: The Virus Infectious Disease Ontology", *PLoS ONE*, January 18, 2024, https://doi.org/10.1371/journal.pone.0285093.

Abstract: The COVID-19 pandemic prompted immense work on the investigation of the SARS-CoV-2 virus. Rapid, accurate, and consistent interpretation of generated data is thereby of fundamental concern. Ontologies––structured, controlled, vocabularies––are designed to support consistency of interpretation, and thereby to prevent the development of data silos. This paper describes how ontologies are serving this purpose in the COVID-19 research domain, by following principles of the Open Biological and Biomedical Ontology (OBO) Foundry and by reusing existing ontologies such as the Infectious Disease Ontology (IDO) Core, which provides terminological content common to investigations of all infectious diseases. We report here on the development of an IDO extension, the Virus Infectious Disease Ontology (VIDO), a reference ontology covering viral infectious diseases. We motivate term and definition choices, showcase reuse of terms from existing OBO ontologies, illustrate how ontological decisions were motivated by relevant life science research, and connect VIDO to the Coronavirus Infectious Disease Ontology (CIDO). We next use terms from these ontologies to annotate selections from life science research on SARS-CoV-2, highlighting how ontologies employing a common upper-level vocabulary may be seamlessly interwoven. Finally, we outline future work, including bacteria and fungus infectious disease reference ontologies currently under development, then cite uses of VIDO and CIDO in host-pathogen data analytics, electronic health record annotation, and ontology conflict-resolution projects.

NON-REFEREED ARTICLES IN SCHOLARLY JOURNALS AND INVITED TALKS

1. Barry Smith, "Historicity, value and mathematics", *Analecta Husserliana*, 4 (1975), 219–239.

> **Abstract:** At the beginning of the present century, a series of paradoxes were discovered within mathematics which suggested a fundamental unclarity in traditional mathematical methods. These methods rested on the assumption of a realm of mathematical idealities existing independently of our thinking activity, and in order to arrive at a firmly grounded mathematics different attempts were made to formulate a conception of mathematical objects as purely human constructions. It was, however, realised that such formulations necessarily result in a mathematics which lacks the richness and power of the old 'platonistic' methods, and the latter are still defended, in various modified forms, as embodying truths about self-existent mathematical entities. Thus there is an idealism-realism dispute in the philosophy of mathematics in some respects parallel to the controversy over the existence of the experiential world to the settlement of which Ingarden devoted his life. The present paper is an attempt to apply Ingarden's methods to the sphere of mathematical existence. This exercise will reveal new modes of being applicable to non-real objects, and we shall put forward arguments to suggest that these modes of being have an importance outside mathematics, especially in the areas of value theory and the ontology of art.

2. Barry Smith, "Matematyka a ontologiczna estetyka Ingardena", *Studia Filozoficzne*, 1/122 (1976), 51–56.

> **Abstract:** Outlines a theory of how the existence of mathematical objects can be explained using the aesthetic and ontological conceptual apparatus developed by Roman Ingarden in his *The Controversy over the Existence of the World* and *The Literary Work of Art*.

3. Karl Schuhmann and Barry Smith, "Against idealism: Johannes Daubert vs. Husserl's *Ideas* I", *Review of Metaphysics*, 38 (1985), 763–793.

> **Abstract:** In manuscripts of 1930-1 Johannes Daubert, principal member of the Munich board of realist phenomenologists, put forward a series of detailed criticisms of the idealism of Husserl's *Ideas I*. The paper provides a sketch of these criticisms and of Daubert's own alternative conceptions of consciousness and reality, as also of Daubert's views on perception, similar, in many respects, to those of J. J. Gibson.
>
> Reprinted in: Karl Schuhmann, *Selected Papers in Phenomenology*, C. Leijenhorst and P. Steenbakkers (eds.), Dordrecht, Boston and London: Kluwer (2004), 35–59.

4. Kevin Mulligan and Barry Smith, "Franz Brentano on the ontology of mind" (Review article on Brentano's *Deskriptive Psychologie*), *Philosophy and Phenomenological Research*, 45 (1985), 627–644.

> **Abstract:** We provide a detailed exposition of Brentano's descriptive psychology, focusing on the unity of consciousness, the modes of connection and the types of part, including separable parts, distinctive parts, logical parts and what Brentano calls modificational quasi-parts. We also deal with Brentano's account of the objects of sensation and the experience of time.

5. Wolfgang Grassl and Barry Smith, "The Politics of National Diversity", *The Salisbury Review*, 5 (1987), 33–37.

> Reprinted in: R. Scruton (ed.), *Conservative Thoughts*, London: Claridge Press (1988), 101–114.

6. Kevin Mulligan, Peter Simons and Barry Smith, "Drei Briten in Kakanien", interview by Axel Bühler in *Information Philosophie*, 3 (1987), 22–33.

> The three young philosophers Kevin Mulligan, Peter Simons and Barry Smith have become well-known in the last few years especially in German-speaking analytical philosophy and phenomenology circles. This is on the one hand as a result of their historical and systematic philosophical work; but it is also because of the provocative way in which they represent their philosophy. Because they often appear in threes, they have become known as the "gang of three" or "three musketeers" or even – and this in an admiring sense – "mafiosi" (Rescher).

They are known primarily for the small workshops they have been organizing in uncomplicated Anglo-Saxon manner all over Europe. Their goal has been to show that analytic philosophy as it has been pursued up to now is in need of reform and also that the history of scientific philosophizing is not identical to the history of Anglo-Saxon analytic philosophy. Above all, they have tried to make more well known the Austrian tradition of scientific philosophy, and they can be given credit for having done much to promote the current interest in this tradition, which means: the history of Austrian philosophy of the 19th and early 20th centuries and its historical context in the Austro-Hungarian Empire.

7. Johannes Marek and Barry Smith, "Einleitung zu A. Martys 'Elemente der deskriptiven Psychologie'", *Conceptus*, 21 (1987), 33–48, editors' introduction to extracts from Marty's lectures (*ibid*., 49–66).

Abstract: Anton Marty delivered courses on descriptive psychology at regular intervals in the University of Prague. The content of these courses follows closely the ideas of Marty's teacher Franz Brentano, though with some interesting divergences and extrapolations. The present work is a historical and systematic introduction to an extract from notes taken of Marty's lecture, with some discussion of the work of Dilthey on similar topics, and of Marty's influence on Franz Kafka and on the Gestalt psychologist Max Wertheimer.

8. Barry Smith, "On the Austrianness of Austrian Economics", *Critical Review*, 4, 1-2 (1990), 212–238.

Abstract: Much recent work on the intellectual background of Austrian economics reveals an unfortunate lack of awareness of the distinct nature of the Austrian contribution to philosophy, from which the Austrian economists drew many of their ideas. The present essay offers a sketch of this contribution, contrasting Austrian philosophy especially with the modes of philosophy dominant in Germany. This makes it possible to throw new light on the relations on Mises, Kant and the Vienna circle, and it allows us also to establish the extent to which Austrian economics might properly be seen as being allied to the German hermeneutic tradition of Dilthey, Gadamer, et al. The essay concludes with a criticism of the hermeneutic relativism recently canvassed by some Austrian economists, concentrating especially on the work of Don Lavoie, whose writings are treated as symptomatic of a wider and somewhat regrettable trend.

Partially reprinted as "The Philosophy of Austrian Economics: Principles and Provocations", in S. C. Littlechild (ed.), *Austrian Economics*, vol. I, Aldershot/Brookfield VT: Edward Elgar, 1990, 527–538.

9. Barry Smith, "The Question of Apriorism", *Austrian Economics Newsletter*, (Fall 1990), 1–5.

Abstract: We defend a view according to which Austrian economics rests on what can most properly be called an Aristotelian methodology. This implies a realist perspective, according to which the world exists independently of our thinking and reasoning activities; an essentialist perspective, according to which the world contains certain simple essences or natures which may come together in law-like ways to form more complex static and dynamic wholes, and an apriorist perspective, according to which given essences and essential structures are intelligible, in the sense that they ca be grasped non-inductively in our thinking. We show the consequences of this view for an analysis of the thinking of Mises and Hoppe, both of which – we claim – incorporate what we believe to be foreign mixtures of Kantianism in their account of the foundations of Austrian economics.

Reprinted in *Rothbard e neo-hayekiani nella Scuola austriaca di economia* (Special issue of *Nuova Civiltà delle Macchine*), Dario Antiseri, Enzo Di Nuoscio, Francesco Di Iorio (eds.), June 2011, 59–68.

Czech translation: "Apriorizmus v ekonómii"

10. Barry Smith, "Puntel on Truth, Or: Old Idealistic Wine in New Semantic Bottles", *Ethik und Sozialwissenschaften. Streitforum für Erwägungskultur*, 3 (1992), 166–169.

11. Barry Smith, "No Philosophy. No Transformation. No Theses" [peer commentary on Herta Nagl-Docekal, "The Feminist Transformation of Philosophy"], *Ethik und Sozialwissenschaften. Streitforum für Erwägungskultur*, 4 (1992), 571–573.

12. Barry Smith, "Report on the International Brentano Conference. Graz, 25–26 May 1990", in *Nachrichten der Forschungsstelle und des Dokumentationszentrums für Österreichische Philosophie*, 2 (1990), 9–12.

13. Barry Smith, "First International Summer Institute in Cognitive Science held at UB", *UB International*, 3/2 (1994), 4, 7.

14. Barry Smith, "On Feminist Nomadism", *Free Inquiry*, 15/2 (1995), 30–31.

15. Ellen Klein and Barry Smith, "Philosophy and Feminist Politics: A Brief Guide", *Free Inquiry*, 16/1 (1995/96), 60–61.

16. Barry Smith, "Questionnaire on Cognitive Science", *Kog-Bit. Journal aus dem Graduiertenkolleg Kognitionswissenschaft der Universität Hamburg*, 13 (1996), 12.

17. Barry Smith and Peter Baumann, "Von Kant über Pol Pot zu Derrida", *KogBit. Journal aus dem Graduiertenkolleg Kognitionswissenschaft der Universität Hamburg*, 14 (1996), 8–11.

Revised version as "The Worst Cognitive Performance in History", *Noûsletter*, 1997, 13–15.

18. Barry Smith, "Bringing the Humanities Down to Earth", *Academic Questions*, 10 (4), 1997, 58-62.

Abstract: The phenomenon known as 'Pascal's syndrome', familiar to those who work with adolescents, affects a significant fraclion of adolescents who, in striving to establish themselves as independent adults, pass lhrough a phase in which they make utterances that amount lo a radical negation of everything their parents think or believe. Such rebellion may express itself in political, religious, economic, or sexual terms. In some cases, however, it leads co what can only be described as an ontological rebellion, expressing itself in utterances such as 'Reality does not exist,' or 'The world is a gigantic conspiracy,' and so forth. A very small minority of sufferers from such ontological rebellion become philosophers. We address the implications of this phenomenon for the present-day state of the humanities disciplines.

19. Barry Smith, "Applied Ontology: A New Discipline is Born", *Philosophy Today*, vol. 12, number 29 (1998), 5–6.

Italian translation as "Ontologo, il mestiere del futoro: È nata l'ontologia applicata", in: *Il Sole 24 Ore* (May 24, 1998), p. 35.

20. Barry Smith, "Qu'est-ce qu'une niche? Biologie et Ontologie formelle", *Biofutur. Le Mensuel européen de Biotechnologie*, 181 (September 1998), 13.

21. Barry Smith, "Presidential Teaching Tool", *Nousletter* (Buffalo), (July 1999), 3–4.

22. Reinhild Steingröver-McRae and Barry Smith, "The Last Days of the Human Race", *Austria Kultur*, 9: 5 (September/October 1999), 16–17.

23. Barry Smith, "Revisiting the Derrida Affair," interview by J. Sims, *Sophia*, 38: 2 (October 1999).

Abstract: In 1992 the proposal to award an honorary degree to Jacques Derrida exposed Cambridge University to the scrutiny of the academic world as well as to the press. The original proposal led four senior dons in Cambridge to announce a 'non-placet' vote. Barry Smith then authored a letter to The Times published on 9 May, 1992 along with eighteen other signatures from renowned philosophers, calling into doubt Derrida's qualifications for such an honor. The

interview here reproduced describes the background and motivation of the letter, and of Derrida's response.

24. Barry Smith, "Obiektywnosc percepcji zmyslowej", *Roczniki Filozoficzne* 49: 1 (2001), 63–75.

Abstract: There is an old problem in philosophy: the problem of how we pass from the mental theater of our representations to the external realm of concrete physical objects. This problem arises against the background of representationalist theories of the relation between mind and its objects which are marked by the following three features: 1. The perceiving subject is idealized. It is conceived as lying outside any context or environment and in abstraction from any goal-directed behavior. 2. Perception is seen as beginning with raw or bare sensations. Then, by a process of inference, there arise beliefs about external physical objects. 3. Physical objects are assumed to be out there in the world, but to be inaccessible to direct experience. This representationalist theory lives on in the computational theories of the mind and in the doctrines of methodological solipsism embraced by contemporary cognitive scientists. But by making perception dependent on sensation, and by making sensations the direct objects of experience, it has matters exactly upside down. The paper draws on the ecological psychology of J. J. Gibson and Roger Barker in order to provide the metaphysical principles of a more adequate theory.

25. Barry Smith, "From Classical Metaphysics to Medical Informatics", *Humboldt-Kosmos*, 79 (July 2002), 31–32.

Italian translation as: "Dalla metafisica classica all'informatica medica" in Maurizio Ferraris (ed.), *Ontologia*, Naples: Guida (2003), 154–158.

26. Barry Smith, "Groups, Sets, and Wholes", *Revista di estetica*, N.S. 24/3 (2003), 129–130.

27. Barry Smith and Werner Ceusters, "Towards industrial strength philosophy: how analytical ontology can help medical informatics", *Interdisciplinary Science Reviews*, 28 (2003), 106–111.

Abstract: Initially the problems of data integration, for example in the field of medicine, were resolved in case by case fashion. Pairs of databases were cross-calibrated by hand, rather as if one were translating from French into Hebrew. As the numbers and complexity of database systems increased, the idea arose of streamlining these efforts by constructing one single benchmark taxonomy, as it were a central switchboard, into which all of the various classification systems would need to be translated only once. By serving as a lingua franca for database integration this benchmark taxonomy would ensure that all databases calibrated in its terms would be automatically compatible with each other. We describe one strategy for creating such a lingua franca, in which philosophical ontology plays a central role.

Italian translation as: "Verso una filosofia al servizio dell'industria: l'utilità dell'ontologia analitica per l'informatica medica", *Sistemi Intelligenti*, 15: 3 (2003), 407–417.

28. Barry Smith, "The Measure of Civilizations", *Academic Questions*, 16: 1 (2002/03), 16–22.

Abstract: Is it possible to compare civilizations one with another? Is it possible, in other words, to construct some neutral and objective framework in terms of which we could establish in what respects one civilization might deserve to be ranked more highly than its competitors? Morality will surely provide one axis of such a framework (and we note in passing that believers in Islam might quite reasonably claim that their fellow-believers are characteristically more moral than are many in the West). Criteria such as material well-being will need to play a role, too, as also will happiness or pleasure (and again we note that it is not clear a priori that there is more happiness in the West than there is in other civilizations). But even happiness (pace some proponents of the utilitarian philosophy) comes in different types, and to count in the civilization stakes the happiness involved would presumably need to be of the right kind. We explore what this might mean in terms of the idea of a self-chosen life plan.

Russian translation

29. Barry Smith, "Il senso della vita, oltre ogni nichilismo", *Il Domenicale* (3 May 2003), 5.

30. Barry Smith, "Soldi, elezioni e molecole", *Il Sole 24 Ore* (7 December 2003), 37.

31. Barry Smith and Berit Brogaard, "E il 16º giorno nacque un nuovo individuo", *Il Sole 24 Ore* (21 December 2003).

32. Barry Smith and Enrico Berti, "Le prime cellule non sono già umane? No, altrimenti saremmo nati due volte", *Il Sole 24 Ore* (28 December 2003).

33. Barry Smith and Dirk Siebert, "Warum benutzen Ärzte keine Computer?", *Deutsches Ärzteblatt/Praxis Computer* (January 2004), 18–20.

34. Barry Smith, "Die ganze Welt ist eine Bühne", *Interdisziplinäre Phänomenologie / Interdisciplinary Phenomenology* (Kyoto), 1 (2004), 31–44.

> **Abstract:** Die klassische bikategoriale Ontologie von Substanzen und Akzidentien ist für die Festlegung der Strukturen menschlichen und tierischen Verhaltens nicht hinreichend, da die Umwelten dieses Verhaltens sich nicht in dieses klassische System einfügen. Wir bieten dementsprechend den Grundriß einer Theorie der besonderen Gebilde, die die Alltagswelten menschlicher und tierischer Verhalten konstituieren. Die Ausgangsüberlegung ist die folgende, Wir sind alle (Schau)spieler, und diese brauchen eine Bühne. Unsere Bühne ist die jeweilige Umwelt, in der wir leben und handeln. Der Terminus 'Umwelt' wird hierbei in Analogie zu Husserls Begriff der Lebenswelt verwendet. Er bezeichnet dementsprechend einen strukturierten Teil der Welt, in den sich ein Lebewesen, z.B. ein Mensch, einpaßt. Die Umwelt ist, wenn man so will, demnach die Bühne, auf welcher sich unser Verhalten abspielt. Der Versuch, das Wesen solcher Umwelten ontologisch festzulegen, bringt allerdings ein schwieriges Problem mit sich - ein Problem so alt wie Platons Höhlengleichnis und so neu wie gegenwärtige Reflexionen amerikanischer Philosophen zur Metaphysik der virtuellen Realität und zum Gedankenexperiment des Gehirns im Tank. Es gibt nämlich in manchen Fällen grobe Inkonsistenzen zwischen (1) der Umwelt, wie wir sie uns gerade vorstellen, und (2) der Umwelt als Bestandteil der wirklichen Welt. Das Problem, zwischen diesen beiden Umweltklassen einen Ausgleich zu finden, wird im letzten Teil behandelt.

35. Barry Smith, Werner Ceusters and Dirk Siebert, "Was die philosophische Ontologie zur biomedizinischen Informatik beitragen kann", *Information: Wissenschaft und Praxis*, 55: 3 (2004), 143–146.

36. Barry Smith, Maurizio Ferraris and Leonardo Zaibert, "La costituzione ontologica", *Il sole 24 Ore* (27 June 2004).

37. Barry Smith, "Niente è più sicuro della morte e delle tasse", *Il sole 24 Ore* (7 December 2004).

38. James J. Cimino and Barry Smith, "Introduction: International Medical Informatics Association Working Group 6 and the 2005 Rome Conference", *Journal of Biomedical Informatics*, 2006; 39(3): 249–251.

39. Barry Smith, "Philosophical Flaws in Standardization", *The Risks of Freedom Briefing*, 26 (2006), 3.

40. Thaddeus H. Grasela, Jill Fiedler-Kelly, Brenda Cirincione, Darcy Hitchcock, Kathleen Reitz, Susanne Sardella, and Barry Smith, "Informatics: The Fuel For Pharmacometric Analysis", *AAPS Journal*, 2007; March, 9(1), E84–E91. PMC2751306

> **Abstract:** The current informal practice of pharmacometrics as a combination art and science makes it hard to appreciate the role that informatics can and should play in the future of the discipline and to comprehend the gaps that exist because of its absence. The development of pharmacometric informatics has important implications for expediting decision-making and for improving the reliability of decisions made in model-based development. We argue that well-

defined informatics for pharmacometrics can lead to much needed improvements in the efficiency, effectiveness and reliability of the pharmacometrics process. The purpose of this paper is to provide a description of the pervasive yet often poorly appreciated role of informatics in improving the process of data assembly, a critical task in the delivery of pharmacometric analysis results. First, we provide a brief description of the pharmacometric analysis process. Second, we describe the business processes required to create analysis-ready datasets for the pharmacometrician. Third, we describe selected informatic elements required to support the pharmacometrics and data assembly processes. Finally, we offer specific suggestions for performing a systematic analysis of existing challenges as an approach to defining the next generation of pharmacometric informatics.

41. Barry Smith, "The Open Biomedical Ontologies (OBO) Foundry in 2008", *MMHCC (Mouse Models of Human Cancer Consortium) Newsletter,* March 2008, 1–2.

42. Robert Arp and Barry Smith, "Ontologies of Cellular Networks", *Science Signalling*, Vol. 1, Issue 50 (December 2008), 1-3, DOI: 10.1126/scisignal.150mr2.

Abstract: As part of a series of workshops on different aspects of biomedical ontology sponsored by the National Center for Biomedical Ontology (NCBO), a workshop titled "Ontologies of Cellular Networks" took place in Newark, New Jersey, on 27 to 28 March 2008. This workshop included more than 30 participants from various backgrounds in biomedicine and bioinformatics. The goal of the workshop was to provide an introduction to the basic tools and methods of ontology, as well as to enhance coordination between groups already working on ontologies of cellular networks. The meeting focused on three questions: What is an ontology? What is a pathway? What is a cellular network?

43. Barry Smith, Louis J. Goldberg, Alan Ruttenberg and Michael Glick, "Ontology and the Future of Dental Research Informatics", *The Journal of the American Dental Association*, October, 141 (10), 2010, 1173–75.

Abstract: How do we find what is clinically significant in the swarms of data being generated by today's diagnostic technologies? As electronic records become ever more prevalent – and digital imaging and genomic, proteomic, salivaomics, metabalomics, pharmacogenomics, phenomics and transcriptomics techniques become commonplace – fdifferent clinical and biological disciplines are facing up to the need to put their data houses in order to avoid the consequences of an uncontrolled explosion of different ways of describing information. We describe a new strategy to advance the consistency of data in the dental research community. The strategy is based on the idea that existing systems for data collection in dental research will continue to be used, but proposes a methodology in which past, present and future data will be described using a consensus-based controlled structured vocabulary called the Ontology for Dental Research (ODR).

44. Barry Smith and Richard H. Scheuermann, "Ontologies for Clinical and Translational Research", *Journal of Biomedical Informatics*, 44:1 (2011), 3–7.

45. Barry Smith, Louis J. Goldberg, Alan Ruttenberg and Michael Glick, "Ontology and Research: Authors' Response", *The Journal of the American Dental Association*, 142(3), 2011, 252–54.

46. Fabian Neuhaus, Elizabeth Florescu, Antony Galton, Michael Gruninger, Nicola Guarino, Leo Obrst, Arturo Sánchez-Ruíz, Amanda Vizedom, Peter Yim and Barry Smith, "Creating the Ontologists of the Future", *Applied Ontology* 6 (2011), 91–98.

Abstract: The goal of the Ontology Summit 2010 was to address the current shortage of persons with ontology expertise by developing a strategy for the education of ontologists. To achieve this goal we studied how ontologists are currently trained, the requirements identified by organizations that hire ontologists, and developments that might impact the training of ontologists in the future. We developed recommendations for the body of knowledge that should be taught and the skills that should be developed by future ontologists; these recommendations are intended as guidelines for institutions and organizations that may consider establishing a program for training ontologists. Further, we recommend a number of specific actions for the community to pursue.

47. Barry Smith, "Guest Editorial: caBIG has another fundamental problem: it relies on 'incoherent' messaging standard", *The Cancer Letter*, 37: 16, April 22, 2011, 1 and 5–6.

48. Stefano Borgo, Riichiro Mizoguchi and Barry Smith, "On the Ontology of Functions", *Applied Ontology*, 6 (2011), 99–104.

49. Andreas Tolk and Barry Smith, "Editors' Introduction to Special Issue on Command and Control Ontology", *International Journal of Intelligent Defence Support Systems,* 4 (3), 2011, 209–214.

50. Dipak Kalra, Mark Musen, Barry Smith, Werner Ceusters, "Policy Brief on Semantic Interoperability", *Interoperability Reviews: ARGOS Trans-Atlantic Observatory Policy Briefs*, Washington, DC: American Medical Informatics Association, Summer 2011, Vol. 2 No. 1.

51. Georg Fuellen, Melanie Boerries, Hauke Busch, Aubrey de Grey, Udo Hahn, Thomas Hiller, Andreas Hoeflich, Ludger Jansen, Georges E. Janssens, Christoph Kaleta, Anne C. Meinema, Sascha Schäuble, Paul N. Schofield, Barry Smith, Jürgen Sühnel, Julio Vera, Wolfgang Wagner, Eva C. Wonne, Daniel Wuttke, "In-Silico-Approaches and the Role of Ontologies in Aging Research", *Rejuvenation Research*, 2013 Dec;16(6):540-6.

> **Abstract:** The 2013 Rostock Symposium on Systems Biology and Bioinformatics in Aging Research was again dedicated to dissecting the aging process using in silico means. A particular focus was on ontologies, as these are a key technology to systematically integrate heterogeneous information about the aging process. Related topics were databases and data integration. Other talks tackled modeling issues and applications, the latter including talks focussed on marker development and cellular stress as well as on diseases, in particular on diseases of kidney and skin.

52. Barry Smith, "It Usually Begins with the Gene Ontology", *Methods of Information in Medicine*, 2013, 52 (6), 559-60.

> Comment on P. L. Elkin, S. H. Brown and G. Wright, "Biomedical Informatics: We Are What We Publish", *Methods of Information in Medicine*, 2013, 52 (6), 538-546.

53. Carolyn Korsmeyer and Barry Smith, "Comment: Kolnai's Disgust", *Emotion Review*, 6 (3), 2014, 221–222.

> **Abstract:** In his *The Meaning of Disgust*, Colin McGinn employs elements of the phenomenological theory of disgust advanced by Aurel Kolnai in his "On Disgust" of 1929. Kolnai's treatment of what he calls "material" disgust and of its primary elicitors—putrefying organic matter, bodily wastes and secretions, sticky contaminants, vermin—anticipates more recent scientific treatments of this emotion as a mode of protective recoil. In her review of McGinn's book, Nina Strohminger charges McGinn with neglecting such scientific studies. We here attempt to show how Kolnai goes beyond experimental findings in his careful description of the phenomenological differences between disgust and other emotions of forceful disapproval.

54. "The Curious Case of the Complicated Border: The Story of Baarle," *Dutch International Society Magazine*, 47 (4), 2016, 11-17.

55. Sonia Kamińska and Barry Smith, "How Many Kafka's Are There?", *Polish Journal of Aesthetics,* 53 (2), 2019.

> The aim of this volume is to present Kafka not as a writer, or not only as a writer, but as a philosopher. However, even after narrowing the scope of our interest down, there will still be several Kafka's left on the table. Themes treated in the volume include: the so-called Brentano School in Prague, Kafka's affiliation to the Louvre Circle, Kafka and existentialist philosophy, Kafka's Jewish heritage, his love of Nietzsche and Meister Eckhart and—last but not least, since he was such an exceptional writer—his aesthetics.

56. Barry Smith, "The bridge between philosophy and information-driven science", *Journal of Knowledge Structures and Systems* 2 (2): 47-55. 2021.

> **Abstract:** This essay is a response to Luis M. Augusto's intriguing paper on the rift between mainstream and formal ontology. I will show that there are in fact two questions at issue here: 1. concerning the links between mainstream and formal approaches within philosophy, and 2. concerning the application of philosophy (and especially philosophical ontology) in support of information-driven research for example in the life sciences.

CHAPTERS IN BOOKS

1. Barry Smith, "Roman Ingarden: Ontological Foundations for Literary Theory", in J. Odmark (ed.), *Language, Literature and Meaning I: Problems of Literary Theory*, Amsterdam: Benjamins, 1979, 373–390.

> **Abstract:** The paper seeks to apply the work of the Polish phenomenologist Roman Ingarden to certain problems in literary theory; contrasts the notions of ontological and epistemological incompleteness of the represented objects of a literary work and considers the question of the nature of such objects. The paper concludes by analyzing some of the degrees of freedom possessed by the readings of literary work in relation to the work itself.

2. Barry Smith, "Kafka and Brentano: A Study in Descriptive Psychology", in Barry Smith (ed.), *Structure and Gestalt: Philosophy and Literature in Austria-Hungary and Her Successor States*, Amsterdam: John Benjamins, 1981, 113–161.

> **Abstract:** There is a narrow thread in the vast literature on Kafka which pertains to Kafka's knowledge of philosophy, and more precisely to Kafka's use in his fictional writings of some of the main ideas of Franz Brentano. Kafka attended courses in philosophy at the Charles University given by Brentano's students Anton Marty and Christian von Ehrenfels, and was for several years a member of a discussion-group organized by orthodox adherents of the Brentanian philosophy in Prague. The present essay summarizes what is known about Kafka's relations to the Brentanist movement. It draws on Brentanian ideas on the evidence of inner perception, on oblique consciousness, on active introspection, on correct and incorrect judgment, and on consciousness as a species of inner tribunal, in order to throw light on central features of Kafka's writings, including stylistic features. Special attention is directed towards *Die Verwandlung* and *Der Prozess,* and a reading of the latter is offered according to which the trial of Joseph K. occurs entirely within the mind of K. himself.
>
> Revised version as: "Brentano and Kafka", *Axiomathes*, 8 (1997), 83–104.
>
> French translation as: "Kafka et Brentano", *Philosophiques,* 26/2 (1999), 349–371.

3. Barry Smith, "The Production of Ideas: Notes on Austrian Intellectual History from Bolzano to Wittgenstein", in Barry Smith (ed.), *Structure and Gestalt: Philosophy and Literature in Austria-Hungary and Her Successor States*, Amsterdam: John Benjamins, 1981, 211–234.

> **Abstract:** This paper takes the form of a series of sketches of 19th century Austrian political and intellectual history, allied with a number of more general reflections designed to contribute to our understanding of some of the peculiar characteristics of Austrian thought, particularly Austrian philosophy and economics, in theperiod in question.

4. Barry Smith and Kevin Mulligan, "Pieces of a Theory", in Barry Smith (ed.), *Parts and Moments. Studies in Logic and Formal Ontology*, Munich: Philosophia, 1982, 15–109.

> **Abstract:** A survey of theories of part, whole and dependence from Aristotle to the Gestalt psychologists, with special attention to Husserl's Third Logical Investigation "On the Theory of Parts and Wholes".

5. Barry Smith, "Introduction to Adolf Reinach, 'On the Theory of the Negative Judgment'", in Barry Smith (ed.), *Parts and Moments. Studies in Logic and Formal Ontology*, Munich: Philosophia, 1982, 289–313.

Abstract: Reinach's essay of 1911 establishes an ontological theory of logic, based on the notion of Sachverhalt or state of affairs. He draws on the theory of meaning and reference advanced in Husserl's Logical Investigations and at the same time anticipates both Wittgenstein's Tractatus and later speech act theorists' ideas on performative utterances. The theory is used by Reinach to draw a distinction between two kinds of negative judgment: the simple negative judgment, which is made true by a negative state of affairs; and the polemical negative judgment, which is a performative utterance in which the truth of some earlier judgment – typically a judgment made by some other person – is denied.

6. Barry Smith, "Meinen und Vorstellen in der literarischen Gegenstandskonstitution", in G. Wolandt (ed.), *Kunst und Kunstforschung. Beiträge zur Ästhetik*, Bonn: Bouvier, 1983, 49–61.

Abstract: Material things have material (spatial) parts. Acts, events, occurrences, have phases, which we can view as their temporal parts. Spatial surfaces and volumes, stretches of time, they all have parts again; they can all be considered "extended". Entities, on the other hand, such as directions, numbers, temperatures, colors, tones, fictional characters, prices, numbers, values, ideologies, goals, are all unextended; they are partless. Let us call such non-extended objects "nodes", in order to express the fact that we have a tendency to grasp them as pure correlates of our thinking, often at the same time viewing them effectively as placeholders within systems of coordinates in various intellectual and social domains. My aim, here, is to clarify this rough idea of "node" for the purpose of providing a corresponding clarification of Ingarden's idea of a *purely intentional object*. I first consider purely intentional objects in general, and then focus in particular on fictional examples.

7. Barry Smith, "Summaries and Note: On the Political Economy of Karl Wittgenstein", in J. C. Nyíri (ed.), *Karl Wittgenstein: Politico-Economic Writings*, Amsterdam: John Benjamins, 1984, 197–227.

8. Barry Smith, "Wittgenstein und das ethische Gesetz", in D. Birnbacher and A. Burkhardt (eds.), *Sprachspiel und Methode. Zum Stand der Wittgenstein-Diskussion*, Berlin/New York: de Gruyter, 1985, 191–211.

Abstract: Der vorliegende Aufsatz stellt den Versuch dar, die normative Seite von Wittgensteins Frühwerk herauszuarbeiten und dabei an seinem Ansatz insofern Kritik zu üben, als gezeigt wird, wie sehr dessen Implikationen mit unseren üblichen ethischen Vorstellungen in Konflikt stehen. Die Arbeit hat aber auch einen etwas wohlwollenderen Aspekt: Sie versucht zu zeigen, wie Wittgensteins scheinbar widersinnige Ansichten so formuliert werden können, daß sie zumindest begreifbar erscheinen. Zu diesem Zweck beginnen wir mit der Untersuchung des demjenigen Wittgensteins erstaunlich ähnlichen ethischen Ansatzes, wie er von einem seiner frühen väterlichen Freunde vertreten wurde, nämlich von Karl Kraus.

9. Barry Smith, "Preface: Austrian Economics from Menger to Hayek", in Wolfgang Grassl and Barry Smith (eds.), *Austrian Economics: Historical and Philosophical Background*, New York: New York University Press, London/Sydney: Croom Helm, 1986, v–viii.

10. Barry Smith, "Austrian Economics and Austrian Philosophy", in Wolfgang Grassl and Barry Smith (eds.), *Austrian Economics: Historical and Philosophical Background*, New York: New York University Press, London/Sydney: Croom Helm, 1986, 1–36, reprinted in the series Routledge Revivals, London: Routledge, 2010.

Abstract: Austrian economics starts out from the thesis that the objects of economic science differ from those of the natural sciences because of the centrality of the economic agent. This allows a certain *a priori* or essentialistic aspect to economic science of a sort which parallels the *a priori* dimension of psychology defended by Brentano and his student Edmund Husserl. We outline these parallels, and show how the theory of a priori dependence relations outlined in

Husserl's *Logical Investigations* can throw light on the Austrian account of entrepreneurship, especially as this is formulated by Israel Kirzner.

11. Barry Smith, "The Theory of Value of Christian von Ehrenfels", in R. Fabian (ed.), *Christian von Ehrenfels: Leben und Werk*, Amsterdam: Rodopi, 1986, 150–171.

Abstract: Christian von Ehrenfels was a student of both Franz Brentano and Carl Menger and his thinking on value theory was inspired both by Brentano's descriptive psychology and by the subjective theory of economic value advanced by Menger, the founder of the Austrian school of economics. Value, for Ehrenfels, is a function of desire, and we ascribe value to those things which we either do in fact desire, or would desire if we were not convinced of their existence. He asserts that the needed theoretical understanding of values is to be achieved by generalizing economic laws of valuation to apply to value in general. The law of marginal utility, for example, is a law to the effect that the n+1st sample of a good which I receive is *ceteris paribus* less valuable than the nth sample (imagine that the samples in question are, for example, a series of identical ham sandwiches). The essay describes how Ehrenfels provides on this basis an account of the different types of values, both intrinsic and non-intrinsic. It outlines also Ehrenfels views on the problem of interpersonal value-comparisons and on the struggle for survival between different values of different types.

12. Kevin Mulligan and Barry Smith, "Mach und Ehrenfels: Über Gestaltqualitäten und das Problem der Abhängigkeit", in R. Fabian (ed.), *Christian von Ehrenfels: Leben und Werk*, Amsterdam: Rodopi, 1986, 85–111.

Abstract: Ernst Mach's atomistic theory of sensation faces problems in doing justice to our ability to perceive and remember complex phenomena such as melodies and shapes. Christian von Ehrenfels attempted to solve these problems with his theory of "Gestalt qualities", which he sees as entities depending one-sidedly on the corresponding simple objects of sensation. We explore the theory of dependence relations advanced by Ehrenfels and show how it relates to the views on the objects of perception advanced by Husserl and by the Gestalt psychologists.

Revised and expanded English version as: "Mach and Ehrenfels: The Foundations of Gestalt Theory", in Barry Smith (ed.), *Foundations of Gestalt Theory*, Munich and Vienna: Philosophia, 1988, 124–157.

Romanian translation as: "Mach şi Ehrenfels. Fundamentele teoriei gestaltiste", in Constantin Stoenescu, Ion Tănăsescu (eds.), *Filosofia Austriacă*, Bucharest: Pelican, 2005, 262–294.

13. Barry Smith, "Materials Towards a History of Speech Act Theory", in A. Eschbach (ed.), *Karl Bühler's Theory of Language*, Amsterdam: John Benjamins, 1987, 125–152.

Abstract: Provides a survey of the development of speech act theory from Aristotle through Reid and Peirce to Edmund Husserl, Anton Marty, Johannes Daubert, Adolf Reinach, and finally to Austin and Searle. A special role is played by Husserl's theory of objectifying acts (meaning, roughly, acts of naming or stating) and of the efforts by his followers to extend this theory to cover phenomena such as questioning and commanding. These efforts culminated in the work of Adolf Reinach, who developed the first systematic theory of speech acts in connection with his monograph of 1913 on "The A Priori Foundations of the Civil Law".

Revised and expanded version as: "Towards a History of Speech Act Theory", in A. Burkhardt (ed.), *Speech Acts, Meanings and Intentions. Critical Approaches to the Philosophy of John R. Searle*, Berlin/New York: de Gruyter, 1990, 29–61.

Italian translation as: "Per una storia della teoria degli atti linguistici", in: *Il realismo fenomenologico. Sulla filosofia dei circoli di Monaco e Gottinga*, Stefano Besoli e Luca Guidetti (eds.), Macerata: Quodlibet, 2000, 385–418.

Spanish translation as: "Una breve historia de la teoría de los actos de habla", in *Pragmática: Desarrollos teóricos y debates*, translated by Jorge Gómez, Quito: Edicion Abya-Yala, 2002, 13–82.

14. Barry Smith, "Husserl, Language and the Ontology of the Act", in D. Buzzetti and M. Ferriani (eds.), *Speculative Grammar, Universal Grammar, and Philosophical Analysis of Language*, Amsterdam: John Benjamins, 1987, 205–227.

Abstract: The ontology of language is concerned with the relations between uses of language, both overt and covert, and other entities, whether in the world or in the mind of the thinking subject. We attempt a first survey of the sorts of relations which might come into question for such an ontology, including: relations between referring uses of expressions and their objects, relations between the use of a (true) sentence and that in the world which makes it true, relations between mental acts on the one hand and underlying mental states (attitudes, beliefs), on the other, relations between my acts and states, associated uses of language and overt actions on my part and on the part of those other subjects with whom I communicate.

15. Barry Smith, "On the Cognition of States of Affairs", in K. Mulligan (ed.), *Speech Act and Sachverhalt: Reinach and the Foundations of Realist Phenomenology*, Dordrecht/Boston/Lancaster: Nijhoff, 1987, 189–225.

Abstract: The theory of speech acts put forward by Adolf Reinach in his "The A Priori Foundations of the Civil Law" of 1913 rests on a systematic account of the ontological structures associated with various different sorts of language use. One of the most original features of Reinach's account lies in hIs demonstration of how the ontological structure of, say, an action of promising or of commanding, may be modified in different ways, yielding different sorts of non-standard instances of the corresponding speech act varieties. The present paper is an attempt to apply this idea of standard and modified instances of ontological structures to the realm of judgement and cognition, and thereby to develop a Reinachian theory of how intentionality is mediated through language in acts of thinking and speaking.

Italian translation as: "Adolf Reinach e la fondazione della fenomenologia realistica", *Paradigmi*, 5 (1987), 229–241 and 6 (1987), 485–507.

16. Karl Schuhmann and Barry Smith, "Adolf Reinach: An Intellectual Biography", in K. Mulligan (ed.), *Speech Act and Sachverhalt: Reinach and the Foundations of Realist Phenomenology*, Dordrecht/Boston/Lancaster: Nijhoff, 1987, 1–27.

Abstract: The essay provides an account of the development of Reinach's philosophy of "Sachverhalte" (states of affairs) and on problems in the philosophy of law, leading up to his discovery of the theory of speech acts in 1913. Reinach's relations to Edmund Husserl and to the Munich phenomenologists are also dealt with.

17. Barry Smith, "Austrian Origins of Logical Positivism", in B. Gower (ed.), *Logical Positivism in Perspective*, London/Sydney: Croom Helm, 1987, Totowa: Barnes and Noble, 1988, 35–68.

Abstract: Recent work on Austrian philosophy has revealed, hitherto, unsuspected links between Vienna circle positivism on the one hand, and the thought of Franz Brentano and his circle on the other. the paper explores these links, casting light also on the Polish analytic movement, on the development of Gestalt psychology, and on the work of Schlick and Neurath.

Reprinted in: K. Szaniawski (ed.), *The Vienna Circle and the Lvov-Warsaw School*, Dordrecht/Boston/Lancaster: Kluwer, 1989, 19–53.

18. Barry Smith, "Gestalt Theory: An Essay in Philosophy", in Barry Smith (ed.), *Foundations of Gestalt Theory*, Munich and Vienna: Philosophia, 1988, 11–81.

Abstract: The Austrian philosopher Christian von Ehrenfels published his essay "On 'Gestalt Qualities'" in 1890. The essay initiated a current of thought which enjoyed a powerful position in the philosophy and psychology of the first half of this century and has more recently enjoyed a minor resurgence of interest in the area of cognitive science, above all in criticisms of the so-called 'strong programme' in artificial intelligence. The theory of Gestalt is of course associated

most specifically with psychologists of the Berlin school such as Max Wertheimer, Wolfgang Köhler and Kurt Koffka. We shall see in what follows, however, that an adequate philosophical understanding of the Gestalt idea and of Ehrenfels' achievement will require a close examination not merely of the work of the Berlin school but also of a much wider tradition in Austrian and German philosophy in general.

19. Barry Smith, "Knowing How vs. Knowing That", in J. C. Nyíri and Barry Smith (eds.), *Practical Knowledge. Outlines of a Theory of Traditions and Skills*, London/Sydney/New York: Croom Helm, 1988, 1–16.

Abstract: A sketch of the history of the opposition between propositional and practical knowledge is followed by a brief account of the relevant ideas of Merleau-Ponty, Polanyi, and H. and S. Dreyfus (on expertise and artificial intelligence). The paper concludes with a discussion of the work of Ryle on the notion of a 'discipline', drawing implications for a theory of traditions.

20. Barry Smith, "Practices of Art", in J. C. Nyíri and Barry Smith (eds.), *Practical Knowledge. Outlines of a Theory of Traditions and Skills*, London/Sydney/New York: Croom Helm, 1988, 172–209.

Abstract: Starting out from the ontology of human work set out by Marx in *Das Kapital*, the paper seeks to analyse the relations between the artist and his actions and aims, the work of art he produces, and the audience for this work. The paper concludes with a discussion of the problem of creativity in the arts, drawing on ideas of Roman Ingarden and other phenomenologists.

21. Barry Smith, "Logic and Formal Ontology", in J. N. Mohanty and W. McKenna (eds.), *Husserl's Phenomenology: A Textbook*, Lanham: University Press of America, 1989, 29–67.

Abstract: Logic for Husserl is a science of science, a science of what all sciences have in common in their modes of validation. Thus logic deals with universal laws relating to truth, to deduction, to verification and falsification, and with laws relating to theory as such, and to what makes for theoretical unity, both on the side of the propositions of a theory and on the side of the domain of objects to which these propositions refer. This essay presents a systematic overview of Husserl's views on these matters as put forward in his Logical Investigations. It shows how Husserl's theory of linguistic meanings as species of mental acts, his formal ontology of part, whole and dependence, his theory of meaning categories, and his theory of categorial intuition combine with his theory of science to form a single whole. Finally, it explores the ways in which Husserl's ideas on these matters can be put to use in solving problems in the philosophy of language, logic and mathematics in a way which does justice to the role of mental activity in each of these domains while at the same time avoiding the pitfalls of psychologism.

Revised version in: *Manuscrito*, 23: 2, 2000, 275–323.

Italian translation as: "Logica e ontologia formale nelle *Logische Untersuchungen* di Edmund Husserl", *Rivista di Filosofia*, 83, 1991, 53–70.

Spanish translation as: "Lógica y ontología formal", Grupo de Acción Filosófica (GAF), Buenos Aires, Argentina, 2004.

Russian translation

22. Barry Smith, "Kasimir Twardowski: An Essay on the Borderlines of Psychology, Ontology and Logic", K. Szaniawski (ed.), *The Vienna Circle and the Philosophy of the Lvov-Warsaw School*, Dordrecht/Boston/Lancaster: Kluwer, 1989, 313–373.

Abstract: The influence of Kasimir Twardowski on modern Polish philosophy is all-pervasive. As is well known, almost all important 20th century Polish philosophers went through the hard training of his courses in Lvov. Twardowski instilled in his students an enduring concern for clarity and rigour. He taught them to regard philosophy as a collaborative effort, a matter of disciplined discussion and argument. And he encouraged them to work together with scientists from other disciplines — above all with psychologists, and also with mathematicians — so that the Lvov school of philosophy would gradually evolve into the Warsaw school of logic.

Revised version as: "Kasimir Twardowski: On Content and Object ", chapter 6 of Barry Smith, *Austrian Philosophy: The Legacy of Franz Brentano*, La Salle and Chicago: Open Court, 1994, 160-200.

23. Barry Smith, "Constraints on Correspondence" in *Traditionen und Perspektiven der analytischen Philosophie. Festschrift für Rudolf Haller*, H. Rutte, W. Sauer and W. Gombocz (eds.), Vienna: Hölder/Pichler/Tempsky, 1989, 415–430.

Abstract: My aim is to lay down some constraints on a correspondence theory of truth for empirical sentences of a natural language on the basis of a theory according to which that to which a true empirical sentence of such a language corresponds is a part of the natural world. The problem is to find some means of delineating those portions of the world which serve as correspondents, portions of reality otherwise called 'truthmakers'.

24. Barry Smith, "Logica Kirchbergensis", in P. Klein (ed.), *Praktische Logik. Traditionen und Tendenzen*, Abhandlungen eines Seminars beim 13. Internationalen Wittgenstein-Symposium, Kirchberg am Wechsel 1988 (Veröffentlichungen der Joachim-Jungius Gesellschaft Hamburg, 61), Göttingen: Vandenhoeck & Ruprecht, 1989, 123–145.

Abstract: In der klassischen Logik von Aristoteles bis Wolff findet sich eine durchgängige Parallelität von logischen (einschließlich grammatikalischen und psychologischen) und ontologischen Gebilden. Der Logiker beschäftigt sich mit Subjekt und Prädikat, aber gleichzeitig auch z.B. mit Substanz und Akzidenz als Entitäten in der Welt. Nach Kant begann für die Logik eine Phase, in der diese ontologische oder objektbezogene Seite verloren ging. Gegen Ende des 19. Jahrhunderts beginnt man dann aber wieder über die ontologischen Korrelate des Denkens und des Urteilens zu sprechen. Wir zeigen, dass diese Wiederbelebung der alten Logik mit der Einführung des Terminus 'Sachverhalt' in die Sprache der Philosophie verbunden ist.

25. Karl Schuhmann and Barry Smith, "Vorwort", editors' forward to vol. I of Adolf Reinach, *Sämtliche Werke. Kritische Ausgabe mit Kommentar*, Karl Schuhmann and Barry Smith (eds.), Munich/Hamden/Vienna: Philosophia, 1989, XIV–XVIII.

26. Karl Schuhmann and Barry Smith, "Adolf Reinach (1884-1917)", editors' introduction to vol. II of Adolf Reinach, *Sämtliche Werke. Kritische Ausgabe mit Kommentar*, Karl Schuhmann and Barry Smith (eds.), Munich/Hamden/Vienna: Philosophia, 1989, 613–626.

27. Karl Schuhmann and Barry Smith, "Kommentar und Textkritik", critical apparatus to vol. II of Adolf Reinach, *Sämtliche Werke. Kritische Ausgabe mit Kommentar*, Karl Schuhmann and Barry Smith (eds.), Munich/Hamden/Vienna: Philosophia, 1989, 627–829.

28. Barry Smith, "Brentano and Marty: An Inquiry into Being and Truth", in K. Mulligan (ed.), *Mind, Meaning and Metaphysics: The Philosophy and Theory of Language of Anton Marty*, Dordrecht/Boston/Lancaster: Kluwer, 1990, 111–149.

Abstract: A study of the concepts of reality and existence in the work of Franz Brentano and his student Anton Marty. Topics dealt with include: Aristotle's concept of being in the sense of being true; operationally defined concepts; Brentano's reism; things and states of affairs.

Revised version as: "Anton Marty: On Being and Truth", chapter 4 of Barry Smith, *Austrian Philosophy: The Legacy of Franz Brentano*, La Salle and Chicago: Open Court, 1994.

29. Barry Smith, "On the Phases of Reism", in J. Wolenski, ed., *Kotarbinski: Logic, Semantics and Ontology*, Dordrecht/Boston/London: Kluwer, 1990, 137–184.

Abstract: Kotarbiński is one of the leading figures in the Lvov-Warsaw school of Polish philosophy. We summarize the development of Kotarbiński's thought from his early nominalism and 'pansomatistic reism' to the later doctrine of 'temporal phases'. We show that the surface

clarity and simplicity of Kotarbiński's writings mask a number of profound philosophical difficulties, connected above all with the problem of giving an adequate account of the truth of contingent (tensed) predications. The paper will examine in particular the attempts to resolve these difficulties on the part of Leśniewski. It will continue with an account of the relations of Kotarbińskian reism to the ontology of things or entia realia defended by the later Brentano. Kotarbiński's identification of Brentano as a precursor of reism is, it will be suggested, at least questionable, and the paper will conclude with a more careful attempt to situate the Brentanian and Kotarbińskian ontologies within the spectrum of competing ontological views.

Reprinted in: *Actions, Products, and Things. Brentano and Polish Philosophy*, A. Chrudzimski and D. Łukasiewicz (eds.), Frankfurt: ontos, 2006, 115–176.

30. Jean Petitot and Barry Smith, "New Foundations for Qualitative Physics", in J. E. Tiles, G. T. McKee and C. G. Dean (eds.), *Evolving Knowledge in Natural Science and Artificial Intelligence*, London: Pitman Publishing, 1990, 231–249.

Abstract: Modern physics is not the science of some ultimate bedrock of reality. Rather (crudely speaking) it is a science which deals with a limited number of ways in which matter manifests itself in qualitative reality. It deals with these manifestations not, however, as denizens of the qualitative world, but in purified form, as quantities or magnitudes. Physics seeks to use mathematical devices to explain the given manifestations by showing how they are subject to formal laws or principles. We describe a variety of such manifestations and show how qualitative reality is preserved, in the physicists' view of reality, but filtered through structures of a quantitative sort.

Russian translation

31. Barry Smith, "Grundlegung eines fallibilistichen Apriorismus", in N. Leser, J. Seifert and K. Pflitzner (eds.), *Die Gedankenwelt Sir Karl Poppers. Kritischer Rationalismus im Dialog*, Heidelberg: Carl Winter Universitätsverlag, 1991, 393–411.

Abstract: We assume a position of scientific realism to the effect (i) that the world exists and (ii) that through the working out of ever more sophisticated theories our scientific picture of reality will approximate ever more closely to the world as it really is. Against this background consider, now, the following question: 1. Do the empirical theories with the help of which we seek to approximate a good or true picture of reality rest on any non-empirical presuppositions? One can answer this question with either a 'yes' or a 'no'. 'No' is the preferred answer of most contemporary methodologists – Murray Rothbard is one distinguished counterexample to this trend – who maintain that empirical theories are completely free of non-empirical ('a priori') admixtures and who see science as a matter of the gathering of pure 'data' obtained through simple observation. From such data scientific propositions are then supposed to be somehow capable of being established.

English translation as: "In Defense of Extreme (Fallibilistic) Apriorism", *Journal of Libertarian Studies* 12 (1996), 179–192.

Russian translation

32. Barry Smith, "Relevance, Relatedness and Restricted Set Theory", in G. Schurz and G. J. W. Dorn (eds.), *Advances in Scientific Philosophy. Essays in Honour of Paul Weingartner*, Amsterdam/Atlanta: Rodopi, 1991, 45–56.

Abstract: What sort of set theory results when restrictions are placed on the sorts of elements which may form a set? Given an arbitrary relevance relation, one can formulate a notion of set which will apply only to totalities of mutually relevant entities. Relevance might signify for example: exists at the same time as, belongs to the same body as, is less than a certain distance from, etc. The resultant theory, which embodies topological constraints, can then be used as the basis for an account of relevance between propositions which is in the tradition of the relevant logics of analytic implication studied by M. Dunn and W. T. Parry.

33. Barry Smith, "Characteristica Universalis", in K. Mulligan (ed.), *Language, Truth and Ontology* (Philosophical Studies Series), Dordrecht/Boston/London: Kluwer, 1992, 48–77.

Abstract: Recent work in formal philosophy has concentrated overwhelmingly on the logical problems pertaining to epistemic shortfall - which is to say on the various ways in which partial and sometimes incorrect information may be stored and processed. A directly depicting language, in contrast, would reflect a condition of epistemic perfection. It would enable us to construct representations not of our knowledge but of the structures of reality itself, in much the way that chemical diagrams allow the representation (at a certain level of abstractness) of the structures of molecules of different sorts. A diagram of such a language would be true if that which it sets out to depict exists in reality, i.e. if the structural relations between the names (and other bits and pieces in the diagram) map structural relations among the corresponding objects in the world. Otherwise it would be false. All of this should, of course, be perfectly familiar. (See, for example, Aristotle, *Metaphysics*, 1027 b 22, 1051 b 32ff.) The present paper seeks to go further than its predecessors, however, in offering a detailed account of the syntax of a working universal characteristic and of the ways in which it might be used.

Characteristica Universalis (Danish translation) in: *Almen Semiotik*, 14 (1998), 158–187.

34. Barry Smith, "Austrian Philosophy and Austrian Economics", in J. Lee Auspitz, *et al*. (eds.), *Praxiologies and the Philosophy of Economics,* New Brunswick and London: Transaction Publishers, 1992, 245–272.

35. Barry Smith, "Ontology and the Logistic Analysis of Reality", in N. Guarino and R. Poli (eds.), *Proceedings of the International Workshop on Formal Ontology in Conceptual Analysis and Knowledge Representation,* Padova: Institute for Systems Theory and Biomedical Engineering of the Italian National Research Council, 1993, 51–68.

Abstract: I show how mereology, taken together with certain topological notions, can yield the basis for future investigations in formal ontology. I shall attempt to show also how the mereological framework here advanced can allow the direct and natural formulation of a series of theses – for example pertaining to the concept of boundary – which can be formulated only indirectly (if at all) in set-theoretic terms.

Polish translation as: "Ontologia i logiczna analiza rzeczywistosci", in *Filozofia Nauki*, 2 (1994), 5–22.

36. Barry Smith, "The New European Philosophy" in Barry Smith (ed.), *Philosophy and Political Change in Eastern Europe*, La Salle: The Hegeler Institute, 1993, 165–170 and 191–192.

Abstract: The paper seeks to indicate ways in which the crude distinction between Anglo-Saxon and Continental philosophy may have to be amended in light of recent developments in Eastern Europe. As is well known, the philosophy of science is to no small part a product of the universities of the Habsburg Empire (in Vienna, Prague, Lemberg/Lwow, etc.). Logic, too, has played a more significant role in Eastern Europe (not least in Poland) than in the philosophical cultures of Germany or France. For these and other reasons, a shift in the center of gravity of Continental philosophy is currently being realized, as younger Eastern European philosophers in newly liberalized institutions begin to return to their roots in their native pre-Communist intellectual traditions.

37. Barry Smith, "Husserl's Theory of Meaning and Reference", in L. Haaparanta (ed.), *Mind, Meaning and Mathematics. Essays on the Philosophy of Husserl and Frege*, Dordrecht/Boston/Lancaster: Kluwer, 1994, 163–183.

Abstract: This paper is a contribution to the historical roots of the analytical tradition. As Michael Dummett points out in his *Origins of Analytic Philosophy*, many tendencies in Central European thought contributed to the early development of analytic philosophy. Dummett himself concentrates on just one aspect of this historical complex, namely on the relationship between the theories of meaning and reference developed by Frege and by Husserl in the years around the turn of the century. It is to this specific issue that the present essay is devoted, though we attempt a more sympathetic reading of Husserl's views on these matters than is to be found in

Dummett's work. Topics covered include Husserl's theory of intentionality, his view of meanings as types or essences of mental acts, of the relation between meaning and expression, of states of affairs, and of indexicality.

38. Barry Smith, "Filozofia Austriacka" in T. Lubowiecki and A. Rojszczak (eds.), *Filozofia Austriacka (Principia* VIII–IX), Cracow: Aureus S.C., 1994, 19–50. Polish translation of Chapter 1 of Barry Smith, *Austrian Philosophy: The Legacy of Franz Brentano*, La Salle and Chicago: Open Court, 1994.

39. Josef Seifert and Barry Smith, "The Truth about Fiction", in W. Galewicz, E. Ströker and W. Strozewski (eds.), *Kunst und Ontologie. Für Roman Ingarden zum 100. Geburtstag*, Amsterdam/Atlanta: Rodopi, 1994, 97–118.

40. Barry Smith and David W. Smith, "Introduction" to Barry Smith and David W. Smith (eds.), *The Cambridge Companion to Husserl*, Cambridge and New York: Cambridge University Press, 1995, 1–44.

Husserl's philosophy, by the usual account, evolved through three stages: 1. development of an anti-psychologistic, objective foundation of logic and mathematics, rooted in Brentanian descriptive psychology; 2. development of a new discipline of "phenomenology" founded on a metaphysical position dubbed "transcendental idealism"; transformation of phenomenology from a form of methodological solipsism into a phenomenology of intersubjectivity and ultimately (in his Crisis of 1936) into an ontology of the life-world, embracing the social worlds of culture and history. We show that this story of three revolutions can provide at best a preliminary orientation, and that Husserl was constantly expanding and revising his philosophical system, integrating views in phenomenology, ontology, epistemology and logic with views on the nature and tasks of philosophy and science as well as on the nature of culture and the world in ways that reveal more common elements than violent shifts of direction. We argue further that Husserl is a seminal figure in the evolution from traditional philosophy to the characteristic philosophical concerns of the late twentieth century: concerns with representation and intentionality and with problems at the borderlines of the philosophy of mind, ontology, and cognitive science.

41. Barry Smith, "Common Sense", in Barry Smith and David W. Smith (eds.), *Cambridge Companion to Husserl*, Cambridge and New York: Cambridge University Press, 1995, 394–436.

Abstract: Can there be a theory-free experience? And what would be the object of such an experience. Drawing on ideas set out by Husserl in the "Crisis" and in the second book of his "Ideas", the paper presents answers to these questions in such a way as to provide a systematic survey of the content and ontology of common sense. In the second part of the paper Husserl's ideas on the relationship between the common-sense world (what he called the 'life-world') and the world of physical theory are subjected to a critical evaluation. The relation of Husserl's ideas to current work in folk psychology and naive physics and to the direct realism of J. J. Gibson are also treated.

42. Barry Smith, "The Neurath–Haller Thesis: Austria and the Rise of Scientific Philosophy", in K. Lehrer and J. C. Marek (eds.), *Austrian Philosophy Past and Present* (Boston Studies in the Philosophy of Science), Dordrecht/Boston/Lancaster: Kluwer, 1996, 1–20.

Abstract: The term 'Continental philosophy' designates not philosophy on the continent of Europe as a whole, but rather a selective slice of Franco-German philosophy. Through a critical analysis of the arguments advanced by Otto Neurath, the paper addresses the issue of why Austrian philosophers in particular are not counted in the pantheon of Continental philosophers. Austrian philosophy is marked by the predominance of philosophical analysis and of the philosophy of science. The paper concludes that it is not Austria which is the special case when seen against the background of contemporary mainstream philosophy, but rather Germany and France.

Reprinted as: "Austria and the Rise of Scientific Philosophy", in A. Chrudzimski and W. Huemer (eds.), *Phenomenology and Analysis. Essays on Central European Philosophy*, Frankfurt and Lancaster: ontos / de Gruyter, 2004, 33–56.

French version as: "L'Autriche et la naissance de la philosophie scientifique", *Actes de la Recherche en Sciences Sociales* (Paris), 109 (1995), 61–71.

43. Barry Smith, "Foreword" to Wojciech Zelaniec, *The Recalcitrant Synthetic A Priori*, Lublin: Artom, 1996, 7–8.

44. Barry Smith and Leonardo Zaibert, "Prolegomena to a Metaphysics of Real Estate", in Roberto Casati (ed.), *Shadows and Socio-Economic Units. Foundations of Formal Geography,* Department of Geoinformation, Technical University of Vienna, 1996, 151–155.

Abstract: As an object in which property rights can be invested, land is a peculiar hybrid structure that comprehends both spatial and non-spatial aspects. Even in its purely spatial aspect land is treated differently from culture to culture, thus for example in the degree to which property rights in land are held to relate to vague or precisely delineated parcels and to portions of space above and below the surface of the earth. When we examine the non-spatial aspects of landed property, however, the dimensions of variability across cultures are multiplied tremendously. The goal is to provide a general framework for comparison of different socio-legal ontologies of land. The relevance of this project turns on the fact that without land (or real estate) it is difficult (perhaps impossible) to obtain credit; without credit it is difficult for nations to develop. Thus, if land is treated in a radically different way from one nation to another, this will surely exert an effect upon the development of nations.

45. Barry Smith, "Pleasure and Its Modifications: Stephan Witasek and the Aesthetics of the Grazer Schule", in L. Albertazzi (ed.), *The Philosophy of Alexius Meinong* (*Axiomathes VII,* nos. 1–2), 1996, 203–232.

Abstract: The most obvious varieties of mental phenomena directed to non-existent objects occur in our experiences of works of art. The task of applying the Meinongian ontology of the non-existent to the working out of a theory of aesthetic phenomena was however carried out not by Meinong by his disciple Stephan Witasek in his *Grundzüge der allgemeinen Ästhetik of* 1904. Witasek shows in detail how our feelings undergo certain sorts of structural modifications when they are directed towards what does not exist. He draws a distinction between genuine mental phenomena and what he calls 'phantasy-material', asserting that 'the job of the aesthetic object, whether it is a work of art or a product of nature, is to excite and support the actualisation of phantasy-material in the experiencing subject'. We might think of such phantasy-material as a matter of *Ersatz*-emotions or emotional 'slop'. We could then see Witasek's aesthetics as an elaborate taxonomy of the various different sorts of ersatz-emotions which the subject allows to be stimulated within himself in his intercourse with works of art, and see works of art themselves as machines for the production of ever more subtle varieties of such phantasy-material in the perceiving subject.

46. Barry Smith, "The Connectionist Mind: A Study of Hayekian Psychology", in S. F. Frowen (ed.), *Hayek: Economist and Social Philosopher: A Critical Retrospect*, London: Macmillan, 1997, 9–29.

Abstract: In his *The Sensory Order* of 1952 Hayek develops a connectionist view of the mind that is similar to the view developed by Donald Hebb in 1949. The paper presents the details of Hayek's theory in the light of subsequent developments in connectionist psychology. It expands on Hayek's comparison between the mind and the price system of the market order, and it concludes with a series of criticisms of Hayek's views in particular and of connectionism in general, focusing on the issues of active, deliberate thinking, on mental causality, and on the stability of human cognitive categories.

Reprinted in: *Cognitive Economics*, M. Egidi and S. Rizzello (eds.), Cheltenham: Edward Elgar Publishing, 2004, 148-168.

French translation as: "L'esprit connexionniste: une étude de la psychologie de Hayek", *Intellectica,* 28: 1, 1999, 93–115.

47. Jean Petitot and Barry Smith, "Physics and the Phenomenal World", in R. Poli and P. M. Simons (eds.), *Formal Ontology*, Dordrecht/Boston/Lancaster: Kluwer, 1997, 233–254.

Abstract: The paper challenges the assumption, common amongst philosophers, that the reality described in the fundamental theories of microphysics is all the reality we have. It will be argued that this assumption is in fact incompatible with the nature of such theories. It will be shown further that the macro-world of three-dimensional bodies and of such qualitative structures as colour and sound can be treated scientifically on its own terms, which is to say not only from the perspective of psychology but also ontologically. A new sort of emergentist position will be defended, one which yields the basis of a method for describing the perceptually salient macroscopic world in mathematical terms. Broadly, it will be argued that the macroscopic world exists in virtue of certain specific sorts of boundary-patterns in the field of what is captured by the theories of microphysics.

Russian translation in: *Ophyr*, n.d.

48. Barry Smith, "Boundaries: An Essay in Mereotopology", in L. H. Hahn (ed.), *The Philosophy of Roderick Chisholm* (Library of Living Philosophers), Chicago and LaSalle: Open Court, 1997, 534–561.

Abstract: How can two neighboring spheres be in contact, given that, between any two points of the continuum, an infinity of further points must be admitted? Chisholm proposed a solution to this paradox, which rests on a theory of the coincidence of boundaries drawn from the work of Franz Brentano. For Brentano, a boundary can never exist except in connection with other boundaries and except as belonging to a continuum of higher dimension. Taking Chisholm's formalizations of Brentano's ideas as its starting point, the present paper seeks to develop a general theory of topology based on mereology.

49. Barry Smith, "Truth and the Visual Field", in *Naturalizing Phenomenology. Issues in Contemporary Phenomenology and Cognitive Science,* edited by J. Petitot, F. J. Varela, B. Pachoud and J. M. Roy, Stanford: Stanford University Press, 1999, 317–329.

Abstract: The paper uses the tools of mereotopology (the theory of parts, wholes and boundaries) to work out the implications of certain analogies between the 'ecological psychology' of J. J Gibson and the phenomenology of Edmund Husserl. It presents an ontological theory of spatial boundaries and of spatially extended entities. By reference to examples from the geographical sphere it is shown that both boundaries and extended entities fall into two broad categories: those which exist independently of our cognitive acts (for example, the planet Earth, its exterior surface); and those which exist only in virtue of such acts (for example: the equator, the North Sea). The visual field, too, can be conceived as an example of an extended entity that is dependent in the sense at issue. The paper suggests extending this analogy by postulating entities which would stand to true judgments as the visual field stands to acts of visual perception. The judgment field is defined more precisely as that complex extended entity which comprehends all entities which are relevant to the truth of a given (true) judgment. The work of cognitive linguists such as Talmy and Langacker, when properly interpreted, can be shown to yield a detailed account of the structures of the judgment fields corresponding to sentences of different sorts. A new sort of correspondence-theoretic definition of truth for sentences of natural language can then be formulated on this basis.

Preprint in: Carola Eschenbach and Wolfgang Heydrich (eds.), *Parts and Wholes. Integrity and Granularity*, Hamburg: Graduiertenkolleg Kognitionswissenschaft, 1995, 109–118.

Italian translation as: "La verità e il campo visivo", *Paradigmi*, 17, 1999, 48–62.

French translation as : "La vérité et le champ visuel", in *Naturaliser la phénoménologie: Husserlianisme et science cognitive*, Paris: CNRS Editions, 2002, 411–426.

50. Artur Rojszczak and Barry Smith, "Urteilstheorien und Sachverhalte", in Otto Neumaier (ed.), *Satz und Sachverhalt*, Sankt Augustin: Academia Verlag, 2000, 9–72.

51. "Zeno's Paradox for Colours", in Robert Dostal, Lester Embree, Joseph J. Kockelmans, J. N. Mohanty, and Olav K. Wiegand (eds.), *Phenomenology on Kant, German Idealism*, *Hermeneutics*, *and Logic*, Dordrecht: Kluwer (2000), 201–207.

52. Barry Smith, "Objects and Their Environments: From Aristotle to Ecological Psychology", in Andrew Frank, Jonathan Raper and Jean-Paul Cheylan (eds.), *The Life and Motion of Socio-Economic Units* (GISDATA 8), London: Taylor and Francis, 2001, 79–97.

Abstract: The essay is divided into four main parts: the first sketches basic dichotomy of substances (objects, things, persons), on the one hand, and accidents (events, qualities, actions) at the heart of Aristotelian ontology. The second outlines some of the subtypes falling under these two headings. The third concerns the Aristotelian ontology of what is extended in space, including in particular a sketch of Aristotle's theory of places. The fourth and final part then goes beyond Aristotle to give an account of the ontology of the environments which constitute the everyday world of human action.

German version as: "Gegenstände und ihre Umwelten: Von Aristoteles zur ökologischen Ontologie", in Barbara Boisits and Sonja Rinofner-Kreidl (eds.), *Einheit und Vielheit. Organologische Denkmodelle in der Moderne*, Vienna: Passagen Verlag, 2000, 35–64.

53. Barry Smith, "Aristoteles, Kant und die Quantenphysik", in Ruth Hagengruber (ed.), *Philosophie und Wissenschaft*, Würzburg: Königshausen und Neumann, 2002, 79–97.

54. Gerald J. Erion and Barry Smith, "In Defense of Truth: Skepticism, Morality, and *The Matrix*", in W. Irwin (ed.), *Philosophy and The Matrix*, La Salle and Chicago: Open Court, 2002, 16–27.

Portuguese translation as: "Ceticismo, moralidade e Matrix", in W. Irwin (ed.), *Matrix: Bem-Vindo ao Deserto do Real*, São Paulo: Madras, 2003, 62-79.

Italian translation as: "Scetticismo, moralità e Matrix", *Pillole rosse: Matrix e la filosofia,* Milan: Tascabili Bompiani, 22-35.

Abstract: *The Matrix* exposes us to the uncomfortable worries of philosophical skepticism in an especially compelling way. However, with a bit more reflection, we can see why we need not share the skeptic's doubts about the existence of the world. Such doubts are appropriate only in the very special context of the philosophical seminar. When we return to normal life we see immediately that they are groundless. Furthermore, we see also the drastic mistake that Cypher commits in turning his back upon reality and re-entering the matrix. Not only does reason compel us to admit the existence of the external world, it also requires us to face this world, to build for ourselves meaningful lives within it, and to engage, as adults, in the serious business of living.

55. Harold Henderson and Barry Smith. "Introduction: A New Definition of Liberal Education", *Liberal Education in a Knowledge Society,* Barry Smith (ed.), Chicago, Open Court Publishing, 2002, 1-9.

56. Barry Smith, *The Meaning of Life and the Measure of Civilizations* (Brochure 9 in the series The History of Liberalism in Europe), Paris: CREA/CREPHE, 2002, 22 pp.

> **Abstract:** In what respects is Western civilization superior or inferior to its rivals? In raising this question we are addressing a particularly strong form of the problem of relativism. For in order to compare civilizations one with another we would need to be in possession of a framework based on principles of evaluation which would be acceptable, in principle, to all human beings. Morality will surely provide one axis of such a framework (and we note in passing that believers in Islam might quite reasonably claim that their fellow-believers are characteristically more moral than are many in the West). Criteria such as material wellbeing, too, will need to play a role, as also will happiness or pleasure. Even happiness (pace some proponents of the utilitarian philosophy) comes in different types, and to count in the civilization stakes the happiness involved would presumably need to be of the right kind. We propose a specification for what this 'right kind' of happiness might be.
>
> French translation as"La signification de la vie, et comment il convient d'évaluer les civilisations", in *Histoire du Libéralisme en Europe*, Philippe Nemo and Jean Petitot (eds.), Paris: Presses Universitaires de France, 2006, 1399–1411.
>
> Italian translation as "Il significato della vita: come valurare una civiltà" in P. Nemo and J. Petitot (eds.), *Storia del liberalismo in Europa*, Soveria Mannelli: Rubbettino, 2013, 1225–1234.

57. Artur Rojszczak and Barry Smith, "Theories of Judgment", in Thomas Baldwin (ed.), *The Cambridge History of Philosophy 1870-1945*, Cambridge: Cambridge University Press, 2003, 157–173.

> **Abstract:** The dominant theory of judgment in 1870 was one or other variety of combination theory: the act of judgment is an act of combining concepts or ideas in the mind of the judging subject. In the decades to follow a succession of alternative theories arose to address defects in the combination theory, starting with Bolzano's theory of propositions in themselves, Brentano's theory of judgment as affirmation or denial of existence, theories distinguishing judgment act from judgment content advanced by Brentano's students Twardowski, Husserl and Meinong, and finally, Adolf Reinach's addition of a linguistic dimension to the Brentano-Husserlian theory of judgment – an account of judgments as ways of doing things with words in what Reinach called 'social acts'.

58. Barry Smith, "John Searle: From Speech Acts to Social Reality", in Barry Smith (ed.), *John Searle*, Cambridge: Cambridge University Press, 2003, 1–33.

> **Abstract:** We provide an overview of Searle's contributions to speech act theory and the ontology of social reality, focusing on his theory of constitutive rules. In early versions of this theory, Searle proposed that all such rules have the form 'X counts as Y in context C' formula – as for example when Barack Obama (X) counts as President of the United States (Y) in the context of US political affairs. Crucially, the X and the Y terms are here identical. A problem arises for this theory for cases involving 'free-standing Y terms', as for example in the case of money in a computerized bank account. Here there is no physical X to which a status function might be attached. We conclude by arguing that Searle's response to this problem creates difficulties for his naturalistic framework.
>
> Polish translation as: "John Searle: Od aktów mowy do rzeczywistości społecznej", *Roczniki Filozoficzne*, 51: 1, 2003, 265–292.
>
> Italian translation as: "Un'aporia nella costruzione della realtà sociale. Naturalismo e realismo in John R. Searle", in: Paolo Di Lucia (ed.), *Ontologia sociale: Potere deontico e regole costitutive*, Macerata: Quodlibet, 2003, 137-152. This translation appeared in a partial version also in *Il Sole-24 Ore*, Sunday, 7 December 2003, n. 335, p. 32.
>
> Russian translation

59. Barry Smith and Leo Zaibert, "Real Estate: Foundations of the Ontology of Property", in Heiner Stuckenschmidt, Erik Stubjkaer and Christoph Schlieder (eds.), *The Ontology and Modelling of Real Estate Transactions*, Aldershot: Ashgate, 2003, 51–67.

> **Abstract:** Suppose you own a garden-variety object such as a hat or a shirt. Your property right then follows the ageold saw according to which possession is nine-tenths of the law. That is, your possession of a shirt constitutes a strong presumption in favor of your ownership of the shirt. In the case of land, however, this is not the case. Here possession is not only not a strong presumption in favor of ownership; it is not even clear what possession is. Possessing a thing like a hat or a shirt is a rather straightforward affair: the person wearing the hat or shirt possesses the shirt or the hat. But what is possession in the case of land? This essay seeks to provide an answer to this question in the form of an ontology of landed property.

60. Barry Smith, "Aristoteles 2002", in T. Buchheim, H. Flashar and R. A. H. King (eds.), *Kann man heute noch etwas anfangen mit Aristoteles?*, Hamburg: Meiner, 2003, 3–38.

> **Abstract:** The essay surveys recent developments in ontology and defends a strategy for improvement of ontologies based on ontological realism. As a thought experiment, we consider central theses of Aristotelian metaphysics, and show how they fall short of what we believe to be the requirements of ontology today. Above all, Aristotle provides us with no strategy for the reconciliation of common-sense realism and scientific realism where these diverge. We focus specifically on shortfalls in Aristotle's treatment of individual accidents, especially in regard to the category of place. We then show how Aristotle's metaphysics needs to be supplemented by a theory of holes, of fiat boundaries, of granularity, and of vagueness.

61. Thomas Bittner and Barry Smith, "A Theory of Granular Partitions", *Foundations of Geographic Information Science*, Matthew Duckham, Michael F. Goodchild and Michael F. Worboys (eds.), London: Taylor & Francis, 2003, 117–151.

> **Abstract:** We have a variety of different ways of dividing up, classifying, mapping, sorting and listing the objects in reality. The theory of granular partitions presented here seeks to provide a general and unified basis for understanding such phenomena in formal terms that is more realistic than existing alternatives. Our theory has two orthogonal parts: the first is a theory of classification; it provides an account of partitions as cells and subcells; the second is a theory of reference or intentionality; it provides an account of how cells and subcells relate to objects in reality. We define a notion of well-formedness for partitions, and we give an account of what it means for a partition to project onto objects in reality. We continue by classifying partitions along three axes: (a) in terms of the degree of correspondence between partition cells and objects in reality; (b) in terms of the degree to which a partition represents the mereological structure of the domain it is projected onto; and (c) in terms of the degree of completeness with which a partition represents this domain.
>
> Revised version in K. Munn and B. Smith (eds.), *Applied Ontology: An Introduction*, Frankfurt/Lancaster: ontos, 2008, 125–158.
>
> Revised German version as "Granulare Partitionen", in L. Jansen and B. Smith (eds.), *Biomedizinische Ontologie. Philosophie – Lebenswissenschaften – Informationstechnik* (UTB Forum), Zurich: vdf, 2008, 67–84.

62. Barry Smith, "The Ecological Approach to Information Processing", in Kristóf Nyíri (ed.), *Mobile Learning: Essays on Philosophy, Psychology and Education*, Vienna: Passagen Verlag, 2003, 17–24.

> **Abstract:** Imagine a 5-stone weakling whose brain has been loaded with all the knowledge of a champion tennis player. He goes to serve in his first match – Wham! – His arm falls off. The 5-stone weakling just doesn't have the bone structure or muscular development to serve that hard. There are, clearly, different types of knowledge/ability/skill, only some of which are a matter of what can be transferred simply by passing signals down a wire from one brain (or computer) to another. Sometimes it is the body (the hardware) which knows.

Hungarian translation: "Az adatfeldolgozás ökológiai megközelítése", *Proceedings of the Conference on Philosophy, Psychology, Culture*, held in the Hungarian Academy of Sciences, Budapest, 29-30 November 2002.

63. Barry Smith, "Ontology", in Luciano Floridi (ed.), *Blackwell Guide to the Philosophy of Computing and Information*, Oxford: Blackwell, 2003, 155–166.

Abstract: Ontology as a branch of philosophy is the science of what is, of the kinds and structures of objects, properties, events, processes and relations in every area of reality. 'Ontology' in this sense is often used by philosophers as a synonym of 'metaphysics' (a label meaning literally: 'what comes after the Physics'), a term used by early students of Aristotle to refer to what Aristotle himself called 'first philosophy'. But in recent years, in a development hardly noticed by philosophers, the term 'ontology' has gained currency in the field of computer and information science, and in information-driven research in bioinformatics and related areas. We examine these new developments in applied ontology, and show what lessons they might have for both philosophers and information scientists.

Reprinted in Guillermo Hurtado and Oscar Nudler (eds.), *The Furniture of the World. Essays in Ontology and Metaphysics* (Rodopi Studies in Philosophy, vol. 9), Amsterdam: Rodopi, 2012, 47–68.

Spanish translation as: "Ontología" in G. Hurtado and O. Nudler (eds.), *El mobiliario del mundo. Ensayos de ontología y metafísica*, Mexico: Universidad Autónoma de México, 2007, 47–71.

Italian translation as: "Ontologia e sistemi informativi" in: *Networks*, 6, 2006, 137–164.

64. Barry Smith, "Kraus on Weininger, Kraus on Women, Kraus on Serbia" in Wolfgang Huemer and Marc-Oliver Schuster (eds.): *Writing the Austrian Traditions: Relations Between Philosophy and Literature*, Edmonton: University of Alberta Press and Frankfurt/Lancaster: Ontos, 2003, 81–100.

Abstract: Otto Weininger's *Sex and Character* interprets Kant's categorical imperative in a way which takes it to imply that all human relations, including human sexual relations, are immoral; it is thus in a certain sense impossible to lead a moral life on this earth. We discuss Weininger's ideas on man, woman, value and intellect, and describe their influence among the Central European intellectuals of his day, including Wittgenstein, and also including Karl Kraus.

65. Barry Smith, "Kamikaze – und der Westen", in Geog Meggle (ed.), *Terror und der Krieg gegen ihn: Öffentliche Reflexionen*, Paderborn: Mentis, 2003, 107–118.

Abstract: Against the background of a taxonomy of types of suicide advanced by Durkheim we propose an analysis of the phenomenon of terrorist suicide attacks. We argue that suicide of this sort is a specifically non-Western phenomenon. The significant difference between the strategy of Western terrorist groups and those terrorist groups engaged in suicide attacks is rooted in a peculiar feature of the history and character of the West extending back to the Middle Ages.

Vor dem Hintergrund einer von Durkheim ausgehenden Selbstmordarten-Typologie wird das Phänomen von terroristischen Selbstmordattentaten untersucht: Diese scheinen ein spezifisch nicht-westliches Phänomen zu sein. Der deutliche Unterschied zwischen der Strategie westlicher Terrorgruppen und solchen Terrorgruppen, die Selbstmordattentate ausüben, geht auf ein besonderes Merkmal der Geschichte und der Eigenart des Westens zurück; und dies wiederum ist tief im Mittelalter verwurzelt.

66. Artur Rojszczak and Barry Smith, "Truthmakers, Truthbearers and the Objectivity of Truth", in J. Hintikka, *et al*. (eds.), *Philosophy and Logic: In Search of the Polish Tradition*, Dordrecht/Boston/Lancaster: Kluwer, 2003, 229–268.

Abstract: The aim of this paper is to show that the account of objective truth taken for granted by logicians at least since the publication in 1933 of Tarski's "The Concept of Truth in Formalized Languages" arose out of a tradition of philosophical thinking initiated by Bolzano and Brentano. The paper shows more specifically that certain investigations of states of affairs and other objectual correlates of judging acts, investigations carried out by Austrian and Polish philosophers around the turn of the century, formed part of the background of views that led to standard current accounts of the objectivity of truth. It thus lends support to speculations on the role of Brentano and his heirs in contemporary logical philosophy advanced by Jan Woleński in his masterpiece of 1989 on the Logic and philosophy in the Lvov-Warsaw School of 1989.

67. Arkadiusz Chrudzimski and Barry Smith, "Brentano's Ontology: From Conceptualism to Realism", in Dale Jacquette (ed.), *The Cambridge Companion to Brentano*, Cambridge: Cambridge University Press, 2004, 175–194.

Abstract: It is often claimed that the beginnings of Brentano's ontology were Aristotelian in nature; but this claim is only partially true. Certainly the young Brentano adopted many elements of Aristotle's metaphysics, and he was deeply influenced by the Aristotelian way of doing philosophy. But he always interpreted Aristotle's ideas in his own fashion. He accepted them selectively, and he used them in the service of ends that would not have been welcomed by Aristotle himself. The present paper is an exposition of the development of Brentano's ontology, beginning with the Lectures on Metaphysics first delivered by Brentano in Würzburg in 1867 and concluding with his late work from 1904–1917.

Reprinted in *Brentano* (Major Works series), Cambridge University Press and Routledge, in press.

68. Carolyn Korsmeyer and Barry Smith, "Visceral Values: Aurel Kolnai on Disgust," in Aurel Kolnai, *On Disgust,* Chicago and La Salle: Open Court Publishing Company, 2004, 1–23.

Abstract: In 1929 when Aurel Kolnai published his essay "On Disgust" in Husserl's *Jahrbuch* he could truly assert that disgust was a "sorely neglected" topic. Now, however, this situation is changing as philosophers, psychologists, and historians of culture are turning their attention not only to emotions in general but more specifically to the large and disturbing set of aversive emotions, including disgust. We here provide an account of Kolnai's contribution to the study of the phenomenon of disgust, of his general theory of emotions and of the phenomenological methodology he employed in his work.

69. Barry Smith, "Carving Up Reality", in M. Gorman and J. Sanford (eds.), *Categories: Historical and Systematic Essays*, Washington: Catholic University of America Press, 2004, 225–237.

Abstract: If Mont Blanc is a vague object, then its vagueness will depend on the context in which reference is made. In a geological context the mountain might include only rock, perhaps together with a certain amount of air in the crevices and tunnels which have been formed beneath its surface. In a context of soil chemistry we might include also a surrounding thin layer of organic matter. In a skiing context we might include some snow. This essay sketches in informal terms the theory of granular partitions, which is designed to do justice to this context-dependence of vagueness by means of what might be described as a contextualized supervaluationism. Granularity and vagueness, it is argued, are two sides of a single coin: what is vague at one level of granularity may appear crisp at another. The resultant theory can be shown to resolve certain problems in our description of perceptual content, for example when John says that he sees the wall, but that he does not see the molecules by which the wall is constituted.

Spanish translation as "Tallando la realidad", in Juan González (ed.), *Perspectivas contemporáneas sobre la cognición: percepción, categorización y conceptualización*, Madrid: Siglo XXI Editores, 2006, 53-68.

70. David M. Mark and Barry Smith, "A Science of Topography: From Qualitative Ontology to Digital Representations", in Michael P. Bishop and John F. Shroder (eds.),

Geographic Information Science and Mountain Geomorphology, Chichester, England: Springer-Praxis, 2004, 75–100.

> **Abstract:** The shape of the Earth's surface, its topography, is a fundamental dimension of the environment, shaping or mediating many other environmental flows or functions. But there is a major divergence in the way that topography is conceptualized in different domains. Topographic cartographers, information scientists, geomorphologists and environmental modelers typically conceptualize topographic variability as a continuous field of elevations or as some discrete approximation to such a field. Pilots, explorers, anthropologists, ecologists, hikers and archeologists, on the other hand, typically conceptualize this same variability in terms of hills and valleys, mountains and plains, barrows and trenches, that is, as (special sorts of) objects, with locations, shapes, and often names of their own. In this chapter, we sketch an approach to bridging this fundamental gap in geographic information infrastructure.

71. David Mark, Barry Smith, Max Egenhofer, Stephen Hirtle, "UCGIS Emerging Research Themes: Ontological Foundations for Geographic Information Science", in: R. B. McMaster and E. L. Usery (eds.), *A Research Agenda for Geographic Information Science*, Boca Raton, Florida: CRC Press, 2004, 335–350.

> **Abstract:** We propose as a UCGIS research priority the topic of "Ontological Foundations for Geographic Information." Under this umbrella we unify several interrelated research subfields, each of which deals with different perspectives on geospatial ontologies and their roles in geographic information science. While each of these subfields could be addressed separately, we believe it is important to address ontological research in a unitary, systematic fashion, embracing conceptual issues concerning what would be required to establish an exhaustive ontology of the geospatial domain, issues relating to the choice of appropriate methods for formalizing ontologies, and considerations regarding the design of ontology-driven information systems. This integrated approach is necessary, because there is a strong dependency between the methods used to specify an ontology, and the conceptual richness, robustness and tractability of the ontology itself. Likewise, information system implementations are needed as testbeds of the usefulness of every aspect of an exhaustive ontology of the geospatial domain. None of the current UCGIS research priorities provides such an integrative perspective, and therefore the topic of "Ontological Foundations for Geographic Information Science" is unique.

72. Barry Smith, "Why Polish Philosophy Does Not Exist", J. J. Jadacki and J. Pasniczek (eds.), *The Lvov-Warsaw School: The New Generation* (Poznan Studies in the Philosophy of the Sciences and the Humanities, vol. 89), 2006, 19–39.

> **Abstract:** Why have Polish philosophers fared so badly as concerns their admission into the pantheon of Continental Philosophers? Why, for example, should Heidegger and Derrida be included in this pantheon, but not Ingarden or Tarski? Why, to put the question from another side, should there be so close an association in Poland between philosophy and logic, and between philosophy and science? We distinguish a series of answers to this question, which are dealt with under the following headings: (a) the role of socialism; (b) the disciplinary association between philosophy and mathematics; (c) the influence of Austrian philosophy in general and of Brentanian philosophy in particular; (d) the serendipitous role of Twardowski; (e) the role of Catholicism. The conclusion of the paper is that there is no such thing as 'Polish philosophy' because philosophy in Poland is philosophy *per se*; it is part and parcel of the mainstream of world philosophy, simply because, in contrast to French or German philosophy, it meets international standards of training, rigour, professionalism and specialization.

Polish translation: "Dlaczego nie istnieje filozofia polska?", *Filozofia Nauki*, 5 (1997), 5–15.

73. Barry Smith and Wolfgang Grassl, "On Creativity and the Philosophy of the Supranational State", in Tamás Demeter (ed.), *Essays on Wittgenstein and Austrian Philosophy: In Honour of J. C. Nyíri*, Amsterdam/New York: Rodopi, 2004, 25–39.

> **Abstract:** Building on the writings of Wittgenstein on rule-following and deviance, Kristóf Nyíri advanced a theory of creativity as consisting in a fusion of conflicting rules or disciplines. Only such fusion can produce something that is both intrinsically new and yet capable of being

apprehended by and passed on to a wider community. Creativity, on this view, involves not the breaking of rules, or the deliberate cultivation of deviant social habits, but rather the acceptance of enriched systems of rules, the adherence to which presupposes simultaneous immersion in disciplines hitherto seen as being unrelated. The paper presents a demonstration of the fruitfulness of this theory by means of an account of some of the political, cultural and intellectual peculiarities of the Habsburg Monarchy.

74. Barry Smith and David Mark, "Geographical Categories: An Ontological Retrospective", in Peter Fisher (ed.), *Classics from the International Journal of Geographical Information Science*, London: Taylor and Francis, 2006, 507–512.

75. Leo Obrst, Werner Ceusters, Inderjeet Mani, Steve Ray, Barry Smith, "The Evaluation of Ontologies: Toward Improved Semantic Interoperability", in C. Baker and K.-H. Cheung, ed., *Semantic Web: Revolutionizing Knowledge Discovery in the Life Sciences*, New York: Springer Verlag, 2007, 139–158.

Abstract: Recent years have seen rapid progress in the development of ontologies as semantic models intended to capture and represent aspects of the real world. There is, however, great variation in the quality of ontologies. If ontologies are to become progressively better in the future, more rigorously developed, and more appropriately compared, then a systematic discipline of ontology evaluation must be created to ensure quality of content and methodology. Systematic methods for ontology evaluation will take into account representation of individual ontologies, performance (in terms of accuracy, domain coverage and the efficiency and quality of automated reasoning using the ontologies) on tasks for which the ontology is designed and used, degree of alignment with other ontologies and their compatibility with automated reasoning. A sound and systematic approach to ontology evaluation is required to transform ontology engineering into a true scientific and engineering discipline. This chapter discusses issues and problems in ontology evaluation, describes some current strategies, and suggests some approaches that might be useful in the future.

76. Barry Smith and Jonathan Simon, "Truthmaker Explanations", in: Jean-Maurice Monnoyer, *Metaphysics and Truthmakers*, Frankfurt/Lancaster/New Brunswik: Ontos, 2007, 79-98.

Abstract: This paper is a fresh attempt to articulate the role of a theory of truthmakers. We argue that truthmaker theory constitutes a cornerstone of good methodology in metaphysics, but that a conflation of truthmaker theory with the theory of truth has been responsible for certain excesses associated with truthmaker-based approaches in the recent literature. If truthmaker theory is not a component of a theory of truth, then truthmaker maximalism – the view that every truth has a truthmaker – loses its primary motivation. More generally, if the task of truthmaker theory is not to provide a definition or account of truth in truthmaker terms, there is no pressing need for hard, a priori principles stating which truths have truthmakers and which do not.

French translation: "Explications vérifactionnistes" in *Philosophiques,* 38 (1), 2011, 277–194.

Résumé: Le présent article est une tentative nouvelle d'articuler le rôle d'une théorie des vérifacteurs. Nous soutenons que la théorie de la vérifaction constitue une pierre angulaire dans une bonne méthodologie en métaphysique, mais que l'amalgame entre la théorie de la vérifaction et la théorie de la vérité a été responsable de certains excès associés aux approches vérifactionnistes dans la littérature récente. Nous montrons que la théorie de la vérifaction conserve son attrait comme instrument d'investigation métaphysique, et ce, malgré notre accord avec les doctrines défl ationnistes telles que celles défendues par Ayer, Quine, Field et Horwich (ou, du moins, malgré notre neutralité à leur égard). Nous soutenons en outre que les intuitions sous-jacentes à la théorie de la vérifaction s'éclairent quand nous les dissocions d'une théorie de la vérité et, par-dessus tout, de la tentative de fournir une défi nition de la vérité.

77. Leo Zaibert and Barry Smith, "The Varieties of Normativity: An Essay on Social Ontology", in Savas L. Tsohatzidis (ed.), *Intentional Acts and Institutional Facts: Essays on John Searle's Social Ontology*, Dordrecht: Springer, 2007, 155–174.

Abstract: For much of the first fifty years of its existence, analytic philosophy shunned discussions of normativity and ethics. Ethical statements were considered as pseudo-propositions, or as expressions of pro- or con-attitudes of minor theoretical significance. Nowadays, in contrast, prominent analytic philosophers pay close attention to normative problems. Here we focus our attention on the work of Searle, at the same time drawing out an important connection between Searle's work and that of two other seminal figures in this development: H.L.A. Hart and John Rawls. We show that all three thinkers tend to assume that there is but one type of normativity within the realm of social institutions – roughly, the sort of normativity that is involved in following the results of chess – and that they thereby neglect features that are of crucial significance for an adequate understanding of social reality.

78. Barry Smith and Werner Ceusters, "Ontology as the Core Discipline of Biomedical Informatics: Legacies of the Past and Recommendations for the Future Direction of Research", in *Computing, Information, Cognition*, Gordana Dodig Crnkovic and Susan Stuart (eds.), Newcastle: Cambridge Scholars Press, 2007, 104–122.

Abstract: The automatic integration of rapidly expanding information resources in the life sciences is one of the most challenging goals facing biomedical research today. Controlled vocabularies, terminologies, and coding systems play an important role in realizing this goal, by making it possible to draw together information from heterogeneous sources – for example pertaining to genes and proteins, drugs and diseases – secure in the knowledge that the same terms will also represent the same entities on all occasions of use. In the naming of genes, proteins, and other molecular structures, considerable efforts are under way to reduce the effects of the different naming conventions which have been spawned by different groups of researchers. Electronic patient records, too, increasingly involve the use of standardized terminologies, and tremendous efforts are currently being devoted to the creation of terminology resources that can meet the needs of a future era of personalized medicine, in which genomic and clinical data can be aligned in such a way that the corresponding information systems become interoperable.

79. Werner Ceusters and Barry Smith, "Referent Tracking for Corporate Memories", in P. Rittgen (ed.), *Handbook of Ontologies for Business Interaction*, Hershey, New York and London: Information Science Reference, 2007, 34–46.

Abstract: For corporate memory and enterprise ontology systems to be maximally useful, they must be freed from certain barriers placed around them by traditional knowledge management paradigms. This means, above all, that they must mirror more faithfully those portions of reality which are salient to the workings of the enterprise, including the changes that occur with the passage of time. The purpose of this chapter is to demonstrate how theories based on philosophical realism can contribute to this objective. We discuss how realism-based ontologies (capturing what is generic) combined with referent tracking (capturing what is specific) can play a key role in building the robust and useful corporate memories of the future.

80. Barry Smith and Bert R. E. Klagges, "Ontologie des menschlichen Lebewesens: Substanz und Funktion", in L. Honnefelder, M. C. Schmidt (eds.), *Naturalismus als Paradigma – Wie weit reicht die naturwissenschaftliche Erklärung des Menschen?*, Berlin: Berlin University Press, 2007, 61-75.

81. Barry Smith and Berit Brogaard, "Ontologie des Embryos: Wann beginnt menschliches Leben?", in L. Honnefelder, M. C. Schmidt (eds.), *Naturalismus als Paradigma - Wie weit reicht die naturwissenschaftliche Erklärung des Menschen?*, Berlin: Berlin University Press, 2007, 196-204.

Abstract: Der Abschluß der Gastrulation, der gleichzeitig auch den Anfang der Neurulation bedeutet, ist die zeitliche Grenze, die Beginn eines menschlichen Individuums markiert. Oft wird behauptet, daß jegliche natürliche Veränderung stetig ist. Wie ist es dann aber möglich, eine zeitliche Grenze auszuzeichnen, an der ein menschliches Lebewesen zu existieren beginnt? Man beachte, was geschieht, wenn wir vom Thema zeitlicher Unstetigkeit zum räumlichen übergehen. Lebewesen haben räumliche Grenzen (wie sie durch ihre Haut geformt wird). Die letzteren sind genuine Diskontinuitäten, auch angesichts der Kontinuität der Materie in der physikalischen Welt. Und ebenso müssen wir schließen: Das Leben menschlicher Lebewesen hat zeitliche Grenzen -

seinen Beginn und sein Ende - die auch angesichts der Kontinuität physikalischer, chemischer und biologischer Prozesse, in die sie involviert sind, echte Diskontinuitäten sind.

82. Pierre Grenon and Barry Smith, "Persistence and Ontological Pluralism", in C. Kanzian (ed.), *Persistence*, Frankfurt/Lancaster: ontos, 2008, 33-48.

Abstract: We aim to provide the ontological grounds for an adequate account of persistence. We defend a perspectivalist, or moderate pluralist, position, according to which some aspects of reality can be accounted for in ontological terms only via partial and mutually complementary ontologies, each one of which captures some relevant aspect of reality. Our thesis here is that this is precisely the sort of ontological account that is needed for the understanding of persistence, specifically an account involving two independent ontologies, one for continuants, and one for occurrents.

83. Fabian Neuhaus and Barry Smith, "Modelling Principles and Methodologies: Relations in Anatomical Ontologies", in: Albert Burger, Duncan Davidson and Richard Baldock (eds.), *Anatomy Ontologies for Bioinformatics: Principles and Practice*, New York: Springer, 2008, 289-305.

Abstract: It is now increasingly accepted that many existing biological and medical ontologies can be improved by adopting tools and methods that bring a greater degree of logical and ontological rigor. In this chapter we will focus on the merits of a logically sound approach to ontologies from a methodological point of view. As we shall see, one crucial feature of a logically sound approach is that we have clear and functional definitions of the relational expressions such as 'is a' and 'part of'.

84. Melissa A. Haendel, Fabian Neuhaus, David Osumi-Sutherland, Paula M. Mabee, José L. V. Mejino Jr., Chris J. Mungall, Barry Smith, "CARO: The Common Anatomy Reference Ontology", in: Albert Burger, Duncan Davidson and Richard Baldock (eds.), *Anatomy Ontologies for Bioinformatics: Principles and Practice*, New York: Springer, 2008, 327-349.

Abstract: The Common Anatomy Reference Ontology (CARO) is being developed to facilitate interoperability between existing anatomy ontologies for different species, and will provide a template for building new anatomy ontologies. CARO has a structural axis of classification based on the top-level nodes of the Foundational Model of Anatomy. CARO will complement the developmental process sub-ontology of the GO Biological Process ontology, using it to ensure the coherent treatment of developmental stages, and to provide a common framework for the model organism communities to classify developmental structures. Definitions for the types and relationships are being generated by a consortium of investigators from diverse backgrounds to ensure applicability to all organisms. CARO will support the coordination of cross-species ontologies at all levels of anatomical granularity by cross-referencing types within the cell type ontology (CL) and the Gene Ontology (GO) Cellular Component ontology. A complete cross-species CARO could be utilized in other ontologies for cross-product generation.

85. Barry Smith, "Searle and de Soto: The New Ontology of the Social World", Barry Smith, David Mark and Isaac Ehrlich (eds.), *The Mystery of Capital and the Construction of Social Reality*, Chicago: Open Court, 2008, 35-51.

Abstract: Consider a game of blind chess between two chess masters that is recorded in some standard chess notation. The recording is a representation of the game. But what is the game itself? This question is, we believe, central to the entire domain of social ontology. We argue that the recorded game is a special sort of quasi-abstract pattern, something that is: (i) like abstract entities such as numbers or forms, in that it is both nonphysical and nonpsychological; but at the same time, (ii) through its association with specific players and a specific occasion, tied to time and history. We discover other abstract patterns of this sort especially in the domains of law and commerce. This essay draws on the work in social ontology, and specifically on the attempts of Hernando de Soto and of John Searle to develop an ontology of the social world based on an analysis of the peculiar interdependence between quasi-abstract patterns and their representations in documents of different sorts.

Preliminary version as "The Foundations of Social Coordination: John Searle and Hernando de Soto", in N. Psarros (ed.), *Facets of Sociality*, Frankfurt: Ontos, 2007, 3-22.

86. Barry Smith and Mathias Brochhausen, "Establishing and Harmonizing Ontologies in an Interdisciplinary Health Care and Clinical Research Environment", in: B. Blobel P. Pharow and M. Nerlich (eds.), *eHealth: Combining Health Telematics, Telemedicine, Biomedical Engineering and Bioinformatics on the Edg*e (Global Expert Summit Textbook, Studies in Health, Technology and Informatics, 134), IOS Press, Amsterdam, 2008, 219-234.

Abstract: Ontologies are being ever more commonly used in biomedical informatics and we provide a survey of some of these uses, and of the relations between ontologies and other terminology resources. In order for ontologies to become truly useful, two objectives must be met. First, ways must be found for the transparent evaluation of ontologies. Second, existing ontologies need to be harmonised. We argue that one key foundation for both ontology evaluation and harmonisation is the adoption of a realist paradigm in ontology development. For science-based ontologies of the sort which concern us in the eHealth arena, it is reality that provides the common benchmark against which ontologies can be evaluated and aligned within larger frameworks. Given the current multitude of ontologies in the biomedical domain the need for harmonisation is becoming ever more urgent. We describe one example of such harmonisation within the ACGT project, which draws on ontology-based computing as a basis for sharing clinical and laboratory data on cancer research.

87. Mathias Brochhausen, Gabriele Weiler, Luis Martín, Cristian Cocos, Holger Stenzhorn, Norbert Graf, Martin Dörr, Manolis Tsiknakis, and Barry Smith, "Applications of the ACGT Master Ontology on Cancer", R. Meersman, Z. Tari, and P. Herrero (Eds.): *Proceedings of 4th International IFIP Workshop On Semantic Web and Web Semantics* (*OTM 2008: Workshops*), LNCS 5333, 2008, 1046–1055.

Abstract: We present applications of the ACGT Master Ontology (ACGT MO), which is a new terminology resource for a transnational network providing data exchange in oncology, emphasizing the integration of both clinical and molecular data. The development of a new ontology was necessary due to problems with existing biomedical ontologies in oncology. The ACGT MO is a test case for the application of best practices in ontology development. This paper provides an overview of the application of the ontology within the ACGT project thus far.

88. Barry Smith, "Informatica", in M. Ferraris (eds.), *Storia dell'Ontologia*, Milan: Bompiani, 2008, 503-530.

89. Barry Smith, "Realitätsrepräsentation: Das Ziel der Ontologie", in L. Jansen and B. Smith (eds.), *Biomedizinische Ontologie. Philosophie – Lebenswissenschaften - Informationstechnik* (UTB Forum), Zurich: vdf, 2008, 31-46.

90. Barry Smith "The Benefits of Realism: A Realist Logic with Applications", in K. Munn and B. Smith (eds.), *Applied Ontology: An Introduction*, Frankfurt/Lancaster: ontos/Walter de Gruyter, 2008, 109-124.

We propose a formalization of a realist ontology using first order logic with identity and allowing quantification over terms representing both individuals and universals. In addition to identity, the ontology includes also relational predicates such as subtype, instantiation, parthood, location, and inherence. Inspired in part by Davidson's treatment of events, the ontology includes also various relations linking events to their participants and to the times at which they occur. The approach allows a simulation of some of the features of second order logic within a classical first order framework.

91. Ulf Schwarz and Barry Smith, "Ontological Relations", in K. Munn and B. Smith (eds.), *Applied Ontology: An Introduction*, Frankfurt/Lancaster: ontos/Walter de Gruyter, 2008, 219-234.

German version "Ontologische Relationen", in L. Jansen and B. Smith (eds.), *Biomedizinische Ontologie. Philosophie – Lebenswissenschaften - Informations-technik* (UTB Forum), Zurich: vdf, 2008, 155-172.

In Kapitel 5 dieses Buches wurde mit dem ontologischen Sextett eine Klassifizierung der Realität vorgestellt, die das klassische Aristotelische Viereck erweitert, indem sie Einzeldinge und Universalien in insgesamt sechs Kategorien umfaßt. Zwischen den Entitäten dieser Kategorien sind bestimmte Beziehungen postuliert worden, wie zum Beispiel Inhärenz, Partizipation, Instantiierung, Exemplifizierung und Charakterisierung. In diesem Kapitel soil der Frage nachgegangen werden, wie eben diese Beziehungen zwischen den Entitäten dieser Kategorien genauer charakterisiert und die sie bezeichnenden relationalen Ausdrücke eindeutig formal definiert werden konnen.

92. Richard H. Scheuermann, Megan Kong, Carl Dahlke, Jennifer Cai, Jamie Lee, Yu Qian, Burke Squires, Patrick Dunn, Jeff Wiser, Herb Hagler, Barry Smith, David Karp, "Ontology-Based Knowledge Representation of Experiment Metadata in Biological Data Mining", *Biological Data Mining,* Jake Chen and Stefano Lonardi (eds.), Boca Raton: Chapman Hall / Taylor and Francis, September 2009, 529-559.

Abstract: According to the PubMed resource from the U.S. National Library of Medicine, over 750,000 scientific articles have been published in the ~5000 biomedical journals worldwide in the year 2007 alone. The vast majority of these publications include results from hypothesis-driven experimentation in overlapping biomedical research domains. Unfortunately, the sheer volume of information being generated by the biomedical research enterprise has made it virtually impossible for investigators to stay aware of the latest findings in their domain of interest, let alone to be able to assimilate and mine data from related investigations for purposes of meta-analysis. While computers have the potential for assisting investigators in the extraction, management and analysis of these data, information contained in the traditional journal publication is still largely unstructured, free-text descriptions of study design, experimental application and results interpretation, making it difficult for computers to gain access to the content of what is being conveyed without significant manual intervention. In order to circumvent these roadblocks and make the most of the output from the biomedical research enterprise, a variety of related standards in knowledge representation are being developed, proposed and adopted in the biomedical community. In this chapter, we will explore the current status of efforts to develop minimum information standards for the representation of a biomedical experiment, ontologies composed of shared vocabularies assembled into subsumption hierarchical structures, and extensible relational data models that link the information components together in a machine-readable and human-useable framework for data mining purposes.

93. Lindsay Grey Cowell and Barry Smith, "Infectious Disease Ontology", in Vitali Sintchenko (ed.), *Infectious Disease Informatics*, New York: Springer, December 2009, 373-395.

Abstract: Technological developments have resulted in tremendous increases in the volume and diversity of the data and information that must be processed in the course of biomedical and clinical research and practice. Researchers are at the same time under ever greater pressure to share data and to take steps to ensure that data resources are interoperable. The use of ontologies to annotate data has proven successful in supporting these goals and in providing new possibilities for the automated processing of data and information. In this chapter, we describe different types of vocabulary resources and emphasize those features of formal ontologies that make them most useful for computational applications. We describe current uses of ontologies and discuss future goals for ontology-based computing, focusing on its use in the field of infectious diseases. We review the largest and most widely used vocabulary resources relevant to the study of infectious diseases and conclude with a description of the Infectious Disease Ontology (IDO) suite of interoperable ontology modules that together cover the entire infectious disease domain.

94. Barry Smith, "Signs and Meanings", *Signs and Meanings: Five Questions*, Peer Bundgaard and Frederik Stjernfelt (eds.), Copenhagen: Automatic Press, September 2009, 199-206.

95. Barry Smith, "Metaphysics", *Metaphysics: Five Questions*, Asbjørn Steglich-Petersen (ed.), Copenhagen: Automatic Press, July 2010, 143-158.

> **Abstract:** An attempt to trace a unifying thread of ontological realism extending through: 1. my early writings on Frege, Brentano, Husserl, Wittgenstein, Ingarden and (with Kevin Mulligan and Peter Simons) truthmakers; 2. work on formal (especially mereotopological) theories of the common-sense world, on fiat objects, geographical categories, and environments (with David Mark, Roberto Casati and Achille Varzi); 3. work (with John Searle) on social ontology and (inspired by Hernando de Soto) on the theory of document acts; and 4. current work on applied ontology in biology and medicine, and on the ontology of document acts and of information artifacts.

96. Werner Ceusters and Barry Smith, "Switching Partners: Dancing with the Ontological Engineers", in Thomas Batcherer and Roderick Coover (eds.), *Switching Codes. Thinking through Digital Technology in the Humanities and the Arts*, Chicago and London: University of Chicago Press, 2011, 103-124.

> **Abstract:** Ontologies are today being applied in almost every field to support the alignment and retrieval of data of distributed provenance. Here we focus on new ontological work on dance and on related cultural phenomena belonging to what UNESCO calls the "intangible heritage." Currently data and information about dance, including video data, are stored in an uncontrolled variety of ad hoc ways. This serves not only to prevent retrieval, comparison and analysis of the data, but may also impinge on our ability to preserve the data that already exists. Here we explore recent technological developments that are designed to counteract such problems by allowing information to be retrieved across disciplinary, cultural, linguistic and technological boundaries. Software applications such as the ones envisaged here will enable speedier recovery of data and facilitate its analysis in ways that will assist both archiving of and research on dance.

97. Barry Smith, "Preface", in G. Sartor, et al. (Eds.), *Approaches to Legal Ontologies. Theories, Domains, Methodologies*, New York: Springer, 2011, p. 5.

98. Dipak Kalra, Mark Musen, Barry Smith, Werner Ceusters, Georges De Moor, "ARGOS Policy Brief on Semantic Interoperability", in: G. De Moor (ed.), *Transatlantic Cooperation Surrounding Health Related Information and Communication Technology* (Studies in Health Technology and Informatics 170), 2011, 1-15.

> **Abstract:** Semantic interoperability is one of the priority themes of the ARGOS Trans-Atlantic Observatory. This topic represents a globally recognised challenge that must be addressed if electronic health records are to be shared among heterogeneous systems, and the information in them exploited to the maximum benefit of patients, professionals, health services, research, and industry. Progress in this multi-faceted challenge has been piecemeal, and valuable lessons have been learned, and approaches discovered, in Europe and in the US that can be shared and combined. Semantic interoperability requires the use of standards, not only for EHR data to be transferred and structurally mapped into a receiving repository, but also for the clinical content of the EHR to be interpreted in conformity with the original meanings intended by its authors. Wide-scale engagement with professional bodies, globally, is needed to develop these clinical information standards. Accurate and complete clinical documentation, faithful to the patient's situation, and interoperability between systems, require widespread and dependable access to published and maintained collections of coherent and quality-assured semantic resources, including models such as archetypes and templates that would (1) provide clinical context, (2) be mapped to interoperability standards for EHR data, (3) be linked to well specified multi-lingual terminology value sets, and (4) be derived from high quality ontologies.

99. Barry Smith and Wojciech Żełaniec, "Laws of Essence or Constitutive Rules? Reinach vs. Searle on the Ontology of Social Entities", in *Eidetica del Diritto e Ontologia Sociale. Il Realismo di Adolf Reinach,* Francesca De Vecchi (ed.), Milan: Mimesis, 2012, 83-108.

> **Abstract:** Amongst the entities making up social reality, are there necessary relations whose necessity is not a mere reflection of the logical connections between corresponding concepts? We

distinguish three main groups of answers to this question, associated with Hume and Adolf Reinach at opposite extremes, and with Searle who occupies a position somewhere in the middle. We first set forth Reinach's views on what he calls 'material necessities' in the realm of social entities. We then attempt to show that Searle has not identified a sustainable position somewhere between the Humean and the Reinachian extremes. This is because Searle's position is threatened by circularity, and to steer clear of that danger it must incorporate at least some elements of Reinach's essentialism.

100. Barry Smith, Lowell Vizenor and Werner Ceusters, "Human Action in the Healthcare Domain: A Critical Analysis of HL7's Reference Information Model" in C. Svennerlind, J. Almäng, R. Ingthorsson (eds.), *Johanssonian Investigations. Essays in Honour of Ingvar Johansson on His Seventieth Birthday*, Berlin / New York: de Gruyter, 2013, 554-573.

Abstract: If we are to develop efficient, reliable and secure means for sharing information across healthcare systems and organizations, then a careful analysis of human actions will be needed. To address this need, the HL7 organization has proposed its Reference Information Model (RIM), which is designed to provide a comprehensive representation of the entire domain of healthcare centered around the phenomenon of human action. Taking the Basic Formal Ontology as our starting point, we examine the RIM from an ontological point of view, describing how it fails to provide a representation of the healthcare domain which would enjoy the sort of clarity, coherence, rigor and completeness that is claimed on its behalf.

101. Barry Smith, "Austrian and Hungarian Philosophy: On the Logic of Wittgenstein and Pauler", in Anne Reboul (ed.), *Mind, Values and Metaphysics. Philosophical Papers Dedicated to Kevin Mulligan*, Vol. 1, New York: Springer, 2014, 387-486.

Abstract: As Kevin Mulligan, more than anyone else, has demonstrated, there is a distinction within the philosophy of the German-speaking world between two principal currents: of idealism or transcendentalism, characteristic of Northern Germany, on the one hand; and of realism or objectivism, characteristic of Austria and the South, on the other. We explore some of the implications of this distinction with reference to the influence of Austrian (and German) philosophy on philosophical developments in Hungary, focusing on the work of Ákos von Pauler, and especially on Pauler's reading of Wittgenstein's *Tractatus*.

Hungarian translation as: "Osztrák és magyar filozófia: Wittgenstein és Pauler logikájáról", *Századvég*, 17 (65), 2012, 5-30.

102. Barry Smith, "Document Acts", in Anita Konzelmann Ziv and Hans Bernhard Schmid (eds.), *Institutions, Emotions, and Group Agents. Contributions to Social Ontology*, Dordrecht: Springer, 2014, 19-31.

Abstract: The theory of document acts is an extension of the more traditional theory of speech acts advanced by Reinach, Austin and Searle. It is designed to do justice to the ways in which documents can be used to bring about a variety of effects in virtue of the fact that, where speech is evanescent, documents are continuant entities. This means that documents can be preserved in such a way that they can be inspected and modified at successive points in time and grouped together into enduring document complexes. We outline some components of a theory of document acts, and show how it can throw light on certain problems in Searle's ontology of social reality.

Italian translation as: "Atti Documentali", in: *Verità, immagine, normatività*, edited by Pier Luigi Lecis, Giuseppe Lorini, Vinicio Busacchi, Pietro Salis, Olimpia G. Loddo, Macerata: Quodlibet, 2017, 369-390.

103. Barry Smith, "The Relevance of Philosophical Ontology to Information and Computer Science", *Philosophy, Computing and Information Science*, Ruth Hagengruber and Uwe Riss (eds.), London: Pickering and Chatto, 2014, 75-83.

Abstract: The discipline of ontology has enjoyed a checkered history since 1606, with a significant expansion in recent years. We focus here on those developments in the recent history

of philosophy which are most relevant to the understanding of the increased acceptance of ontology, and especially of realist ontology, as a valuable method also outside the discipline of philosophy.

104. Barry Smith, "Values in Contexts: An Ontological Theory", *Inherent and Instrumental Values. Excursions in Value Inquiry,* G. John M. Abbarno (ed.), Lanham, MD: University Press of America, 2015, 17-29.

Abstract: Values exist not in isolation, but in complex wholes. Values are what they are because of the complex wholes in which they are situated. To do justice to this thesis will require a holistic ontology, a theory according to which many types of entities exist only as inseparable parts or moments of wider contexts or environments. An ontological theory of environments – with roots in Gestalt psychology and the ecological psychology of J. J. Gibson and Roger Barker, and which is related also to the theory of motivation sketched by Edmund Husserl as part of his theory of the lifeworld or *Lebenswelt* – will help us to understand the ontology of values. It will help us also to understand what values are. It will not, however, tell us what is good or bad. From facts of ontology, no value propositions follow.

105. Barry Smith, "Towards a Science of Emerging Media", *Philosophy of Emerging Media: Understanding, Appreciation and Application*, edited by J. E. Katz and J. Floyd, Oxford: Oxford University Press, December 2015, 29-48.

Abstract: If media studies are to become established as a genuine science, then it needs to be determined what the subject matter of this science is to be. I propose a specification of this subject matter as consist In his Untimely Meditations on the Relations between Self and Non-Self, Bozzi considers two popular approaches to answering ing in: 1. the new sorts of digital entities that have been added to social reality through the invention of the digital computer, and 2. the new sorts of interactions involving human beings which such entities make possible. I support this proposal by examining examples of some of the ways in which the digital products of emerging media differ from entities of other sorts. I then draw consequences from this examination to demonstrate how these products mark out a new realm within the larger domain of social ontology.

106. Robert Kelly and Barry Smith, "Comments on Bozzi's Untimely meditations on the relation between self and non-self", *Paolo Bozzi's Experimental Phenomenology*, Ivana Bianchi and Richard Davies (eds.), London and New York: Routledge, 2019, 125-129.

Abstract: In his Untimely Meditations on the Relations between Self and Non-Self, Paolo Bozzi considers two popular approaches to answering the question of how it is possible, given the nature of our experience, that we can delimit what we take to be ourselves from what we take to be outside of ourselves. He considers two popular approaches to answering this question—one rooted in the discussion of personal identity in Hume's *Treatise on Human Nature*, the other rooted in the origins of constructivism in psychology. We show how Bozzi uses these two approaches to set the stage for his own account, which is at the same time realist and also rooted in experimental phenomenology and Gestalt theory. Bozzi's conclusions are, first, that against at least one reading of Hume there really is a self. And second—against the extreme constructivist position, —that the self can be distinguished ontologically from the objects of the external world.

107. Barry Smith, "Drawing Boundaries", in: T. Tambassi T. (ed.), *The Philosophy of GIS*, 2019, New York: Springer, 137-158.

Abstract: In "On Drawing Lines on a Map" (1995), I suggested that the different ways we have of drawing lines on maps open up a new perspective on ontology, resting on a distinction between two sorts of boundaries: *fiat* and *bona fide*. "Fiat" means, roughly: human-demarcation-induced. "Bona fide" means, again roughly: a boundary constituted by some real physical discontinuity. I presented a general typology of boundaries based on this opposition and showed how it generates a corresponding typology of the different sorts of objects which boundaries determine or demarcate. In this paper, I describe how the theory of fiat boundaries has evolved since 1995, how it has been applied in areas such as property law and political

geography, and how it is being used in contemporary work in formal and applied ontology, especially within the framework of Basic Formal Ontology.

108. Barry Smith, ″本体：广谱的知识集成工具″ (Ontology: Tool for Broad Spectrum Knowledge Integration), Foreword to 基于基本形式化本体的本体构建 (Chinese translation of Robert Arp, Barry Smith and Andrew Steele, *Building Ontologies with Basic Formal Ontology*), People's Medical Publishing House, October 2020), 4-8.

109. "Neural Chitchat", in: *The Sherry Turkle Miracle*, Papers from a Hungarian Academy of Sciences online workshop, Budapest, May 27, 2021, 39-43.

Abstract: A constant theme in Sherry Turkle's work is the idea that computers shape our social and psychological lives. This idea is of course in a sense trivial, as can be observed when walking down any city street and noting how many of the passers-by have their heads buried in screens. In *The Second Self*, however, Turkle makes a stronger claim to the effect that where people confront machines that seem to think this suggests a new way for us to think – about human thought, emotion, memory, and understanding and thereby affects the way we think and see ourselves as humans. I here attempt here to throw a sceptical light on claims of this sort by examining the Chinese chatbot "Xiǎoice", which is described by its authors as "the most popular social chatbot in the world".

110. Jobst Landgrebe and Barry Smith, "Unsterblichkeit 2.0", in: Ludger Jansen and Rebekka A. Klein (eds.), *Seele digital*? *Mind uploading, virtuelles Bewusstsein und christliche Auferstehungshoffnung*, Regensburg: Verlag Friedrich Pustet, August 2022, 69-83.

Das in diesem Aufsatz vorgebrachte Argumentationsmuster hat folgende Schritte:

1. Der menschliche Geist ist vom Körper nicht trennbar, sie bilden ein Kontinuum.
2. Unser Bewusstsein und alle darauf aufbauenden geistigen Phänomene sind die Emanation eines materiellen Prozesses, den ein komplexes System verursacht.
3. Komplexe Systeme lassen sich mathematisch nicht modellieren und nicht kausal verstehen.
4. Computer sind Turing-Maschinen. Sie können nur mathematische Modelle berechnen. Es wird niemals Hyper-Turing Maschinen geben, und wenn es sie gäbe, könnten sie auch nur mathematische Modelle berechnen.
5. Es ist nicht möglich, den Geist den Körper als Substrat des Geistes durch einen Computer zu ersetzen.

Die digitale Unsterblichkeit ist demzufolge ein Ding der Unmöglichkeit.

111. Jobst Landgrebe and Barry Smith, "Sam Harris and the Myth of Artificial Intelligence", in Sandra Woien, ed. *Sam Harris. Critical Responses*, Chicago, Open Universe, January 2023, 153-161.

Sam Harris is a contemporary illustration of the difficulties standing in the way of coherent interdisciplinary thinking in an age where science and the humanities have drifted so far apart. We are here with Harris's views on AI, and specifically with his view according to which, with the advance of AI, there will evolve a machine superintelligence with powers that far exceed those of the human mind. This he sees as something that is not merely possible, but rather a matter of inevitability. If, however, we look carefully at what intelligence is, and at how computers really work on the basis of mathematical models, then we can see that it is forever impossible to emulate inside a computer even the intelligence of crows or rabbits, let alone that of human beings.

112. Barry Smith, "The Future of Ontologies", in Peter Elkin, ed., *Terminology, Ontology and their Implementations*, Cham: Springer Nature Switzerland AG, July 20, 2023, 573-577.

113. Barry Smith, "Biomedical Ontologies", Peter Elkin, ed., *Terminology, Ontology and their Implementations*, Springer Nature Switzerland AG, July 20, 2023, 125-169.

> **Abstract:** We begin at the beginning, with an outline of Aristotle's views on ontology and with a discussion of the influence of these views on Linnaeus. We move from there to consider the data standardization initiatives launched in the nineteenth century and then turn to investigate how the idea of computational ontologies developed in the AI and knowledge representation communities in the closing decades of the twentieth century. We show how aspects of this idea, particularly those relating to the use of the term "concept" in ontology development, influenced SNOMED CT and other medical terminologies. Against this background, we then show how the Foundational Model of Anatomy, the Gene Ontology, Basic Formal Ontology, and other OBO Foundry ontologies came into existence and discuss their role in the development of contemporary biomedical informatics.

114. Barry Smith, "Thinking Like an Austrian", in Cavallo, J.A., Block, W.E. (eds), *Libertarian Autobiographies*, Cham: Palgrave, September 2023, 41-45.

> **Abstract:** I was introduced to libertarianism and Austrian economics as an undergraduate in Oxford, and I began to explore the links between philosophers and economists in the former Austria-Hungary. I was led also to the phenomenological movement founded by Edmund Husserl, more specifically to the Munich branch of the movement whose members sought to apply Husserl's methods to the study of extra-philosophical topics such as law, language, the state, and religion. Between 1976 and (roughly) 2000, I focused my work on these Austro-German themes, co-founding an organization by the name of the Seminar for Austro-German Philosophy which attempted to familiarize other philosophers in the English-speaking world with the contributions of thinkers such as Menger, Hayek, Brentano, Reinach, and Ingarden.

115. "ChatGPT: Not intelligent", in: G. Molnar and K. Nyiri, *AI: From Robotics to Philosophy. Proceedings of the Hungarian Academy of Sciences Workshop on The Intelligent Robots of the Future – Or Human Evolutionary Development Based on AI Foundations*, Proceedings of the Hungarian Academy of Sciences Workshop, 2023, 52-56.

> **Abstract:** In our book, *Why Machines Will Never Rule the World*, Jobst Landgrebe defend an argument to the effect that we can engineer machines that can emulate the behaviours only of simple systems. This means: only of those systems whose behaviour we can predict mathematically. The human brain is an example of a complex system, and thus its behaviour cannot be emulated by a machine. We use this argument to debunk the claims of those who believe that large language models such as ChatGPT are poised to achieve a level of intelligence that will equal or even surpass that of the human brain.

PAPERS IN REFEREED CONFERENCE PROCEEDINGS

1. Barry Smith, "Wittgenstein and the Background of Austrian Philosophy", in E. Leinfellner, *et al*. (eds.), *Wittgenstein and His Impact on Contemporary Thought*, Vienna: Hölder-Pichler-Tempsky, Dordrecht: Reidel, 1978, 31–35.

> **Abstract:** Surveys the evidence for an influence of Austrian philosophers – specifically Brentano, Meinong, Husserl, Twardowski and Mach – on the early Wittgenstein. Such influence might either have been direct, for instance through Wittgenstein's reading of Mach, or indirect, through the mediation of Russell and Moore. The paper concludes by addressing the possible influence of Stumpf and Reinach on Wittgenstein's technical usage of the term '*Sachverhalt*' in the *Tractatus*.

2. Barry Smith, "On Tractarian Law", in H. Berghel, *et al*. (eds.), *Wittgenstein, the Vienna Circle and Critical Rationalism*, Vienna: Hölder-Pichler-Tempsky, Dordrecht: Reidel, 1979, 31–35.

> **Abstract:** 'It is clear', wrote Wittgenstein in the *Tractatus*, 'that ethics has nothing to do with punishment and reward in the usual sense of the terms' (6.422). But he insisted also that there must be some kind of ethical punisment and reward; 'the reward,' he tells us, 'must be something pleasant, and the punishment something unpleasant'. I attempt to interpret

Wittgenstein's intentions here as a modification of ethico-legal views we find in Schopenhauer, Kierkegaard, and Weininger. 'Reward' and 'punishment' are conceived as elements in an ideal legal system, of which existing penal law and the divine law would be special cases.

3. Barry Smith, "On Making Sense of Ingarden", in Maria Gołaszewska (ed.), *Crisis of Aesthetics*, Cracow: Jagiellonian University, 1979, 283–289.

4. Barry Smith, "It", in R. Haller and W. Grassl (eds.), *Language, Logic and Philosophy*, Vienna: Hölder-Pichler-Tempsky, Dordrecht: Reidel, 1980, 342–345.

Abstract: A brief study of the logical, linguistic, psychological and ontological problem of 'impersonalia', which is to say of assertions such as 'it's raining' or '*es blitzt*' which seem to have no subject. Such assertions cause problems not only for defenders of traditional subject-predicate views of assertive sentences, but also for those, such as Frege, who defended a view in terms of functions and arguments.

5. Barry Smith, "Some Formal Moments of Truth", in W. Leinfellner, *et al*. (eds.), *Language and Ontology*, Vienna: Hölder-Pichler-Tempsky, Dordrecht: Reidel, 1982, 186–190.

Abstract: A preliminary statement of the formal theory of the truthmaker relation advanced in the paper "Truth-makers" (Mulligan, Simons and Smith) in 1984. Correspondence theories of truth have. I give a brief account of some more or less obvious formal characteristics of this almost forgotten basic truthmaker relation. I then attempt to show how this account may be extended to provide elements of a theory of truth which is in keeping with the spirit of Wittgenstein's *Tractatus*.

6. Barry Smith, "Acts and their Objects", in P. Weingartner and H. Czermak (eds.), *Epistemology and Philosophy of Science*, Vienna: Hölder-Pichler-Tempsky, Dordrecht: Reidel, 1983, 38–41.

7. Barry Smith, "Logical and Philosophical Remarks on Parts and Wholes", in P. Sällström (ed.), *An Inventory of Present Thinking about Parts and Wholes*, vol. I, Stockholm: Forskningsradsnämnden, 1983, 123–128.

8. Barry Smith, "Reflections on Dependence", in P. Sällström (ed.), *An Inventory of Present Thinking about Parts and Wholes*, vol. II, Stockholm: Forskningsradsnämnden, 1984, 29–42.

9. Barry Smith, "How not to talk about what does not exist", in R. Haller (ed.), *Aesthetics*, Vienna: Hölder-Pichler-Tempsky, Dordrecht: Reidel, 1984, 194–196.

Abstract: Defends a view of intentional directedness according to which those seemingly object-directed acts – involved for example in reading works of fiction – which lack existing objects as targets, are not intentional (thus: not directed towards any object). Rather, each such act seems to its subject as if it were so directed because it is associated with a belief of a certain special sort, whose intentional directedness is not towards any putative external object but rather towards the very act itself with which the belief is associated.

10. Barry Smith, "On the Structures of Perceptual *Gestalten*", in R. M. Chisholm, *et al*. (eds.), *Philosophy of Mind. Philosophy of Psychology*, Vienna: Hölder-Pichler-Tempsky, 1985, 301–304.

The Gestalt tradition was initiated in 1890 by Christian von Ehrenfels with his essay "On Gestalt Qualities". We describe how Ehrenfels and other thinkers in the tradition stretching from Brentano, Meinong and Ehrenfels to Benussi, held different views of the the way in which the organized structure which is the object of perception – for example a melody or pattern of colors – relates to the physiological processing on the side of the perceiver on the one hand, and to the objects in the world – for example single tones or patches of color. We focus particularly on the problem of the objectivity of perceptual Gestalten and on the contrast between the so-called Graz school of Meinong and Benussi and the Berlin school of Wertheimer, Köhler and Koffka.

11. Wolfgang Grassl and Barry Smith, "A Theory of Austria", in J. C. Nyíri (ed.), *From Bolzano to Wittgenstein: The Tradition of Austrian Philosophy*, Vienna: Hölder-Pichler-Tempsky, Dordrecht: Reidel, 1986, 11–30.

> **Abstract:** The present essay seeks, by way of the Austrian example, to make a contribution to what might be called the philosophy of the supranational state. More specifically, we shall attempt to use certain ideas on the philosophy of Gestalten as a basis for understanding some aspects of that political and cultural phenomenon which was variously called the Austrian Empire, the Habsburg Empire, the Danube Monarchy or Kakanien.

12. Barry Smith, "Wittgensteinian Philosophy and the Culture of the Commentary", in R. Haller and J. Brandl (eds.), *Wittgenstein: Towards a Re-Evaluation*, Vienna: Hölder-Pichler-Tempsky, 1990, vol. 2, 247–254.

> **Abstract:** The commentary is a form of literature that once predominated in all major philosophical cultures, from classical China to Renaissance Italy. Commentaries on the writings of German thinkers such as Kant, Hegel, Marx and Heidegger have kept the form alive to some extent in recent centuries; but among contemporary philosophers in the analytic mainstream it is a form that is almost never used. Why then, among philosophers in the analytic tradition, should the writings of Wittgenstein have spawned the growth of a commentary literature? What are the marks of an author, and of the surrounding culture, which spawn such growth?

13. "Zur Nichtübersetzbarkeit der deutschen Philosophie", in D. Papenfuss and O. Pöggeler (eds.), *Zur philosophischen Aktualität Heideggers*, vol. 3, *Im Spiegel der Welt: Sprache, Übersetzung, Auseinandersetzung*, Frankfurt: Klostermann, 1992, 125–147.

> **Abstract:** Warum hat sich die deutsche Philosophie so sehr und so langanhaltend an Autoritäten und Texte gebunden gefühlt, fast als ob man – wie die alten Iatrophilologen – Wissen aus bloßen Worten herauspressen wollte? Warum haben sich in Deutschland so häufig philosophische Sprachstile entwickelt, die ein Hindernis fur das Verständnis der entsprechenden Texte sind?
>
> Russian translation: "К непереводимости немецкой философии", *Социологос* [*Sociologos*]. No. 5-6, 124-139.

14. Barry Smith, "Über die Grenzen der Übersetzbarkeit", in Armin Paul Frank, Kurt–Jürgen Maass, Fritz Paul and Horst Turk (eds.), *Übersetzen. Verstehen. Brücken bauen. Geisteswissenschaftliches und literarisches Übersetzen im internationalen Kulturaustausch* (Göttinger Beiträge zur Internationalen Übersetzungsforschung, 8/1), Berlin/Bielefeld/Munich: Erich Schmidt Verlag, 1994, 295–301.

15. Barry Smith, "Philosophieren und Kommentieren: Überlegungen zu ihrem Verhältnis", in H. F. Fulda and Rolf-Peter Horstmann (eds.), *Vernunftbegriffe in der Moderne. Stuttgarter Hegel-Kongress 1993*, Stuttgart: Klett Cotta, 1994, 857–868.

> Shorter version as: "Worin unterscheiden sich deutsche und angelsächsische Philosophie?", *Information Philosophie,* 2/1994, 30–38.

16. Barry Smith, "Fiat Objects", in N. Guarino, L. Vieu and S. Pribbenow (eds.), *Parts and Wholes: Conceptual Part-Whole Relations and Formal Mereology, 11th European Conference on Artificial Intelligence, Amsterdam, 8 August 1994*, Amsterdam: European Coordinating Committee for Artificial Intelligence, 1994, 15–22.

> **Abstract:** Human cognitive acts are directed towards entities of a wide range of different types. What follows is a new proposal for bringing order into this typological clutter. The starting point for our categorial scheme is the concept of extended entity. Two sorts of extended entity are initially distinguished: objects, which are extended in space; and processes, which are extended in time. Examples of objects are: you and I. Objects are possessed of divisible bulk: they can be divided, in reality or in thought, into spatial parts. Examples of processes are: your life and my current headache. It is unproblematic that both objects and processes have outer

boundaries: the exterior surface of your skin; the beginning and the ending of your life. Here however we focus on what we can think of as inner boundaries – the boundary dividing your upper and lower torso? Or the boundary dividing your life before from your life after your fourteenth birthday?

17. Barry Smith, "Topological Foundations of Cognitive Science", in C. Eschenbach, C. Habel and B. Smith (eds.), *Topological Foundations of Cognitive Science*, Hamburg: Graduiertenkolleg Kognitionswissenschaft, 1994, 3–22.

Abstract: The paper introduces the concepts at the heart of *point-set-topology* and of *mereotopology* (topology founded in the non-atomistic theory of parts and wholes) in an informal and intuitive fashion. It will then seek to demonstrate how mereotopological ideas can be of particular utility in cognitive science applications. The prehistory of such applications (in the work of Husserl, the Gestaltists, of Kurt Lewin and of J. J. Gibson) will be sketched, together with an indication of the field of possibilities in linguistics, perceptual psychology, categorization and geographic information systems. Topological structures will be shown to play a central role in studies of naive physics not least in virtue of the fact that even well-attested departures from true physics on the part of common sense leave the topology and vectorial orientation of the underlying physical phenomena invariant: our common sense would thus seem to have a veridical grasp of the topology and broad general orientation of physical phenomena, both static and dynamic, even where it illegitimately modifies the relevant shape and metric properties. The implications of this and related insights for the methodology of psychology will be explored.

Danish translation as: "Kognitionsforskningens topologiske grundlag", in *Semikolon,* 3 (7), 2003, 91-105, also published as Peer F. Bundgaard, Jesper Egholm & Martin Skov (eds.), *Dynamisk semiotik. Kognition, sprog, ontologi*, Copenhagen: Gyldendal.

18. Barry Smith, "On Drawing Lines on a Map", in Andrew U. Frank and Werner Kuhn (eds.), *Spatial Information Theory. A Theoretical Basis for GIS* (Lecture Notes in Computer Science 988), Berlin/Heidelberg/New York, etc.: Springer, 1995, 475–484.

Abstract: The paper is an exercise in descriptive ontology, with specific applications to problems in the geographical sphere. It presents a general typology of spatial boundaries, based in particular on an opposition between *bona fide* or physical boundaries on the one hand, and *fiat* or human-demarcation-induced boundaries on the other. Cross-cutting this opposition are further oppositions in the realm of boundaries, for example between: crisp and indeterminate, complete and incomplete, enduring and transient, symmetrical and asymmetrical. The resulting typology generates a corresponding categorization of the different sorts of *objects* which (complete) boundaries determine or demarcate. The theory is applied first of all in the areas of geography and of administrative and property law. Indications are then given as to how the typology may be applied also in other fields where physical and fiat boundaries are at work, including the field of cognitive linguistics and the related field of the ontology of truth.

19. Barry Smith, "Towards an Ontology of Common Sense", in Jaakko Hintikka and Klaus Puhl (eds.), *The British Tradition in Twentieth-Century Philosophy*, Vienna: Hölder-Pichler-Tempsky, 1995, 300–309.

Abstract: Just as some have argued that the folk-psychological ontology of beliefs, desires, etc. yields the best explanation we can have of the order of cognitive phenomena conceived from the perspective of first-person experience, so we argue here that (1) the commonsensical ontology of folk physics yields the best explanation we can have of our externally directed cognitive experience and that (2) an ontology of mesoscopic things, events and processes must play a role, in particular, in our best scientific theory of human action.

20. Barry Smith, "The Cognitive Geometry of War", in Peter Koller and Klaus Puhl (eds.), *Current Issues in Political Philosophy: Justice in Society and World Order,* Vienna: Hölder-Pichler-Tempsky, 1997, 394–403.

Abstract: Why does 'ethnic cleansing' occur? Why does the rise of nationalist feeling in Europe and of Black separatist movements in the United States often go hand in hand with an upsurge

of anti-Semitism? Why do some mixings of distinct religious and ethnic groups succeed, where others (for example in Northern Ireland, or in Bosnia) fail so catastrophically? Why do phrases like 'balkanisation', 'dismemberment', 'mutilation', 'violation of the motherland' occur so often in warmongering rhetoric? All of these questions are, it will turn out, connected. To understand how they are connected we we will need to examine how human beings acquire a relationship to specific chunks of land, a relationship that is emotionally so strong that they are prepared to die – or kill – to protect that land for themselves or to win it back from others. Territoriality, the biologically rooted predisposition to defend core areas of home ranges against intruders, is a near-universal phenomenon amongst animals of all species. But the ways in which defended territories are conceived and demarcated differ widely from species to species and from group to group. By coming to an understanding of the geometry of these differences we can come to understand also some of the factors which give rise to interethnic conflict.

French translation as: "La géométrie cognitive de la guerre", in Bernard Baertschi and Kevin Mulligan (eds.), *Les Nationalismes*, Paris, PUF, 2002, 199–226.

Romanian translation in *Nationalismele*, Bucharest: Nemira, 2010

21. Barry Smith and Achille Varzi, "Fiat and Bona Fide Boundaries: Towards an Ontology of Spatially Extended Objects", in S. C. Hirtle and A. U. Frank (eds.), *Spatial Information Theory. International Conference COSIT '97. Laurel Highlands, Pennsylvania, October 1997* (Lecture Notes in Computer Science 1329), Berlin/New York: Springer Verlag, 103–119.

Abstract: Human cognitive acts are directed towards objects extended in space of a wide range of different types. What follows is a new proposal for bringing order into this typological clutter. The theory of spatially extended objects should make room not only for the objects of physics but also for objects at higher levels, including the objects of geography and of related disciplines. It should leave room for different types of boundaries, including both the bona fide boundaries which we find in the physical world and the fiat (or human-demarcation-induced) boundaries with which much of geography has to deal. Two distinct axiomatic theories of boundaries are accordingly presented, and the need for both is examined in some detail. The resultant dual framework is shown to have application above all for our understanding of issues involving contact, division, and separation, issues which have posed serious difficulties for the ontological theories of boundaries that have been proposed hitherto.

22. Barry Smith, "Basic Concepts of Formal Ontology", in Nicola Guarino (ed.), *Formal Ontology in Information Systems*, Amsterdam, Oxford, Tokyo, Washington, DC: IOS Press (Frontiers in Artificial Intelligence and Applications), 1998, 19–28.

Abstract: The term 'formal ontology' was first used by the philosopher Edmund Husserl in his *Logical Investigations* to signify the study of those formal structures and relations – above all relations of part and whole – which are exemplified in the subject-matters of the different material sciences. We follow Husserl in presenting the basic concepts of formal ontology as falling into three groups: the theory of part and whole, the theory of dependence, and the theory of boundary, continuity and contact. These basic concepts are presented in relation to the problem of providing an account of the formal ontology of the mesoscopic realm of everyday experience, and specifically of providing an account of the concept of individual substance.

Polish translation as "Podstawowe pojęcia ontologii formalnej", *Lectiones & Acroases Philosophicae*, 8, 2 (2015), 141-161.

23. Roberto Casati, Barry Smith and Achille Varzi, "Ontological Tools for Geographic Representation", in Nicola Guarino (ed.), *Formal Ontology in Information Systems* Amsterdam, Oxford, Tokyo, Washington, DC: IOS Press (Frontiers in Artificial Intelligence and Applications), 1998, 77–85.

Abstract: This paper is concerned with certain ontological issues in the foundations of geographic representation. It sets out what these basic issues are, describes the tools needed

to deal with them, and draws some implications for a general theory of spatial representation. Our approach has ramifications in the domains of mereology, topology, and the theory of location, and the question of the interaction of these three domains within a unified spatial representation theory is addressed. In the final part we also consider the idea of non-standard geographies, which may be associated with geography under a classical conception in the same sense in which non-standard logics are associated with classical logic.

"地理的表象のための存在論的ツール", Japanese translation by Y. Yamashita, *InterCommunication,* 45, Summer 2003, 80–91.

Casati, R., Smith, B., & Varzi, A. C. (2003). 地理的表象のための存在論的ツール. *Inter communication= インターコミュニケーション*, *12*(3), 80-91.

24. Barry Smith and David M. Mark, "Ontology and Geographic Kinds", in T. Poiker and N. Chrisman (eds.), *Proceedings of the 8th International Symposium on Spatial Data Handling (SDH '98)*, Vancouver: International Geographic Union, 1998, 308–320.

Abstract: Cognitive categories in the geographic realm appear to manifest certain special features as contrasted with categories for objects at surveyable scales. We have argued that these features reflect specific ontological characteristics of geographic objects. This paper presents hypotheses as to the nature of the features mentioned, reviews previous empirical work on geographic categories, and presents the results of pilot experiments that used English-speaking subjects to test our hypotheses. Our experiments show geographic categories to be similar to their non-geographic counterparts in the ways in which they generate instances of different relative frequencies at different levels. Other tests, however, provide preliminary evidence for the existence of important differences in subjects' categorizations of geographic and non-geographic objects, and suggest further experimental work especially with regard to the role in cognitive categorization of different types of object-boundaries at different scales.

Reprinted in Yaser Bishr and Werner Kuhn (eds.), *The Role of Ontology in Modelling Geospatial Features*, Institut für Geoinformatik, Westfälische Wilhelms-Universität, Münster: Formatik, 1999.

The role of ontology in modelling geospatial features. Institut für Geoinformatik, Westfälische Wilhelms-Universität Münster, 1999.

25. Barry Smith, "Agglomerations", in C. Freksa, and David M. Mark (eds.), *Spatial Information Theory. Cognitive and Computational Foundations of Geographic Information Science* (Springer Lecture Notes in Computer Science 1661), 1999, 267–282.

Abstract: Where some have attempted to apply cognitive methods to the study of geography, the present paper is designed to serve as a starting point for applying methods of geographic ontology to the phenomena of cognition. Agglomerations are aggregates of entities that are dispersed through space on geographic scales. Examples include: plagues, biological species, major world religions. The paper applies standard mereotopological theories of spatial regions to agglomerations in this sense. It offers the beginnings of a general theory of the relations between social, cultural, ethnic and religious agglomerations on the one hand and territorially demarcated spatial objects on the other. In this way it serves as the basis for a general ontological theory of types of human groups and also of types of conflict between these groups. At the same time it provides ontological foundations for the epidemiological study of cognitive phenomena, and especially of cognitive phenomena in the sociopolitical realm.

26. David Mark, Barry Smith and Barbara Tversky "Ontology and Geographic Objects: An Empirical Study of Cognitive Categorization," in C. Freksa and David M. Mark (eds.), *Spatial Information Theory. Cognitive and Computational Foundations of Geographic Information Science* (Lecture Notes in Computer Science 1661), 1999, 283–298.

Abstract: Cognitive categories in the geographic realm appear to manifest certain special features as contrasted with categories for objects at surveyable scales. We have argued that these features reflect specific ontological characteristics of geographic objects. This paper presents hypotheses as to the nature of the features mentioned, reviews previous empirical work on geographic categories, and presents the results of pilot experiments that used English-speaking subjects to test our hypotheses. Our experiments show geographic categories to be similar to their non-geographic counterparts in the ways in which they generate instances of different relative frequencies at different levels. Other tests, however, provide preliminary evidence for the existence of important differences in subjects' categorizations of geographic and non-geographic objects, and suggest further experimental work especially with regard to the role in cognitive categorization of different types of object-boundaries at different scales.

27. Barry Smith and Achille C. Varzi, "The Formal Structure of Ecological Contexts," in P. Bouquet, P. Brezillon, L. Serafini, M. Beneceretti, F. Castellani (eds.), *CONTEXT '99: Modeling and Using Context*. *Proceedings of the Second International and Interdisciplinary Conference* (Lecture Notes in Artificial Intelligence, 1688), Berlin and Heidelberg: Springer-Verlag, 1999, 339–350.

Abstract: This paper presents the outline of a formal ontology of contexts. More specifically, it deals with the ontology of ecological contexts (niches, habitats, environments, ambients) and of the relations between organisms, niches, and the spatial regions they occupy. The first part sets out the basic conceptual background. The second part outlines a semi-formal theory which builds upon notions and principles of mereology, topology, and the theory of spatial location.

28. David M. Mark, Barry Smith, Berit Brogaard-Pedersen, "Ontology of Common Sense Geographic Phenomena: Foundations for Interoperable Multilingual Geospatial Databases", 3rd AGILE Conference on Geographic Information Science – Helsinki/Espoo, Finland, May 25–27, 2000, 32-34.

Abstract: Information may be defined as the conceptual or communicable part of the content of mental acts. The content of mental acts includes sensory data as well as concepts, particular as well as general information. An information system is an external (non-mental) system designed to store such content. Information systems afford indirect transmission of content between people, some of whom may put information into the system and others who are among those who use the system. In order for communication to happen, the conceptual systems of the originators and users of the information must be sufficiently similar. A formal conceptual framework that can provide the basis for exchange of information is termed an ontology. In its most fundamental form, ontology studies the most basic constituents of reality. Traditionally, ontology seeks to reflects structures that are independent of thought and cognition. The term ontology is used more broadly in artificial intelligence and software engineering, to refer to the conceptual basis for an information system.

29. Barry Smith, "On Forms of Communication in Philosophy", in *Proceedings of the 20th World Congress of Philosophy,* Volume X: *Philosophy of Science*, Editor: Tian Yu Cao, Bowling Green: Philosophy Documentation Center, 2001, 73–82.

30. Barry Smith and Achille C. Varzi, "Environmental Metaphysics", in U. Meixner (ed.), *Metaphysics in the Post-Metaphysical Age. Proceedings of the 22nd International Wittgenstein-Symposium*, Vienna: öbv&hpt, 2001, 231–239.

Abstract: We propose the beginnings of a general theory of environments, of the parts or regions of space in which organisms live and move. We draw on two sources: on the one hand on recent work on the ontology of space; and on the other hand on work by ecological scientists on concepts such as territory, habitat and niche.

Japanese translation by S. Kajitani: "環境の形而上学" (Kankyo no Keijijyogaku), *理想* (*The Riso/Risosha* (Tokyo), 669, 2002, 170–180.

31. Barry Smith, "True Grid", in Daniel Montello (ed.), *Spatial Information Theory. Foundations of Geographic Information Science, Proceedings of COSIT 2001,* Morro

Bay, California, September 2001 (Lecture Notes in Computer Science 2205), Berlin/New York: Springer, 14–27.

> **Abstract:** The Renaissance architect, moral philosopher, cryptographer, mathematician, Papal adviser, painter, city planner and land surveyor Leon Battista Alberti provided the theoretical foundations of modern perspective geometry. Alberti's work on perspective exerted a powerful influence on painters of the stature of Albrecht Dürer, Leonardo da Vinci and Piero della Francesca. But his Della pittura of 1435–36 contains also a hitherto unrecognized ontology of pictorial projection. We sketch this ontology, and show how it can be generalized to apply to representative devices in general, including maps and spatial and non-spatial databases.
>
> Revised version as: "Pictures, Maps and Other Cognitive Artifacts", *Visio*, 6: 2-3, 2001, 163–176.

32. David M. Mark, Andre Skupin and Barry Smith, "Features, Objects, and Other Things: Ontological Distinctions in the Geographic Domain", in Daniel Montello (ed.), *Spatial Information Theory. Foundations of Geographic Information Science, Proceedings of COSIT 2001, Morro Bay, California, September 2001* (Lecture Notes in Computer Science 2205), Berlin/New York: Springer, 488–502.

> **Abstract:** Two hundred and sixty-three subjects each gave examples for one of five geographic categories: geographic features, geographic objects, geographic concepts, something geographic, and something that could be portrayed on a map. The frequencies of various responses were significantly different, indicating that the basic ontological terms feature, object, etc., are not interchangeable but carry different meanings when combined with adjectives indicating geographic or mappable. For all of the test phrases involving geographic, responses were predominantly natural features such as mountain, river, lake, ocean, hill. Artificial geographic features such as town and city were listed hardly at all for geographic categories, an outcome that contrasts sharply with the disciplinary self-understanding of academic geography. However, geographic artifacts and fiat objects, such as roads, cities, boundaries, countries, and states, were frequently listed by the subjects responding to the phrase something that could be portrayed on a map. In this paper, we present the results of these experiments in visual form, and provide interpretations and implications for further research.

33. Thomas Bittner and Barry Smith, "A Taxonomy of Granular Partitions", Daniel Montello (ed.), *Spatial Information Theory. Foundations of Geographic Information Science,* Proceedings of COSIT 2001*,* Morro Bay, California, September 2001 (Lecture Notes in Computer Science 2205), Berlin/New York: Springer, 28–43.

> **Abstract:** In this paper we propose a formal theory of partitions (ways of dividing up or sorting or mapping reality) and we show how the theory can be applied in the geospatial domain. We characterize partitions at two levels: as systems of cells (theory A), and in terms of their projective relation to reality (theory B). We lay down conditions of well-formedness for partitions and we define what it means for partitions to project truly onto reality. We continue by classifying well-formed partitions along three axes: (a) degree of correspondence between partition cells and objects in reality; (b) degree to which a partition represents the mereological structure of the domain it is projected onto; and (c) degree of completeness and exhaustiveness with which a partition represents reality. This classification is used to characterize three types of partitions that play an important role in spatial information science: cadastral partitions, categorical coverages, and the partitions involved in folk categorizations of the geospatial domain.

34. Barry Smith and Christopher Welty, "Ontology: Towards a New Synthesis", editors' introduction to: Christopher Welty and Barry Smith (eds.), *Formal Ontology in Information Systems*, New York: ACM Press, 2001, iii-ix.

> **Abstract:** This introduction to the Second International Conference on Formal Ontology in Information Systems presents a brief history of ontology as a discipline spanning the boundaries of philosophy and information science. We sketch some of the reasons for the growth of ontology in the information science field, and offer a preliminary stocktaking of how the term 'ontology'

is currently used. We conclude by suggesting some grounds for optimism as concerns the future collaboration between philosophical ontologists and information scientists.

35. Thomas Bittner and Barry Smith, "Granular Partitions and Vagueness" in Christopher Welty and Barry Smith (eds.), *Formal Ontology in Information Systems*, New York: ACM Press, 2001, 309–321.

36. Wolfgang Degen, Barbara Heller, Heinrich Herre and Barry Smith, "GOL: A General Ontological Language", in D (eds.), *Formal Ontology in Information Systems*, New York: ACM Press, 2001, 34–46. Preprint version with the title "GOL: Towards an Axiomatized Upper-Level Ontology", IMISE Report, University of Leipzig, 2001.

Abstract: Every domain-specific ontology must use as a framework some upper-level ontology which describes the most general, domain-independent categories of reality. In the present paper we sketch a new type of upper-level ontology, which is intended to be the basis of a knowledge modelling language GOL (for: 'General Ontological Language'). It turns out that the upper-level ontology underlying standard modelling languages such as KIF, F-Logic and CycL is restricted to the ontology of sets. Set theory has considerable mathematical power and great flexibility as a framework for modelling different sorts of structures. At the same time it has the disadvantage that sets are abstract entities (entities existing outside the realm of time, space and causality), and thus a set-theoretical framework should be supplemented by some other machinery if it is to support applications in the ripe, messy world of concrete objects. In the present paper we partition the entities of the real world into sets and urelements, and then we introduce several new ontological relations between these urelements. In contrast to standard modelling and representation formalisms, the concepts of GOL provide a machinery for representing and analysing such ontologically basic relations.

37. Barry Smith and Leo Zaibert, "The Metaphysics of Real Estate", in Christoph Schlieder, Erik Stubkjaer and Heiner Stuckenschmidt (eds.), *Von der Theorie zur Praxis: Entwicklung und Transfer von Informatik-Technologien. Papers of the Kick-Off Meeting of the COST Action G9 "Modeling Real-Property Transactions', Bremen, Nov. 1-3, 2001,* University of Bremen, Fachbereich Mathematik/Informatik, 2001, 19–21.

Abstract: The parceling of land into real estate is more than a simple geometrical affair. Real estate is a historical product of interaction between human beings, political, legal and economic institutions, and the physical environment. And while many authors, from Jeremy Bentham to Hernando de Soto, have drawn attention to the ontological (metaphysical) aspect of property in general, no comprehensive analysis of landed property has been attempted. The paper presents such an analysis and shows how landed property differs from other types of property in a way which implies a special role for political and economic philosophy of property rights in land.roduct of interaction between human beings, political, legal and economic institutions, and the physical environment. And while many authors, from Jeremy Bentham to Hernando de Soto, have drawn attention to the ontological (metaphysical) aspect of property in general, no comprehensive analysis of landed property has been attempted. The paper presents such an analysis and shows how landed property differs from other types of property in a way which implies a special role for political and economic philosophy of property rights in land.

38. Thomas Bittner and Barry Smith, "A unified theory of granularity, vagueness and approximation", Proceedings of COSIT Workshop on Spatial Vagueness, Uncertainty and Granularity (2001).

Abstract: We propose a view of vagueness as a semantic property of names and predicates. All entities are crisp, on this semantic view, but there are, for each vague name, multiple portions of reality that are equally good candidates for being its referent, and, for each vague predicate, multiple classes of objects that are equally good candidates for being its extension. We provide a new formulation of these ideas in terms of a theory of granular partitions. We show that this theory provides a general framework within which we can understand the relation between vague terms and concepts and the corresponding crisp portions of reality. We also sketch how it might be possible to formulate within this framework a theory of vagueness which

dispenses with the notion of truth-value gaps and other artifacts of more familiar approaches. Central to our approach is the idea that judgments about reality involve in every case (1) a separation of reality into foreground and background of attention and (2) the feature of granularity. On this basis we attempt to show that even vague judgments made in naturally occurring contexts are not marked by truth-value indeterminacy. We distinguish, in addition to crisp granular partitions, also vague partitions, and reference partitions, and we explain the role of the latter in the context of judgments that involve vagueness. We conclude by showing how reference partitions provide an effective means by which judging subjects are able to temper the vagueness of their judgments by means of approximations.

38. Maureen Donnelly and Barry Smith "Layers: A New Approach to Locating Objects in Space", in W. Kuhn, M. F. Worboys, and S. Timpf (eds.), *Spatial Information Theory: Foundations of Geographic Information Science* (Lecture Notes in Computer Science 2825), Berlin: Springer, 2003, 50–65.

Abstract: Standard theories in mereotopology focus on relations of parthood and connection among spatial or spatio-temporal regions. Objects or processes which might be located in such regions are not normally directly treated in such theories. At best, they are simulated via appeal to distributions of attributes across the regions occupied or by functions from times to regions. The present paper offers a richer framework, in which it is possible to represent directly the relations between entities of various types at different levels, including both objects and the regions they occupy. What results is a layered mereotopology, a theory which can handle multiple layers (analogous to the layers of a lasagna) of spatially or spatiotemporally coincident but mereologically non-overlapping entities.

39. Daniel Cohnitz and Barry Smith, "Assessing Ontologies: The Question of Human Origins and Its Ethical Significance", in C. Kanzian and E. Runggaldier (eds.), *Persons: An Interdisciplinary Approach*, Vienna: hpt&öbv, 2003, 243–59.

Abstract: In their paper "Sixteen Days" Barry Smith and Berit Brogaard try to answer the question: when does a human being begin to exist? In this paper we will address some methodological issues connected with this exercise in ontology. We shall begin by sketching the argument of "Sixteen Days". We shall then attempt to characterize what is special about the ontological realism of "Sixteen Days" as contrasted to the linguistic constructivism which represents the more dominant current in contemporary analytic philosophy. This will allow us to infer guidelines for assessing the quality of ontological theories of various types. We shall argue that ontological parsimony, groundedness, faithfulness to ordinary language, consistency with science, coherence, and fruitfulness are at least part of the adequacy criteria for such theories. These criteria will then be applied to the theory presented in "Sixteen Days", and they will lead us to some revisions of this theory as well as to some reflections on its ethical implications.

40. Anand Kumar and Barry Smith "Ontology for Task-Based Clinical Guidelines and the Theory of Granular Partitions", *Proceedings of the 9th Conference on Artificial Intelligence in Medicine* (Lecture Notes on Artificial Intelligence 2780), Berlin: Springer, 2003, 71–75.

Abstract: The theory of granular partitions (TGP) is a new approach to the understanding of ontologies and other classificatory systems. The paper explores the use of this new theory in the treatment of task-based clinical guidelines as a means for better understanding the relations between different clinical tasks, both within the framework of a single guideline and between related guidelines. We used as our starting point a DAML+OIL-based ontology for the WHO guideline for hypertension management, comparing this with related guidelines and attempting to show that TGP provides a flexible and highly expressive basis for the manipulation of ontologies of a sort which might be useful in providing more adequate Computer Interpretable Guideline Models (CIGMs) in the future.

41. Barry Smith, Igor Papakin and Katherine Munn, 2003, "Bodily Systems and the Modular Structure of the Human Body", *Proceedings of the 9th Conference on Artificial Intelligence in Medicine* (Lecture Notes on Artificial Intelligence 2780), Berlin: Springer, 2003, 86–90.

Abstract: Medical science conceives the human body as a system comprised of many subsystems at a variety of levels. At the highest level are bodily systems proper, such as the endocrine system, which are central to our understanding of human anatomy, and play a key role in diagnosis and in dynamic modeling as well as in medical pedagogy and computer visualization. But there is no explicit definition of what a bodily system is; such informality is acceptable in documentation created for human beings, but falls short of what is needed for computer representations. Our analysis is intended as a first step towards filling this gap.

42. Werner Ceusters, Barry Smith and Jim Flanagan 2003, "Ontology and Medical Terminology: Why Description Logics Are Not Enough", in *Proceedings of the Conference: Towards an Electronic Patient Record* (TEPR 2003), San Antonio 10-14 May 2003, Boston, MA: Medical Records Institute (CD-ROM publication).

Abstract: Ontology is currently perceived as the solution of first resort for all problems related to biomedical terminology, and the use of description logics is seen as a minimal requirement on adequate ontology-based systems. Contrary to common conceptions, however, description logics alone are not able to prevent incorrect representations; this is because they do not come with a theory indicating what is computed by using them, just as classical arithmetic does not tell us anything about the entities that are added or subtracted. In this paper we shall show that ontology is indeed an essential part of any solution to the problems of medical terminology – but only if it is understood in the right sort of way. Ontological engineering, we shall argue, should in every case go hand in hand with a sound ontological theory.

43. Barry Smith, Jennifer Williams and Steffen Schulze-Kremer, 2003, "The Ontology of the Gene Ontology", in *Biomedical and Health Informatics: From Foundations to Applications*, Proceedings of the Annual Symposium of the American Medical Informatics Association, Washington DC, November 2003, 609–613. PMC1480173

Abstract: The rapidly increasing wealth of genomic data has driven the development of tools to assist in the task of representing and processing information about genes, their products and their functions. One of the most important of these tools is the Gene Ontology (GO), which is being developed in tandem with work on a variety of bioinformatics databases. An examination of the structure of GO, however, reveals a number of problems, which we believe can be resolved by taking account of certain organizing principles drawn from philosophical ontology. We shall explore the results of applying such principles to GO with a view to improving GO's consistency and coherence and thus its future applicability in the automated processing of biological data.

44. Anand Kumar and Barry Smith, 2003, "The Universal Medical Language System and the Gene Ontology: Some Critical Reflections", in A. Günter, R. Kruse and B. Neumann (eds.), *KI 2003: Advances in Artificial Intelligence* (Lecture Notes in Artificial Intelligence 2821), Berlin: Springer, 2003, 135–148.

Abstract: The Unified Medical Language System and the Gene Ontology are among the most widely used terminology resources in the biomedical domain. However, when we evaluate them in the light of simple principles for well-constructed ontologies we find a number of characteristic inadequacies. Employing the theory of granular partitions, a new approach to the understanding of ontologies and of the relationships ontologies bear to instances in reality, we provide an application of this theory in relation to an example drawn from the context of the pathophysiology of hypertension. This exercise is designed to demonstrate how, by taking ontological principles into account we can create more realistic biomedical ontologies which will also bring advantages in terms of efficiency and robustness of associated software applications.

45. Barry Smith, "Ontology in Biomedicine", E. Papp, A. G. Beck-Sickinger and S. Eichler (eds.), *2. Biotechnologie-Tag*, Leipzig: University of Leipzig, 2003, 294–296.

46. Anand Kumar and Barry Smith, "A Framework for Protein Classification", *Proceedings of the 2003 German Conference on Bioinformatics,* Vol. II, 2003, 55–57.

Abstract: It is widely understood that protein functions can be exhaustively described in terms of no single parameter, whether this be amino acid sequence or the three-dimensional structure of the underlying protein molecule. This means that a number of different attributes must be

used to create an ontology of protein functions. Certainly much of the required information is already stored in databases such as Swiss-Prot, Protein Data Bank, SCOP and MIPS. But the latter have been developed for different purposes and the separate data-structures which they employ are not conducive to the needed data integration. When we attempt to classify the entities in the domain of proteins, we find ourselves faced with a number of cross-cutting principles of classification. Our question here is: how can we bring together these separate taxonomies in order to describe protein functions? Our proposed answer is: via a careful top-level ontological analysis of the relevant principles of defeTclassification, combined with a new framework for the simultaneous manipulation of classifications constructed for different purposes.

47. Anand Kumar, Barry Smith, Mario Stefanelli, Silvana Quaglinia and Matteo Piazza, "Implementing Clinical Guidelines in an Organizational Setup", *Proceedings of the Workshop on Model-Based and Qualitative Reasoning in Biomedicine*, AIME 2003, 39–44. See also supplementary paper here.

Abstract: Outcomes research in healthcare has been a topic much addressed in recent years. Efforts in this direction have been supplemented by work in the areas of guidelines for clinical practice and computer-interpretable workflow and careflow models.In what follows we present the outlines of a framework for understanding the relations between organizations, guidelines, individual patients and patient-related functions. The derived framework provides a means to extract the knowledge contained in the guideline text at different granularities, in ways that can help us to assign tasks within the healthcare organization and to assess clinical performance in realizing the guideline. It does this in a way that preserves the flexibility of the organization in the adoption of the guidelines.

48. Thomas Bittner and Barry Smith, "Granular Spatio-Temporal Ontologies", *AAAI Symposium: Foundations and Applications of Spatio-Temporal Reasoning* (FASTR), AAAI Press, 2003, 12–17.

Abstract: We propose an ontological theory that is powerful enough to describe both complex spatio-temporal processes (occurrents) and the enduring entities (continuants) that participate therein. The theory is divided into two major categories of sub-theories: (sub-) theories of type SPAN and (sub-)theories of type SNAP. These theories represent two complementary perspectives on reality and result in distinct though compatible systems of categories. In SNAP we have enduring entities such as substances, qualities, roles, functions; in SPAN we have perduring entities such as processes and their parts and aggregates. We argue that both kinds of ontological theory are required in order to give a non-reductionism account of complex domains of reality.

49. David M Mark, Werner Kuhn, Barry Smith, Andrew G. Turk, "Ontology, natural language, and information systems: Implications of cross-linguistic studies of geographic terms", *6th Annual Conference of the Association of Geographic Information Laboratories for Europe* (AGILE), 45-50.

Abstract: Ontology has been proposed as a solution to the 'Tower of Babel' problem that threatens the semantic interoperability of information systems constructed independently for the same domain. In information systems research and applications, ontologies are often implemented by formalizing the meanings of words from natural languages. However, words in different natural languages sometimes subdivide the same domain of reality in terms of different conceptual categories. If the words and their associated concepts in two natural languages, or even in two terminological traditions within the same language, do not have common referents in the real world, an ontology based on word meanings will inherit the 'Tower of Babel' problem from the languages involved, rather than solve it. In this paper we present evidence from a preliminary comparison of landscape terms in English with those in the Yindjibarndi language of northwestern Australia demonstrating that this problem is not just hypothetical. Some possible solutions are suggested.

50. Istvan-Tibor Nébel, Barry Smith, Ralf Paschke, "A User Profiling Component with the Aid of User Ontologies", *Proceedings of Learning – Teaching – Knowledge – Adaptivity* (LLWA), University of Karlsruhe (2003).

> **Abstract:** What follows is a contribution to the field of user modeling for adaptive teaching and learning programs especially in the medical field. The paper outlines existing approaches to the problem of extracting user information in a form that can be exploited by adaptive software. We focus initially on the so-called stereotyping method, which allocates users into classes adaptively, reflecting characteristics such as physical data, social background, and computer experience. The user classifications of the stereotyping method are however ad hoc and unprincipled, and they can be exploited by the adaptive system only after a large number of trials by various kinds of users. We argue that the remedy is to create a database of user ontologies from which readymade taxonomies can be derived in such a way as to enable associated software to support a variety of different types of users.

51. Barry Smith, Jakob Köhler and Anand Kumar, "On the Application of Formal Principles to Life Science Data: A Case Study in the Gene Ontology", in *Proceedings of* DILS 2004 *(Data Integration in the Life Sciences*), (Lecture Notes in Bioinformatics 2994), Berlin: Springer, 2004, 79–94.

> **Abstract:** Formal principles governing best practices in classification and definition have for too long been neglected in the construction of biomedical ontologies, in ways which have important negative consequences for data integration and ontology alignment. We argue that the use of such principles in ontology construction can serve as a valuable tool in error-detection and also in supporting reliable manual curation. We argue also that such principles are a prerequisite for the successful application of advanced data integration techniques such as ontology-based multi-database querying, automated ontology alignment and ontology-based text-mining. These theses are illustrated by means of a case study of the Gene Ontology, a project of increasing importance within the field of biomedical data integration.

52. Werner Ceusters, Barry Smith and James Matthew Fielding, "LinkSuite™: Software Tools for Formally Robust Ontology-Based Data and Information Integration", in *Proceedings of* DILS 2004 *(Data Integration in the Life Sciences*), (Lecture Notes in Bioinformatics, 2994), Berlin: Springer, 2004, 124–139.

> **Abstract:** The integration of information resources in the life sciences is one of the most challenging problems facing bioinformatics today. We describe how Language and Computing nv, originally a developer of ontology-based natural language understanding systems for the healthcare domain, is developing a framework for the integration of structured data with unstructured information contained in natural language texts. L&C's LinkSuite™ combines the flexibility of a modular software architecture with an ontology based on rigorous philosophical and logical principles that is designed to comprehend the basic formal relationships that structure both reality and the ways humans perceive and communicate about reality.

53. Werner Ceusters, Barry Smith and Martin Van Mol, "Using Ontology in Query Answering Systems: Scenarios, Requirements and Challenges," in R. Bernardi and M. Moortgat (eds.) *Questions and Answers: Theoretical and Applied Perspectives, Proceedings of the 2nd CoLogNET-Elsnet Symposium*, December 2003, Amsterdam, 5–15.

> **Abstract:** Equipped with the ultimate query answering system, computers would finally be in a position to address all our information needs in a natural way. In this paper, we describe how Language and Computing nv (L&C), a developer of ontology-based natural language understanding systems for the healthcare domain, is working towards the ultimate Question Answering (QA) System for healthcare workers. L&C's company strategy in this area is to design in a step-by-step fashion the essential components of such a system, each component being designed to solve some one part of the total problem and at the same time reflect well-defined needs on the prat of our customers. We compare our strategy with the research roadmap proposed by the Question Answering Committee of the National Institute of Standards and Technology (NIST), paying special attention to the role of ontology.

54. Werner Ceusters, Barry Smith, Anand Kumar and Christoffel Dhaen, "Mistakes in Medical Ontologies: Where Do They Come From and How Can They Be Detected?", in D. M. Pisanelli (ed.), *Ontologies in Medicine*: *Proceedings of the Workshop on Medical Ontologies, Rome October 2003* (*Studies in Health and Technology Informatics*, 102 (2004)), Amsterdam: IOS Press, 2004, 145–164.

> **Abstract:** We present the details of a methodology for quality assurance in large medical terminologies and describe three algorithms that can help terminology developers and users to identify potential mistakes. The methodology is based in part on linguistic criteria and in part on logical and ontological principles governing sound classifications. We conclude by outlining the results of applying the methodology in the form of a taxonomy different types of errors and potential errors detected in SNOMED-CT.

55. Pierre Grenon, Barry Smith and Louis Goldberg, "Biodynamic Ontology: Applying BFO in the Biomedical Domain", in D. M. Pisanelli (ed.), *Ontologies in Medicine*: *Proceedings of the Workshop on Medical Ontologies, Rome October 2003* (*Studies in Health and Technology Informatics*, 102), Amsterdam: IOS Press, 2004, 20–38.

> **Abstract:** We propose a modular formal ontology of the biomedical domain with two components, one for biological objects, corresponding broadly to anatomy, and one for biological processes, corresponding broadly to physiology. The result constitutes what might be described as a joint venture between two perspectives – of so-called three-dimensionalism and four-dimensionalism – which are normally regarded as incompatible. We outline an approach which allows them to be combined together, and provide examples of its application in biomedicine.

56. Barry Smith, Igor Papakin and Katherine Munn, "Bodily Systems and the Spatial-Functional Structure of the Human Body", in D. M. Pisanelli (ed.), *Ontologies in Medicine*: *Proceedings of the Workshop on Medical Ontologies, Rome October 2003* (*Studies in Health and Technology Informatics*, 102 (2004)), Amsterdam: IOS Press, 2004, 39–63.

> **Abstract:** The human body is a system made of systems. The body is divided into bodily systems proper, such as the endocrine and circulatory systems, which are subdivided into many sub-systems at a variety of levels, whereby all systems and subsystems engage in massive causal interaction with each other and with their surrounding environments. Here we offer an explicit definition of bodily system and provide a framework for understanding their causal interactions. Medical sciences provide at best informal accounts of basic notions such as system, process, and function, and while such informality is acceptable in documentation created for human beings, it falls short of what is needed for computer representations. In our analysis we will accordingly provide the framework for a formal definition of bodily system and of associated notions.

57. Anand Kumar, Paolo Ciccarese, Barry Smith and Matteo Piazza, "Context-Based Task Ontologies for Clinical Guidelines", in D. M. Pisanelli (ed.), *Ontologies in Medicine*: *Proceedings of the Workshop on Medical Ontologies, Rome October 2003* (*Studies in Health and Technology Informatics*, 102 (2004)), Amsterdam: IOS Press, 2004, 81–94.

> **Abstract:** Evidence-based medicine relies on the execution of clinical practice guidelines and protocols. A great deal of of effort has been invested in the development of various tools which automate the representation and execution of the recommendations contained within such guidelines and protocols by creating Computer Interpretable Guideline Models (CIGMs). Context-based task ontologies (CTOs), based on standard terminology systems like UMLS, form one of the core components of such a model. We have created DAML+OIL-based CTOs for the tasks mentioned in the WHO guideline for hypertension management, drawing comparisons also with other related guidelines. The advantages of CTOs include: contextualization of ontologies, providing ontologies tailored to specific aspects of the phenomena of interest, dividing the complexity involved in creating ontologies into different levels, providing a methodology by

means of which the task recommendations contained within guidelines can be integrated into the clinical practices of a health care set-up.

58. Anand Kumar, Barry Smith, Domenico M. Pisanelli, Aldo Gangemi and Mario Stefanelli, "An Ontological Framework for the Implementation of Clinical Guidelines in Health Care Organizations," in D. M. Pisanelli (ed.), *Ontologies in Medicine*: *Proceedings of the Workshop on Medical Ontologies* (Rome October 2003), Amsterdam: IOS Press, 2004, 95–107.

Abstract: The paper presents the outlines of an ontology of plans and guidelines, which is then used as the basis for a framework for implementing guideline-based systems for the management of workflow in health care organizations. The framework has a number of special features, above all in that it enables us to represent in formal terms assignments of work-items both to individuals and to teams and to tailor guideline to specific contexts of application in health care organizations. It is designed also to enable implementations to do justice to the fact that the processes carried out in health care organizations may deviate in different ways from the norms set forth in corresponding guideline definitions. This means that implementations built in conformity with the framework will be marked by a type of flexibility that might make them more likely to be accepted by healthcare professionals than are standard guideline-based management systems.

59. Werner Ceusters, Barry Smith, Anand Kumar and Christoffel Dhaen, "Ontology-Based Error Detection in SNOMED-CT", in M. Fieschi, *et al*. (eds.), *Medinfo 2004*, Amsterdam: IOS Press, 482–486.

Abstract: Quality assurance in large terminologies is a difficult issue. We present two algorithms that can help terminology developers and users to identify potential mistakes. We demonstrate the methodology by outlining the different types of mistakes that are found when the algorithms are applied to SNOMED-CT®. On the basis of the results, we argue that both formal logical and linguistic tools should be used in the development and quality-assurance process of large terminologies.

60. Barry Smith and Cornelius Rosse, "The Role of Foundational Relations in the Alignment of Biomedical Ontologies", in M. Fieschi, *et al*. (eds.), *Medinfo 2004*, Amsterdam: IOS Press, 444–448.

Abstract: The Foundational Model of Anatomy (FMA) symbolically represents the structural organization of the human body from the macromolecular to the macroscopic levels, with the goal of providing a robust and consistent scheme for classifying anatomical entities that is designed to serve as a reference ontology in biomedical informatics. Here we articulate the need for formally clarifying the *is-a* and *part-of* relations in the FMA and similar ontology and terminology systems. We diagnose certain characteristic errors in the treatment of these relations and show how these errors can be avoided through adoption of the formalism we describe. We then illustrate how a consistently applied formal treatment of taxonomy and partonomy can support the alignment of ontologies.

61. Jonathan Simon, James Matthew Fielding and Barry Smith, "Using Philosophy to Improve the Coherence and Interoperability of Applications Ontologies: A Field Report on the Collaboration of IFOMIS and L&C", in Gregor Büchel, Bertin Klein and Thomas Roth-Berghofer (eds.), *Proceedings of the First Workshop on Philosophy and Informatics. Deutsches Forschungszentrum für künstliche Intelligenz*, Cologne: 2004 (CEUR Workshop Proceedings 112), 65–72.

Abstract: The collaboration of Language and Computing nv (L&C) and the Institute for Formal Ontology and Medical Information Science (IFOMIS) is guided by the hypothesis that quality constraints on ontologies for software applications purposes closely parallel the constraints salient to the design of sound philosophical theories. The extent of this parallel has been poorly appreciated in the informatics community, and it turns out that importing the benefits of philosophical insight and methodology into applications domains yields diverse improvements. L&C's LinKBase® is one of the world's largest medical domain ontologies. Its current primary

use pertains to natural language processing applications, but it also supports intelligent navigation through a range of structured medical and bioinformatics information resources, such as UMLS, SNOMED, Swiss-Prot, and the Gene Ontology (GO). In this report we discuss how and why philosophical methods improve both the internal coherence of LinKBase®, and its capacity to serve as a translation hub, improving the interoperability of the ontologies it embeds.

62. Anand Kumar and Barry Smith, "Towards a Proteomics Meta-Classification", *IEEE Fourth Symposium on Bioinformatics and Bioengineering,* Taichung, Taiwan. IEEE Press, 2004, 419–427.

> **Abstract:** There is a recognized need for a meta-classification that can serve as a foundation for more refined ontologies in the field of proteomics. Standard data sources classify proteins in terms of just one or two specific aspects. Thus SCOP (Structural Classification of Proteins) is described as classifying proteins on the basis of structural features; SWISS-PROT annotates proteins on the basis of their structure and of parameters like post-translational modifications. Such data sources are connected to each other by pairwise term-to-term mappings. However, there are obstacles which stand in the way of combining them together to form a robust meta-classification of the needed sort. We discuss some formal ontological principles which should be taken into account within the existing datasources in order to make such a metaclassification possible, taking into account also the Gene Ontology (GO) and its application to the annotation of proteins.

63. James M. Fielding, Jonathan Simon, Werner Ceusters and Barry Smith, "Ontological Theory for Ontological Engineering: Biomedical Systems Information Integration", *Proceedings of the Ninth International Conference on the Principles of Knowledge Representation and Reasoning* (KR2004), Whistler, BC, 2-5 June 2004, 114–120.

> **Abstract:** Software application ontologies have the potential to become the keystone in state-of-the-art information management techniques. It is expected that these ontologies will support the sort of reasoning power required to navigate large and complex terminologies correctly and efficiently. Yet, there is one problem in particular that continues to stand in our way. As these terminological structures increase in size and complexity, and the drive to integrate them inevitably swells, it is clear that the level of consistency required for such navigation will become correspondingly difficult to maintain. While descriptive semantic representations are certainly a necessary component to any adequate ontology-based system, so long as ontology engineers rely solely on semantic information, without a sound ontological theory informing their modeling decisions, this goal will surely remain out of reach. In this paper we describe how Language and Computing nv (L&C), along with The Institute for Formal Ontology and Medical Information Sciences (IFOMIS), are working towards developing and implementing just such a theory, combining the open software architecture of L&C's LinkSuiteTM with the philosophical rigor of Basic Formal Ontology. In this way we aim to move beyond the more or less simple controlled vocabularies that have dominated the industry to date.

64. Olivier Bodenreider, Barry Smith, Anand Kumar and Anita Burgun, "Investigating Subsumption in DL-Based Terminologies: A Case Study in Snomed-CT", in U. Hahn, S. Schulz and R. Cornet (eds.), *Proceedings of the First International Workshop on Formal Biomedical Knowledge Representation* (KR-MED 2004), 12–20.

> **Abstract:** Formalisms such as description logics (DL) are sometimes expected to help terminologies ensure compliance with sound ontological principles. The objective of this paper is to study the degree to which one DL-based biomedical terminology (SNOMED CT) complies with such principles. We defined seven ontological principles (for example: each class must have at least one parent, each class must differ from its parent) and examined the properties of SNOMED CT classes with respect to these principles. Our major results are: 31% of the classes have a single child; 27% have multiple parents; 51% do not exhibit any differentiae between the description of the parent and that of the child. The applications of this study to quality assurance for ontologies are discussed and suggestions are made for dealing with multiple inheritance.

65. Anand Kumar, Barry Smith and Christian Borgelt, "Dependence Relationships between Gene Ontology Terms based on TIGR Gene Product Annotations", *Proceedings of CompuTerm 2004: 3rd International Workshop on Computational Terminology*, Sophia Ananadiou and Pierre Zweigenbaum (eds.), Geneva: Coling, 31–38.

> **Abstract:** The Gene Ontology is an important tool for the representation and processing of information about gene products and functions. It provides controlled vocabularies for the designations of cellular components, molecular functions, and biological processes used in the annotation of genes and gene products. These constitute three separate ontologies, of cellular components), molecular functions and biological processes, respectively. The question we address here is: how are the terms in these three separate ontologies related to each other? We use statistical methods and formal ontological principles as a first step towards finding answers to this question.

66. Barry Smith and Christiane Fellbaum, "Medical WordNet: A New Methodology for the Construction and Vfalidation of Information Resources for Consumer Health", *Proceedings of Coling: The 20th International Conference on Computational Linguistics*, Geneva 23-27 August 2004, 371–382.

> **Abstract:** A consumer health information system must be able to comprehend both expert and non-expert medical vocabulary and to map between the two. We describe an on-going project to create a new lexical database called Medical WordNet (MWN), consisting of medically relevant terms used by and intelligible to non-expert subjects and supplemented by a corpus of natural-language sentences that is designed to provide medically validated contexts for MWN terms. The corpus derives primarily from online health information sources targeted to consumers, and involves two sub-corpora, called Medical FactNet (MFN) and Medical BeliefNet (MBN), respectively. The former consists of statements accredited as true on the basis of a rigorous process of validation, the latter of statements which non-experts believe to be true. We summarize the MWN / MFN / MBN project, and describe some of its applications.

67. Olivier Bodenreider Barry Smith and Anita Burgun, "The Ontology-Epistemology Divide: A Case Study in Medical Terminology", Achille Varzi and Laure Vieu (eds.), *Formal Ontology in Information Systems. Proceedings of the Third International Conference (FOIS 2004)*, Amsterdam: IOS Press, 2004, 185–195.

> **Abstract:** Medical terminology collects and organizes the many different kinds of terms employed in the biomedical domain both by practitioners and also in the course of biomedical research. In addition to serving as labels for biomedical classes, these names reflect the organizational principles of biomedical vocabularies and ontologies. Some names represent invariant features (classes, universals) of biomedical reality (i.e., they are a matter for ontology). Other names, however, convey also how this reality is perceived, measured, and understood by health professionals (i.e., they belong to the domain of epistemology). We analyze terms from several biomedical vocabularies in order to throw light on the interactions between ontological and epistemological components of these terminologies. We identify four cases: 1) terms containing classification criteria, 2) terms reflecting detectability, modality, uncertainty, and vagueness, 3) terms created in order to obtain a complete partition of a given domain, and 4) terms reflecting mere fiat boundaries. We show that epistemology-loaded terms are pervasive in biomedical vocabularies, that the "classes" they name often do not comply with sound classification principles, and that they are therefore likely to cause problems in the evolution and alignment of terminologies and associated ontologies. This paper introduces the idea of *epistemological intrusion* into the study of medical ontologies.

68. Barry Smith, "Beyond Concepts: Ontology as Reality Representation", Achille Varzi and Laure Vieu (eds.), *Formal Ontology in Information Systems. Proceedings of the Third International Conference (FOIS 2004)*, Amsterdam: IOS Press, 2004, 73–84.

> **Abstract:** There is an assumption commonly embraced by ontological engineers, an assumption which has its roots in the discipline of knowledge representation, to the effect that it is concepts

which form the subject-matter of ontology. The term 'concept' is hereby rarely precisely defined, and the intended role of concepts within ontology is itself subject to a variety of conflicting (and sometimes intrinsically incoherent) interpretations. It seems, however, to be widely accepted that concepts are in some sense the products of human cognition. The present essay is devoted to the application of ontology in support of research in the natural sciences. It defends the thesis that ontologies developed for such purposes should be understood as having as their subject matter, not concepts, but rather the universals and particulars which exist in reality and are captured in scientific laws. We outline the benefits of a view along these lines by showing how it yields rigorous formal definitions of the foundational relations used in many influential ontologies, illustrating our results by reference to examples drawn from the domain of the life sciences.

69. Fabian Neuhaus, Pierre Grenon and Barry Smith, "A Formal Theory of Substances, Qualities, and Universals", Achille Varzi and Laure Vieu (eds.), *Formal Ontology in Information Systems. Proceedings of the Third International Conference (FOIS 2004)*, Amsterdam: IOS Press, 2004, 49–58.

> **Abstract:** One of the tasks of ontology in information science is to support the classification of entities according to their kinds and qualities. We hold that to realize this task as far as entities such as material objects are concerned we need to distinguish four kinds of entities: substance particulars, quality particulars, substance universals, and quality universals. These form, so to speak, an ontological square. We present a formal theory of classification based on this idea, including both a semantics for the theory and a provably sound axiomatization.

70. Thomas Bittner, Maureen Donnelly and Barry Smith, "Individuals, Universals, Collections: On the Foundational Relations of Ontology", in Achille Varzi and Laure Vieu (eds.), *Formal Ontology in Information Systems. Proceedings of the Third International Conference (FOIS 2004)*, Amsterdam: IOS Press, 2004, 37–48.

> **Abstract:** This paper provides an axiomatic formalization of a theory of foundational relations between three categories of entities: individuals, universals, and collections. We deal with a variety of relations between entities in these categories, including the is-a relation among universals and the part-of relation among individuals as well as cross-category relations such as instance-of, member-of, and partition-of. We show that an adequate understanding of the formal properties of such relations – in particular their behavior with respect to time – is critical for formal ontology. We provide examples to support this thesis from the domain of biomedicine.

71. Thomas Bittner and Barry Smith, "Normalizing Medical Ontologies Using Basic Formal Ontology", *Kooperative Versorgung, Vernetzte Forschung, Ubiquitäre Information,* Proceedings of GMDS 2004, Niebüll: Videel OHG, 199–201.

> **Abstract:** Description Logics are nowadays widely accepted as formalisms which provide reasoning facilities which allow us to discover inconsistencies in ontologies in an automatic fashion. Where ontologies are developed in modular fashion, they allow changes in one module to propogated through the system of ontologies automatically in a way which helps to maintain consistency and stability. For this feature to be utilized effectively, however, requires that domain ontologies be represented in a normalized form.

72. Barry Smith, "Ontologie-basierte Qualitätssicherung medizinischer Terminologien", *Kooperative Versorgung, Vernetzte Forschung, Ubiquitäre Information,* Proceedings of GMDS 2004, Niebüll: Videel OHG, 193–195.

> **Abstract:** Die medizinische Ontologie soll helfen, die Flut medizinischer Information soweit zu kanalisieren, dass sie ohne Vereinfachungen oder Verzerrungen computergestützt verarbeitet werden kann. Nach ontologischen Kriterien aufbereitete Terminologiesysteme sollen darüber hinaus die Integration von Daten aus heterogenen Quellen unterstützen.

73. Lowell Vizenor and Barry Smith, "Speech Acts and Medical Records: The Ontological Nexus", *Proceedings of the International Joint Meeting EuroMISE 2004*, Jana Zvarova, *et al.* (eds.), Prague, EuroMISE 2004, p.61. Expanded version.

Abstract: Despite the recent advances in information and communication technology that have increased our ability to store and circulate information, the task of ensuring that the right sorts of information gets to the right sorts of people remains. We argue that the many efforts underway to develop efficient means for sharing information across healthcare systems and organizations would benefit from a careful analysis of human action in healthcare organizations. This in turn requires that the management of information and knowledge within healthcare organizations be combined with models of resources and processes of patient care that are based on a general ontology of social interaction.

74. James Mathew Fielding, Jonathan Simon and Barry Smith, "Formal Ontology for Biomedical Knowledge Systems Integration", *Proceedings of the International Joint Meeting EuroMISE 2004*, Jana Zvarova, *et al.* (eds.), Prague, EuroMISE 2004, 62-66.

Abstract: The central hypothesis of the collaboration between Language and Computing (L&C) and the Institute for Formal Ontology and Medical Information Science (IFOMIS) is that the methodology and conceptual rigor of a philosophically inspired formal ontology will greatly benefit software application ontologies. To this end LinKBase®, L&C's ontology, which is designed to integrate and reason across various external databases simultaneously, has been submitted to the conceptual demands of IFOMIS's Basic Formal Ontology (BFO). With this, we aim to move beyond the level of controlled vocabularies to yield an ontology with the ability to support reasoning applications.

75. Barry Smith, "The Logic of Biological Classification and the Foundations of Biomedical Ontology", in Petr Hájek, Luis Valdés-Villanueva and Dag Westerståhl (ed.), *Logic, Methodology and Philosophy of Science. Proceedings of the 12th International Conference*, London: King's College Publications, 2005, 505–520.

Abstract: Biomedical research is increasingly a matter of the navigation through large computerized information resources deriving from functional genomics or from the biochemistry of disease pathways. To make such navigation possible, controlled vocabularies are needed in terms of which data from different sources can be unified. One of the most influential developments in this regard is the so-called Gene Ontology, which consists of controlled vocabularies of terms used by biologists to describe cellular constituents, biological processes and molecular functions, organized into hierarchies via the relation of class subsumption. Here we seek to provide a rigorous account of the logic of classification that underlies GO and similar biomedical ontologies. Drawing on Aristotle, we develop a system of axioms and definitions for the treatment of biological classes and instances.

76. Anand Kumar and Barry Smith, "Enhancing GO for the Sake of Clinical Bioinformatics", *Proceedings of Bio-Ontologies Workshop,* Intelligent Systems for Molecular Biology (ISMB 2004), Glasgow, July 30.

Abstract: Recent work on the quality assurance of the Gene Ontology (GO, Gene Ontology Consortium 2004) from the perspective of both linguistic and ontological organization has made it clear that GO lacks the kind of formalism needed to support logic-based reasoning. At the same time it is no less clear that GO has proven itself to be an excellent terminological resource that can serve to combine together a variety of biomedical database and information systems. Given the strengths of GO, it is worth investigating whether, by overcoming some of its weaknesses from the point of view of formalontological principles, we might not be able to enhance a version of GO which can come even closer to serving the needs of the various communities of biomedical researchers and practitioners. It is accepted that clinical and bioinformatics need to find common ground if the results of data-intensive biomedical research are to be harvested to the full. It is also widely accepted that no single method will be sufficient to create the needed common framework. We believe that the principles-based approach to life-science data integration and knowledge representation must be one of the methods applied. Indeed in dealing with the ontological representation of carcinomas, and specifically of colon carcinomas, we have established that, had GO (and related biomedical ontologies) followed some of the basic formal-ontological principles we have identified (Smith et al. 2004, Ceusters et al. 2004), then the effort required to navigate successfully between clinical and bioinformatics systems would have been reduced. We point here to the sources of ontologicallyrelated errors in GO, and also provide arguments as to why and how such errors need to be resolved.

77. Barry Smith and Anand Kumar, "On the Proper Treatment of Pathologies in Biomedical Ontologies", *Proceedings of Bio-Ontologies Workshop*, Intelligent Systems for Molecular Biology (ISMB 2005), Detroit, 22–23.

Abstract: In previous work on biomedical ontologies we showed how the provision of formal definitions for relations such as *is_a* and *part_of* can support new types of automated reasoning about biomedical phenomena. We here extend this approach to the *transformation_of* characteristic of pathologies.

78. Barry Smith, "Against Fantology", in Johann C. Marek and Maria E. Reicher (eds.), *Experience and Analysis*, Vienna: HPT&ÖBV, 2005, 153–170.

Abstract: The analytical philosophy of the last one hundred years has been heavily influenced by a doctrine to the effect that one can arrive at a correct ontology by paying attention to certain superficial (syntactic) features of first-order predicate logic as conceived by Frege and Russell. More specifically, it is a doctrine to the effect that the key to the ontological structure of reality is captured syntactically in the 'Fa' (or, in more sophisticated versions, in the 'Rab') of first-order logic, where 'F' stands for what is general in reality and 'a' for what is individual. Hence "f(a)ntology". Because predicate logic has exactly two syntactically different kinds of referring expressions – 'F', 'G', 'R', etc., and 'a', 'b', 'c', etc. – so reality must consist of exactly two correspondingly different kinds of entity: the general (properties, concepts) and the particular (things, objects), the relation between these two kinds of entity being revealed in the predicate-argument structure of atomic formulas in first-order logic.

79. Anand Kumar and Barry Smith, "Oncology Ontology in the NCI Thesaurus", *AIME 2005* (*Artificial Intelligence in Medicine Europe*), (Lecture Notes in Computer Science 3581), 213–220.

Abstract: The National Cancer Institute's Thesaurus (NCIT) has been created with the goal of providing a controlled vocabulary which can be used by specialists in the various sub-domains of oncology. It is intended to be used for purposes of annotation in ways designed to ensure the integration of data and information deriving from these various sub-domains, and thus to support more powerful cross-domain inferences. In order to evaluate its suitability for this purpose, we examined the NCIT's treatment of the kinds of entities which are fundamental to an ontology of colon carcinoma. We here describe the problems we uncovered concerning classification, synonymy, relations and definitions, and we draw conclusions for the work needed to establish the NCIT as a reference ontology for the cancer domain in the future.

80. Barry Smith, Werner Ceusters and Rita Temmerman, "Wüsteria", *Medical Informatics Europe* (MIE 2005), Geneva, *Studies in Health Technology and Informatic,* 116 (2005), 647–652.

Abstract: The last two decades have seen considerable efforts directed towards making Electronic Health Records interoperable through improvements in medical ontologies, terminologies and coding systems. Unfortunately, these efforts have been hampered by a number of influential ideas inherited from the work of Eugen Wüster, the father of terminology standardization and the founder of ISO TC 37. We here survey Wüster's ideas – which see terminology work as being focused on the classification of concepts in people's minds – and we argue that they serve still as the basis for a series of influential confusions. We argue further that an ontology based unambiguously, not on concepts, but on the classification of entities in reality can, by removing these confusions, make a vital contribution to ensuring the interoperability of coding systems and healthcare records in the future.

81. Werner Ceusters and Barry Smith, "Tracking Referents in Electronic Health Records", *Medical Informatics Europe* (MIE 2005), Geneva, *Studies in Health Technology and Informa*tics 116 (2005), 71–76.

Abstract: Electronic Health Records (EHRs) are organized around two kinds of statements: those reporting observations made, and those reporting acts performed. In neither case does the record involve any direct reference to what such statements are actually about. They record not: what is happening on the side of the patient, but rather: what is said about what is

happening. While the need for a unique patient identifier is generally recognized, we argue that we should now move to an EHR regime in which all clinically salient particulars – from the concrete disorder on the side of the patient and the body parts in which it occurs to the concrete treatments given – should be uniquely identified. This will allow us to achieve interoperability among different systems of records at the level where it really matters: in regard to what is happening in the real world. It will also allow us to keep track of particular disorders and of the effects of particular treatments in a precise and unambiguous way. We discuss the ontological and epistemological aspects of our claim and describe a scenario for implementation within EHR systems.

82. Anand Kumar, Y. Lina Yip, Barry Smith, Dirk Marwede and Daniel Novotny, "An Ontology for Carcinoma Classification for Clinical Bioinformatics", *Medical Informatics Europe* (MIE 2005), *Studies in Health Technology and Informatics*, 116, (2005) 635-40.

Abstract: There are a number of existing classifications and staging schemes for carcinomas, one of the most frequently used being the TNM classification. Such classifications represent classes of entities which exist at various anatomical levels of granularity. We argue that in order to apply such representations to the Electronic Health Records one needs sound ontologies which take into consideration the diversity of the domains which are involved in clinical bioinformatics. Here we outline a formal theory for addressing these issues in a way that the ontologies can be used to support inferences relating to entities which exist at different anatomical levels of granularity. Our case study is the colon carcinoma, one of the most common carcinomas prevalent within the European population.

83. Louis J. Goldberg, Werner Ceusters, John Eisner and Barry Smith, "The Significance of SNODENT", *Medical Informatics Europe* (MIE 2005), Geneva, *Studies in Health Technology and Informatics*, vol. 116, 2005, 737–742.

Abstract: SNODENT is a dental diagnostic vocabulary incompletely integrated in SNOMED-CT. Nevertheless, SNODENT could become the de facto standard for dental diagnostic coding. SNODENT's manageable size, the fact that it is administratively self-contained, and relates to a well-understood domain provides valuable opportunities to formulate and test, in controlled experiments, a series of hypothesis concerning diagnostic systems. Of particular interest are questions related to establishing appropriate quality assurance methods for its optimal level of detail in content, its ontological structure, its construction and maintenance. This paper builds on previous software-based methodologies designed to assess the quality of SNOMED-CT.

84. Barry Smith, Jose L.V. Mejino Jr., Stefan Schulz, Anand Kumar and Cornelius Rosse, "Anatomical Information Science", in A. G. Cohn and D. M. Mark (eds.), *Spatial Information Theory. Proceedings of COSIT 2005* (Lecture Notes in Computer Science 3693), Berlin/Heidelberg/New York: Springer, 149–164.

Abstract: The Foundational Model of Anatomy (FMA) is a map of the human body. Like maps of other sorts – including the map-like representations we find in familiar anatomical atlases – it is a representation of a certain portion of spatial reality as it exists at a certain (idealized) instant of time. But unlike other maps, the FMA comes in the form of a sophisticated ontology of its object-domain, comprising some 1.5 million statements of anatomical relations among some 70,000 anatomical kinds. It is further distinguished from other maps in that it represents not some specific portion of spatial reality (say: Leeds in 1996), but rather the generalized or idealized spatial reality associated with a generalized or idealized human being at some generalized or idealized instant of time. It will be our concern in what follows to outline the approach to ontology that is represented by the FMA and to argue that it can serve as the basis for a new type of anatomical information science. We also draw some implications for our understanding of spatial reasoning and spatial ontologies in general.

85. Stephan Schulz, Philipp Daumke, Barry Smith and Udo Hahn, "How to Distinguish Parthood from Location in Bioontologies", *Proceedings of the AMIA Symposium 2005*, Washington DC, 669–673. PMC1560856

Abstract: The pivotal role of the relation *part-of* in the description of living organisms is widely acknowledged. Organisms are open systems, which means that in contradistinction to mechanical artifacts they are characterized by a continuous flow and exchange of matter. A closer analysis of the spatial relations in biological organisms reveals that the decision as to whether a given particular is *part-of* a second particular or whether it is only *contained-in* the second particular is often controversial. We here propose a rule-based approach which allows us to decide on the basis of well-defined criteria which of the two relations holds between two anatomical objects, given that one spatially includes the other. We discuss the advantages and limitations of this approach, using concrete examples from human anatomy.

86. Barry Smith and Werner Ceusters, "An Ontology-Based Methodology for the Migration of Medical Terminologies to Electronic Health Records", *Proceedings of AMIA Symposium 2005*, Washington DC, 704–708. PMC1560617

Abstract: Biomedical terminologies are focused on what is general, Electronic Health Records (EHRs) on what is particular, and it is commonly assumed that the step from the one to the other is unproblematic. We argue that this is not so, and that, if the EHR of the future is to fulfill its promise, then the foundations of both EHR architectures and biomedical terminologies need to be reconceived. We accordingly describe a new framework for the treatment of both generals and particulars in biomedical information systems that is designed: 1) to provide new opportunities for the sharing and management of data within and between healthcare institutions, 2) to facilitate interoperabilityforms among different terminology and record systems, and thereby 3) to allow new kinds of reasoning with biomedical data.

87. Cornelius Rosse, Anand Kumar, Jose Leonardo V. Mejino, Daniel L. Cook, Landon T. Detwiler and Barry Smith, "A Strategy for Improving and Integrating Biomedical Ontologies", *Proceedings of AMIA Symposium 2005,* Washington DC, 639–643. PMC1560467

Abstract: The integration of biomedical terminologies is indispensable to the process of information integration. When terminologies are linked merely through the alignment of their leaf terms, however, differences in context and ontological structure are ignored. Making use of the SNAP and SPAN ontologies, we show how three reference domain ontologies can be integrated at a higher level, through what we shall call the OBR framework (for: Ontology of Biomedical Reality). OBR is designed to facilitate inference across the boundaries of domain ontologies in anatomy, physiology and pathology.

88. Werner Ceusters and Barry Smith, "Requirements for natural language understanding in referent-tracking based electronic health records", *Computer Science and IT with/for Biology*, C. Maria Keet and Enrico Franconi (eds.), Free University of Bolzano, 2005, 43-46.

Abstract: Most electronic patient records contain identifiers to uniquely identify entities such as the patient, the physician, and the healthcare facility. None, however, contains thus far identifiers that uniquely identify the particular disorders patients have, the symptoms they experienced, the actual treatments that have been applied, and so forth. Referent tracking has been introduced as a paradigm to make this also a standard procedure. In this talk, we discuss how natural language understanding can contribute to this.

89. Barry Smith and Werner Ceusters, "HL7 RIM: An Incoherent Standard" (MIE 2006), *Studies in Health Technology and Informatics*, vol. 124, 133–138. (This issue also published as *Ubiquity: Technologies for Better Health in Aging Societies. Proceedings of MIE2006*, edited by Arie Hasman, Reinhold Haux, Johan van der Lei, Etienne De Clercq, Francis Roger-France, Amsterdam: IOS Press, 2006.)

Abstract: The Health Level 7 Reference Information Model (HL7 RIM) is lauded by its authors as 'the foundation of healthcare interoperability'. Yet even after some 10 years of development work, the RIM is still subject to a variety of logical and ontological flaws, which has placed severe obstacles in the way of those who are called upon to develop implementations. We offer evidence that these obstacles are insurmountable and that the time has come to abandon an unworkable paradigm.

90. Werner Ceusters, Peter Elkin and Barry Smith "Referent Tracking: The Problem of Negative Findings" (MIE 2006), *Studies in Health Technology and Informatics*, vol. 124, 741–6. (This issue also published as *Ubiquity: Technologies for Better Health in Aging Societies. Proceedings of MIE2006*, edited by Arie Hasman, Reinhold Haux, Johan van der Lei, Etienne De Clercq, Francis Roger-France, Amsterdam: IOS Press, 2006.)

> **Abstract:** The paradigm of referent tracking is based on a realist presupposition which rejects so-called negative entities (congenital absent nipple, and the like) as spurious. How, then, can a referent tracking-based Electronic Health Record deal with what are standardly called 'negative findings'? To answer this question we carried out an analysis of some 748 sentences drawn from patient charts and containing some form of negation. Our analysis shows that to deal with these sentences we need to introduce a new ontological relationship between a particular and a universal, which holds when no instance of the universal has a specific qualified ontological relation with the particular. This relation is found to be able to accommodate nearly all occurrences of negative findings in the examined sample, in ways which involve no reference to negative entities.

91. Werner Ceusters and Barry Smith, "A Realism-Based Approach to the Evolution of Biomedical Ontologies", *Proceedings of the Annual AMIA Symposium*, Washington DC, 2006, 121-125. PMC1839444.

> **Abstract:** We present a novel methodology for calculating the improvements obtained in successive versions of biomedical ontologies. The theory takes into account changes both in reality itself and in our understanding of this reality. The successful application of the theory rests on the willingness of ontology authors to document changes they make by following a number of simple rules. The theory provides a pathway by which ontology authoring can become a science rather than an art, following principles analogous to those that have fostered the growth of modern evidence-based medicine. Although in this paper we focus on ontologies, the methodology can be generalized to other sorts of terminology-based artifacts, including Electronic Patient Records.

92. Barry Smith, "Against Idiosyncrasy in Ontology Development", in B. Bennett and C. Fellbaum (Eds.), *Formal Ontology in Information Systems* (FOIS 2006), Amsterdam: IOS Press, 2006, 15-26.

> **Abstract:** The world of ontology development is full of mysteries. Recently, ISO Standard 15926 ("Lifecycle Integration of Process Plant Data Including Oil and Gas Production Facilities"), a data model initially designed to support the integration and handover of large engineering artefacts, has been proposed by its principal custodian for general use as an upper-level ontology. As we shall discover, ISO 15926 is, when examined in light of this proposal, marked by a series of quite astonishing defects, which can however provide general lessons for the developers of ontologies in the future.
>
> Russian translation

93. Barry Smith, Waclaw Kusnierczyk, Daniel Schober, Werner Ceusters, "Towards a Reference Terminology for Ontology Research and Development in the Biomedical Domain", O. Bodenreider, ed., *Proceedings of KR-MED* (CEUR, 222), 2006, 57-66.

> **Abstract:** Ontology is a burgeoning field, involving researchers from the computer science, philosophy, data and software engineering, logic, linguistics, and terminology domains. Many ontology-related terms with precise meanings in one of these domains have different meanings in others. Our purpose here is to initiate a path towards disambiguation of such terms. We draw primarily on the literature of biomedical informatics, not least because the problems caused by unclear or ambiguous use of terms have been there most thoroughly addressed. We advance a proposal resting on a distinction of three levels too often run together in biomedical ontology research: 1. the level of reality; 2. the level of cognitive representations of this reality; 3. the level of textual and graphical artifacts. We propose a reference terminology for ontology research and development that is designed to serve as common hub into which the several

competing disciplinary terminologies can be mapped. We then justify our terminological choices through a critical treatment of the 'concept orientation' in biomedical terminology research.

94. Darren A. Natale, Cecilia N. Arighi, Winona Barker, Judith Blake, Ti-Cheng Chang, Zhangzhi Hu, Hongfang Liu, Barry Smith, and Cathy H. Wu, "Framework for a Protein Ontology", *Proceedings of the 1st International Workshop on Text Mining in Bioinformatics*, 2006, 29-36. Journal version.

95. Barry Smith, "On Place and Space: The Ontology of the Eruv", in C. Kanzian (ed.), *Cultures: Conflict – Analysis – Dialogue*, Frankfurt: Ontos Verlag, 2007, 403-416.

Abstract: 'Eruv' is a Hebrew word meaning literally 'mixture' or 'mingling'. An eruv is an urban region demarcated within a larger urban region by means of a boundary made up of telephone wires or similar markers. Through the creation of the eruv, the smaller region is turned symbolically (halachically = according to Jewish law) into a private domain. So long as they remain within the boundaries of the eruv, Orthodox Jews may engage in activities that would otherwise be prohibited on the Sabbath, such as pushing prams or wheelchairs, or carrying walking sticks. There are eruvim in many towns and university campuses throughout the world. There are five eruvim in Chicago, five in Brooklyn, twenty three in Queens and Long Island, and at least three in Manhattan. The US Supreme Court is (like most other major US Federal Government buildings) located within the eruv of Washington DC. In many cases, not all of those living within or near the area of an actual or proposed eruv will themselves be Orthodox Jews, and this has sometimes led to protests against eruv creation. It is such protests which triggered the writing of this essay.

96. Ceusters W, Smith B. "Referent Tracking and its Applications", *Proceedings of the Workshop WWW2007 Workshop i³: Identity, Identifiers, Identification (Workshop on Entity-Centric Approaches to Information and Knowledge Management on the Web),* Banff, Canada, May 8, 2007, http://ceur-ws.org/Vol-249/.

Abstract: Referent tracking (RT) is a new paradigm, based on unique identification, for representing and keeping track of particulars. It was first introduced to support the entry and retrieval of data in electronic health records (EHRs). Its purpose is to avoid the ambiguity that arises when statements in an EHR refer to disorders or other entities on the side of the patient exclusively by means of compound descriptions utilizing general terms such as 'pimple on nose' or 'small left breast tumor'. In this paper, we describe the theoretical foundations of this paradigm and show how it is being applied to the solution of analogous problems of ambiguous identification in the fields of digital rights management, corporate memories and decision algorithms.

97. Blake J, Hill DP, Smith B. "Gene Ontology annotations: What they mean and where they come from", *Proceedings of the Bio-Ontologies Workshop*, ISMB/ECCB, Vienna, July 20, 2007, 79-82. Journal version.

98. Daniel Schober, Waclaw Kusnierczyk, Suzanna E Lewis, Jane Lomax, Members of the MSI, PSI Ontology Working Groups, Chris Mungall, Philippe Rocca-Serra, Barry Smith and Susanna-Assunta Sansone, "Towards naming conventions for use in controlled vocabulary and ontology engineering", *Proceedings of the Bio-Ontologies Workshop*, ISMB/ECCB, Vienna, July 20, 2007, 87-90. Journal version.

Abstract: For most people, the term 'standard' generates an immediate impulse to run in the opposite direction. We all know that this means someone is bent upon the 'one, true capitalization style', thereby fomenting an instantaneous rebellion. While it is somewhat audacious to propose standards, the adoption of a few shared simple conventions is an important strategy to improve quality in controlled vocabularies and ontologies we build. Ontologies should not only satisfy computational requirements, but also meet the needs of human readers who are trying to understand them. When confronted by the full complexity of an ontology, logical coherence and predictable naming is important, then our guesses about where something may be found, or what it is called, are right more often than wrong. Conforming to naming

conventions in ontology construction will help consumers more readily understand what is intended and avoid the introduction of faults, and it is here where its value lies.

99. Werner Ceusters, Kent Spackman and Barry Smith, "Would SNOMED-CT Benefit from Realism-Based Ontology Evolution?", *Proceedings of the Annual Symposium of the American Medical Informatics Association*, Chicago, IL, 2007, 105-109. PMC2655780

Abstract: If SNOMED-CT is to serve as a biomedical reference terminology, then steps must be taken to ensure comparability of information formulated using successive versions. New releases are therefore shipped with a history mechanism. We assessed the adequacy of this mechanism for its treatment of the distinction between changes occurring on the side of entities in reality and changes in our understanding thereof. We found that these two types are only partially distinguished and that a more detailed study is required to propose clear recommendations for enhancement along at least the following lines: (1) explicit representation of the provenance of a class; (2) separation of the time-period during which a component is stated valid in SNOMED-CT from the period it is (or has been) valid in reality, and (3) redesign of the historical relationships table to give users better assistance for recovery in case of introduced mistakes.

100. Ron Rudnicki, Werner Ceusters, Shahid Manzoor and Barry Smith, "What Particulars are Referred to in EHR Data? A Case Study in Integrating Referent Tracking into an Electronic Health Record Application", *Proceedings of the Annual Symposium of the American Medical Informatics Association*, Chicago, IL, 2007, 630-634. PMC2655819.

Abstract: The Referent Tracking paradigm, which advocates the use of instance unique identifiers to refer to the entities comprising the subject matter of patient health records, promises many benefits to those who use health record data to improve patient care. To further the adoption of the paradigm we provide an illustration of how data from an EHR application needs to be decomposed to make it accord with the tenets of Referent Tracking. We describe the ontological principles on which such decomposition needs to be based in order to allow integration efforts to be applied to other EHR applications by interested parties. We find that an ordinary statement from an EHR reveals a surprising amount of 'hidden' data that is revealed by its decomposition according to these principles.

101. Terry Janssen, Herbert Basik, Mike Dean, Barry Smith, "A Multi-INT Semantic Reasoning Framework for Intelligence Analysis Support", *Proceedings of Ontology for the Intelligence Community, Columbia MD, November 2007*, 27-32.

Abstract: The volume of data available to intelligence agencies and the complexity of the national security environment are increasing so quickly as to overwhelm a finite workforce of analysts. Machines must augment human cognitive capacity in order to achieve the needed level of situational awareness. We describe the state of the art in ontology-based approaches to addressing these problems as they arise in other domains, and outline the results of a Lockheed Martin IRAD project to address some of the specific challenges confronting integration of the data generated by multiple intelligence agencies.

Reprinted as "A Multi-INT Semantic Reasoning Framework for Intelligence Analysis Support", in: L. Obrst, T. Janssen, W. Ceusters (eds.), *Ontologies and Semantic Technologies for the Intelligence Community* (Frontiers in Artificial Intelligence and Applications), Amsterdam: IOS Press, 2010, 57-69.

102. Stefan Schulz, Holger Stenzhorn, Martin Boeker, Rudiger Klar, Barry Smith, "Clinical Ontologies Interfacing the Real World", *Third International Conference on Semantic Technologies* (i-semantics 2007), Graz, Österreich, September 2007, 356-363.

Abstract: The desideratum of semantic interoperability has been intensively discussed in medical informatics circles in recent years. Originally it was assumed by many that this issue could be addressed simply by insisting on the application of shared clinical terminologies. More

recently however the use of the term 'ontology' has been steadily growing. We here address the issue of the degree to which the use of ontologies represents any real advance on the road to semantic interoperability.

103. Anand Kumar and Barry Smith, "The Ontology of Processes and Functions: A Study of the International Classification of Functioning Disability and Health", In: *Sharing Knowledge through the ICF: 13th Annual North American WHO Collaborating Center Conference on the ICF*, Niagara Falls, June 7, 2007. North American WHO Collaborating Center (2007)

Abstract: The International Classification of Functioning, Disability and Health provides a classification of human bodily functions, which, while exhibiting non-conformance to many formal ontological principles, provides an insight into which basic functions such a classification should include. Its evaluation is an important first step towards such an adequate ontology of this domain

104. Mitsuhiro Okada, Barry Smith, and Yutaro Sugimoto, "Remarks on Logic for Process Descriptions in Ontological Reasoning: A Drug Interaction Ontology (DIO) Case Study", *InterOntology. Proceedings of the First Interdisciplinary Ontology Meeting*, Tokyo, Japan, 26-27 February 2008, 127-138.

Abstract: We present some ideas on logical process descriptions, using relations from the DIO (Drug Interaction Ontology) as examples and explaining how these relations can be naturally decomposed in terms of more basic structured logical process descriptions using terms from linear logic. In our view, the process descriptions are able to clarify the usual relational descriptions of DIO. In particular, we discuss the use of logical process descriptions in proving linear logical theorems. Among the types of reasoning supported by DIO one can distinguish both (1) basic reasoning about general structures in reality and (2) the domain-specific reasoning of experts. We here propose a clarification of this important distinction between (realist) reasoning on the basis of an ontology and rule-based inferences on the basis of an expert's view.

105. Barry Smith, "The Evaluation of Ontologies: Editorial Review vs. Democratic Ranking", *Proceedings of InterOntology 2008* (Tokyo, Japan, 26-27 February 2008), 127-138.

Abstract: Increasingly, the high throughput technologies used by biomedical researchers are bringing about a situation in which large bodies of data are being described using controlled structured vocabularies—also known as ontologies—in order to support the integration and analysis of this data. Annotation of data by means of ontologies is already contributing in significant ways to the cumulation of scientific knowledge and, prospectively, to the applicability of cross-domain algorithmic reasoning in support of scientific advance. This very success, however, has led to a proliferation of ontologies of varying scope and quality. We define one strategy for achieving quality assurance of ontologies—a plan of action already adopted by a large community of collaborating ontologists—which consists in subjecting ontologies to a process of peer review analogous to that which is applied to scientific journal articles.

106. Cecilia Arighi, Hongfang Liu, Darren Natale, Winona Barker, Harold Drabkin, Zhangzhi Hu, Judith Blake, Barry Smith and Cathy Wu, "TGF-beta Signaling Proteins and the Protein Ontology", *Proceedings of Bio-Ontologies Workshop,* Intelligent Systems for Molecular Biology (ISMB 2008), Toronto, 25-28. Journal version.

Abstract: The Protein Ontology (PRO) addresses the need for a formal description of proteins and their evolutionary relationships. PRO is authored via manual curation on the basis of content derived automatically from various data sources. Curation is needed to ensure correct representations of relationships both internally (between PRO nodes) and externally (to other ontologies). Focusing specifically on the TGF-beta signaling proteins, we describe how this ontology can be used for multiple purposes, including annotation, representation of objects in pathways, data integration, and the representation of biological system dynamics and of disease etiology.

107. Robert Arp and Barry Smith, "Function, Role, and Disposition in Basic Formal Ontology", *Proceedings of the Bio-Ontologies Workshop*, Intelligent Systems for Molecular Biology (ISMB 2008), Toronto, 45-48. Revised version (2011).

> **Abstract:** Numerous research groups are now utilizing Basic Formal Ontology (BFO) as an upper-level framework to assist in the organization and integration of biomedical information. This paper provides elucidation of the three existing BFO subcategories of realizable entity, namely function, role, and disposition. It proposes one further sub-category of tendency, and considers the merits of recognizing two sub-categories of function for domain ontologies, namely, artifactual and biological function. The motivation is to help advance the coherent ontological treatment of functions, roles, and dispositions, to help provide the potential for more detailed classification, and to shed light on BFO's general make-up and use.

108. Barry Smith, "Ontology (Science)", in C. Eschenbach and M. Grüninger (eds.), *Formal Ontology in Information Systems. Proceedings of the Fifth International Conference (FOIS 2008)*, Amsterdam: IOS Press, 21-35.

> **Abstract:** Increasingly, in data-intensive areas of the life sciences, experimental results are being described in algorithmically useful ways with the help of ontologies. Such ontologies are authored and maintained by scientists to support the retrieval, integration and analysis of their data. The proposition to be defended here is that ontologies of this type – the Gene Ontology (GO) being the most conspicuous example – are a part of science. Initial evidence for the truth of this proposition (which some will find self-evident) is the increasing recognition of the importance of empirically-based methods of evaluation to the ontology development work being undertaken in support of scientific research. The ontologies created by scientists must, of course, be associated with implementations satisfying the requirements of software engineering. But these ontologies are not themselves engineering artifacts, and to conceive them as such brings grievous consequences. Rather, we shall argue, ontologies such as the GO are comparable to scientific theories, to scientific databases, or to scientific journal publications. Such a view implies a radically new conception of what is involved in the authoring, maintenance and application of ontologies in scientific contexts, and therewith also a radically new approach to the evaluation of ontologies and to the training of ontologists.

109. Richard H. Scheuermann, Werner Ceusters, and Barry Smith, "Toward an Ontological Treatment of Disease and Diagnosis", *Proceedings of the 2009 AMIA Summit on Translational Bioinformatics*, 2009, 116-120.

> **Abstract:** Many existing biomedical vocabulary standards rest on incomplete, inconsistent or confused accounts of basic terms pertaining to diseases, diagnoses, and clinical phenotypes. Here we outline what we believe to be a logically and biologically coherent framework for the representation of such entities and of the relations between them. We defend a view of disease as involving in every case some physical basis within the organism that bears a disposition toward the execution of pathological processes. We present our view in the form of a list of terms and definitions designed to provide a consistent starting point for the representation of both disease and diagnosis in information systems in the future.

110. Werner Ceusters and Barry Smith, "What do Identifiers in HL7 Identify? An Essay in the Ontology of Identity", *Proceedings of InterOntology 2009* (Tokyo, Japan, February 27-March 1, 2009), 77-86.

> **Abstract:** Health Level 7 (HL7) is an organization seeking to provide universal standards for the exchange of healthcare information. In a document entitled 'HL7 Version 3 Standard: Data Types', the HL7 organization advances descriptions of data types recommended for use as identifiers. We will argue that the descriptions supplied provide insufficient guidance as to what exactly the entities are which these data types uniquely identify. Are they real things, such as persons or pieces of equipment? Or are they representations of such real things in information artifacts? We here outline the problems faced by HL7 in providing answers to such questions, problems which arise because of the lack of anything like a coherent ontology in the HL7 standard, and we make some recommendations for future improvements.

111. Werner Ceusters, Maria Capolupo, Barry Smith, Georges De Moor, "An Evolutionary Approach to the Representation of Adverse Events", *Medical Informatics Europe* (MIE 2009), Sarajevo, *Studies in Health Technology and Informatics*, 150 (2009) 537-541. PMC2829617

> **Abstract:** One way to detect, monitor and prevent adverse events with the help of Information Technology is by using ontologies capable of representing three levels of reality: what is the case, what is believed about reality, and what is represented. We report on how Basic Formal Ontology and Referent Tracking exhibit this capability and how they are used to develop an adverse event ontology and related data annotation scheme for the European ReMINE project.

112. Bernd Blobel, Dipak Kalra, Marc Koehn, Ken Lunn, Peter Pharow, Pekka Ruotsalainen, Stefan Schulz, Barry Smith, "The Role of Ontologies for Sustainable, Semantically Interoperable and Trustworthy EHR Solutions", *Medical Informatics Europe* (MIE 2009), Sarajevo, *Studies in Health Technology and Informatics*, 150 (2009), 953-957.

> **Abstract:** As health systems around the world turn towards highly distributed, specialized and cooperative structures to increase quality and safety of care as well as efficiency and efficacy of delivery processes, there is a growing need for supporting communication and collaboration of all parties involved with advanced ICT solutions. The Electronic Health Record (EHR) provides the information platform which is maturing towards the eHealth core application. To meet the requirements for sustainable, semantically interoperable, and trustworthy EHR solutions, different standards and different national strategies have been established. The workshop summarizes the requirements for such advanced EHR systems and their underlying architecture, presents different strategies and solutions advocated by corresponding protagonists, discusses pros and cons as well as harmonization and migration strategies for those approaches. It particularly highlights a turn towards ontology-driven architectures. The workshop is a joint activity of the EFMI Working Groups "Electronic Health Records" and "Security, Safety and Ethics".

113. Barry Smith, Kristo Mietinnin and William Mandrick, The Ontology of Command and Control, *Proceedings of the 14th International Command and Control Research and Technology Symposium* (ICCRTS), Washington DC, Jun 15-17, Arlington, VA: The Command and Control Research Program, 2009.

> **Abstract:** The goal of the Department of Defense Net-Centric Data Strategy is to improve data sharing throughout the DoD. Data sharing is a critical element of interoperability in the emerging system-of-systems. Achieving interoperability requires the elimination of two types of data heterogeneity: differences of syntax and differences of semantics. This paper builds a path toward semantic uniformity through application of a disciplined approach to ontology. An ontology is a consensus framework representing the types of entities within a given domain and the relations between them. The construction of an ontology begins when a Community of Interest (COI) identifies its authoritative data sources (ADS), which are usually manifest in relevant doctrinal publications, glossaries, data dictionaries, and logical data models. The identified terms are then defined in relation to a common logical framework that has been designed to ensure interoperability with other ontologies created on the basis of the same strategy. As will be described, the Command and Control (C2) Ontology will include representations of a substantial number of entities within the Command and Control (C2) domain. If domain ontologies (e.g. Strike and Counterinsurgency) semantically align with the C2 Ontology, then a substantial barrier to systems interoperability is thereby crossed.

114. Albert Goldfain, Lindsay G. Cowell, Barry Smith, "Towards an Ontological Representation of Resistance: The Case of MRSA", *ICBO 2009: Proceedings of the First International Conference on Biomedical Ontology*, 61-64.

> **Abstract:** This paper addresses a family of issues surrounding the biological phenomenon of resistance and its representation in realist ontologies. Resistance terms from various existing ontologies are examined and found to be either overly narrow, inconsistent, or otherwise

problematic. We propose a more coherent ontological representation using the antibiotic resistance in Methicillin-Resistant Staphylococcus aureus (MRSA) as a case study.

115. Barry Smith, Lowell Vizenor and James Schoening, "Universal Core Semantic Layer", *Ontology for the Intelligence Community*, Proceedings of the Third OIC Conference, George Mason University, Fairfax, VA, October 2009, CEUR Workshop Proceedings, vol. 555.

Abstract: The Universal Core (UCore) was a central element of the US National Information Sharing Strategy supported by multiple U.S. Federal Government Departments, by the intelligence community, and by a number of other national and international institutions. The goal of the UCore initiative is to foster information sharing by means of an XML schema providing consensus representations for four groups of universally understood terms under the headings who, what, when, and where. We here describe a project to create an ontology-based supporting layer for UCore, entitled 'Universal Core Semantic Layer' (UCore SL), and describe how UCore SL can be applied to further UCore's information sharing goals.

116. Shahid Manzoor, Werner Ceusters and Barry Smith, "Referent Tracking for Command and Control Messaging Systems", *Proceedings of Ontology for the Intelligence Community*, George Mason University, Fairfax, VA, October 2009, CEUR Workshop Proceedings, vol. 555.

Abstract: The Joint Battle Management Language (JBML) is an XML-based language designed to allow Command and Control (C2) systems to interface easily with Modeling and Simulation (M&S) systems. While some of the XML-tags defined in this language correspond to types of entities that exist in reality, others are mere syntactic artifacts used to structure the messages themselves. Because these two kinds of tags are not formally distinguishable, JBML messages in effect confuse data with what the data represent. In this paper we show how a realism-based ontology combined with a rule language can be used to make these distinctions explicit. The approach allows storage of the contents of JBML messages in a Referent Tracking System in a format that mimics the structure of reality thereby providing an aid to message validation.

117. Werner Ceusters and Barry Smith, "Malaria Diagnosis and the Plasmodium Life Cycle: The BFO Perspective", in *Interdisciplinary Ontology. Proceedings of the Third Interdisciplinary Ontology Meeting* (Tokyo, Japan, February 27-28, 2010), Tokyo: Keio University Press, 2010, 25-34.

Abstract: Definitive diagnosis of malaria requires the demonstration through laboratory tests of the presence within the patient of malaria parasites or their components. Since malaria parasites can be present even in the absence of malaria manifestations, and since symptoms of malaria can be manifested even in the absence of malaria parasites, malaria diagnosis raises important issues for the adequate understanding of disease, etiology and diagnosis. One approach to the resolution of these issues adopts a realist view, according to which the needed clarifications will be derived from a careful representation of the entities on the side of the patient which form the ultimate truthmakers for clinical statements. We here address a challenge to this realist approach relating to the diagnosis of malaria, and show how this challenge can be resolved by appeal to Basic Formal Ontology (BFO) and to the Ontology for General Medical Science (OGMS) constructed in its terms.

118. Werner Ceusters and Barry Smith, "A Unified Framework for Biomedical Terminologies and Ontologies", *Proceedings of Medinfo 2010,* Cape Town, South Africa, Amsterdam: IOS Press, 12-15 September 2010 (*Studies in Health Technology and Informatics* 2010, 160) 1050-1054. PMC3104298

Abstract: The goal of the OBO (Open Biomedical Ontologies) Foundry initiative is to create and maintain an evolving collection of non-overlapping interoperable ontologies that will offer unambiguous representations of the types of entities in biological and biomedical reality. These ontologies are designed to serve non-redundant annotation of data and scientific text. To achieve these ends, the Foundry imposes strict requirements upon the ontologies eligible for inclusion. While these requirements are not met by most existing biomedical terminologies, the

latter may nonetheless support the Foundry's goal of consistent and non-redundant annotation if appropriate mappings of data annotated with their aid can be achieved. To construct such mappings in reliable fashion, however, it is necessary to analyze terminological resources from an ontologically realistic perspective in such a way as to identify the exact import of the 'concepts' and associated terms which they contain. We propose a framework for such analysis – based on the analysis of configurations and groups of entities in reality – that is designed to maximize the degree to which legacy terminologies and the data coded with their aid can be successfully used for information-driven clinical and translational research.

119. Albert Goldfain, Barry Smith and Lindsay G. Cowell, "Dispositions and the Infectious Disease Ontology", in Antony Galton and Riichiro Mizoguchi (eds.), *Formal Ontology in Information Systems. Proceedings of the Sixth International Conference (FOIS 2010)*, Amsterdam: IOS Press, 2010, 400-413.

Abstract: This paper addresses the use of dispositions in the Infectious Disease Ontology (IDO). IDO is an ontology constructed according to the principles of the Open Biomedical Ontology (OBO) Foundry and uses the Basic Formal Ontology (BFO) as an upper ontology. After providing a brief introduction to disposition types in BFO and IDO, we discuss three general techniques for representing combinations of dispositions under the headings blocking dispositions, complementary dispositions, and collective dispositions. Motivating examples for each combination of dispositions is given along with a specific use case in IDO. Description logic restrictions are used to formalize statements relating to these combinations.

120. Kerry Trentelman, Alan Ruttenberg, Barry Smith, "An Axiomatisation of Basic Formal Ontology with Projection Functions", *Advances in Ontologies*, *Proceedings of the Sixth Australasian Ontology Workshop (AOW 2010), Adelaide, 7 December 2010*, Kerry Taylor, Thomas Meyer and Mehmet Orgun (eds.), 2010, Sydney: ACS, 71-80.

Abstract: This paper proposes a reformulation of the treatment of boundaries, at parts and aggregates of entities in Basic Formal Ontology. These are currently treated as mutually exclusive, which is inadequate for biological representation since some entities may simultaneously be at parts, boundaries and/or aggregates. We introduce functions which map entities to their boundaries, at parts or aggregations. We make use of time, space and spacetime projection functions which, along the way, allow us to develop a simple temporal theory.

121. Barry Smith, Werner Ceusters, Louis J. Goldberg, Richard Ohrbach, "Towards an Ontology of Pain", in Mitsu Okada (ed.), *Proceedings of the Conference on Ontology and Analytical Metaphysics*, February 24-25, 2011, Tokyo: Keio University Press, 2011, 23-36.

Abstract: We present an ontology of pain and of other pain-related phenomena, building on the definition of pain provided by the International Association for the Study of Pain (IASP). Our strategy is to identify an evolutionarily basic canonical pain phenomenon, involving unpleasant sensory and emotional experience based causally in localized tissue damage that is concordant with that experience. We then show how different variant cases of this canonical pain phenomenon can be distinguished, including pain that is elevated relative to peripheral trauma, pain that is caused neuropathically (thus with no necessary peripheral stimulus), and pain reports arising through deception either of self or of others. We describe how our approach can answer some of the objections raised against the IASP definition, and sketch how it can be used to support more sophisticated discrimination of different types of pain resulting in improved data analysis that can help in advancing pain research.

Japanese translation: "痛みと痛み関連の現象のオントロジー (分類体系) に向けて (特集 痛むカラダ–当事者研究最前線)", 現代思想 (Contemporary Thought), 39 (11), 2011, 172-180.

Russian translation

122. Barry Smith, "The Ontology of Documents", in Mitsu Okada (ed.), *Proceedings of the Conference on Ontology and Analytical Metaphysics*, February 24-25, 2011, Tokyo: Keio University Press, 2011, 1-6.

Abstract: As is well known, speech acts such as acts of promising can have ontological consequences. For example an act of promising can give rise to a mutually correlated claim and obligation. Increasingly, speech acts in the narrow sense are being augmented by the use of documents of multiple different sorts. In this paper we analyze the results of this augmentation from the ontological point of view, considering especially the domains of law and commerce. We show how document acts are not isolated phenomena, but rather form large and complex systems with other entities, including occurrent entities such as acts of signing and inspecting, as well as speech acts for example of instructing people to sign or complete a document. The paper concludes with a consideration of some of the special problems associated with the use of digital documents, for example as concerns issues of security and provenance.

Russian translation

123. Janna Hastings, Werner Ceusters, Barry Smith, Kevin Mulligan, "Dispositions and Processes in the Emotion Ontology", *Proceedings of the 2nd International Conference on Biomedical Ontology*, Buffalo, NY, July 28-30, 2011 (CEUR Workshop Proceedings, 833), 71-78.

Abstract: Affective science conducts interdisciplinary research into the emotions and other affective phenomena. Currently, such research is hampered by the lack of common definitions of te rms used to describe, categorise and report both individual emotional experiences and the results of scientific investigations of such experiences. High quality ontologies provide formal definitions for types of entities in reality and for the relationships between such entities, definitions which can be used to disambiguate and unify data across different disciplines. Heretofore, there has been little effort directed towards such formal representation for affective phenomena, in part because of widespread debates within the affective science community on matters of definition and categorization. We describe our efforts towards developing an Emotion Ontology (EMO) to serve the affective science community. We here focus on conformity to the BFO upper ontology and disambiguation of polysemous terminology.

124. Jobst Landgrebe, Barry Smith, "The HL7 Approach to Semantic Interoperability", *Proceedings of the 2nd International Conference on Biomedical Ontology*, Buffalo, NY, July 28-30, 2011 (CEUR Workshop Proceedings, 833), 139-146.

Abstract: Health Level 7 (HL7) is an international standards development organisation in the domain of healthcare information technology. Initially the mission of HL7 was to enable data exchange via the creation of syntactic standards which supported point-to-point messaging. Currently HL7 sees its mission as one of creating standards for semantic interoperability in healthcare IT on the basis of its flagship "version 3" (v3). Unfortunately, v3 has been plagued by quality and consistency issues, and it has not been able to keep pace with recent developments either in semantics and ontology or in computer science and engineering. HL7's response has been to develop its "Services-Aware Interoperability Framework" (SAIF), which is intended to provide a foundation for work on all aspects of standardization in HL7 henceforth. We here summarise the major design principles that must be satisfied by a semantic interoperability framework – principles relating both to static semantics and to computational behaviour. We then assess the SAIF in light of these principles. We conclude that the SAIF is not in a position to support the needed reform of the HL7 v3 family of standards.

125. Jiye Ai, Mauricio Almeida, Andre Andrade, Alan Ruttenberg, David T.W. Wong, Barry Smith, "Towards a Body Fluids Ontology: A Unified Application Ontology for Basic and Translational Science", *Proceedings of the ICBO Workshop on Working with Multiple Biomedical Ontologies,* Buffalo, NY, July 26, 2011 (CEUR Workshop Proceedings, 833), 381-386.

Abstract: We describe the rationale for an application ontology covering the domain of human body fluids that is designed to facilitate representation, reuse, sharing and integration of

diagnostic, physiological, and biochemical data, We briefly review the Blood Ontology (BLO), Saliva Ontology (SALO) and Kidney and Urinary Pathway Ontology (KUPO) initiatives. We discuss the methods employed in each, and address the project of using them as starting point for a unified body fluids ontology resource. We conclude with a description of how the body fluids ontology initiative may provide support to basic and translational science.

126. Albert Goldfain, Barry Smith, Sivaram Arabandi, Mathias Brochhausen, William R. Hogan, "Vital Sign Ontology", *Proceedings of the Workshop on Bio-Ontologies*, ISMB, Vienna, June 2011, 71-74.

Abstract: We introduce the Vital Sign Ontology (VSO), an extension of the Ontology for General Medical Science (OGMS) that covers the consensus human vital signs: blood pressure, body temperature, respiratory rate, and pulse rate. VSO provides a controlled structured vocabulary for describing vital sign measurement data, the processes of measuring vital signs, and the anatomical entities participating in such measurements. VSO is implemented in OWL-DL and follows OBO Foundry guidelines and best practices. If properly developed and extended, we believe the VSO will find applications for the EMR, clinical informatics, and medical device communities.

127. David Salmen, Tatiana Malyuta, Alan Hansen, Shaun Cronen, Barry Smith, "Integration of Intelligence Data through Semantic Enhancement", *Proceedings of the Conference on Semantic Technology in Intelligence, Defense and Security* (STIDS), George Mason University, Fairfax, VA, November 16-17, 2011, CEUR, Vol. 808, 6-13.

Abstract: We describe a strategy for integration of data that is based on the idea of semantic enhancement. The strategy promises a number of benefits: it can be applied incrementally; it creates minimal barriers to the incorporation of new data into the semantically enhanced system; it preserves the existing data (including any existing data-semantics) in their original form (thus all provenance information is retained, and no heavy preprocessing is required); and it embraces the full spectrum of data sources, types, models, and modalities (including text, images, audio, and signals). The result of applying this strategy to a given body of data is an evolving Dataspace that allows the application of a variety of integration and analytic processes to diverse data contents. We conceive semantic enhancement (SE) as a lightweight and flexible process that leverages the richness of the structured contents of the Dataspace without adding storage and processing burdens to what, in the intelligence domain, will be an already storage- and processing-heavy starting point. SE works not by changing the data to which it is applied, but rather by adding an extra semantic layer to this data. We sketch how the semantic enhancement approach can be applied consistently and in cumulative fashion to new data and data-models that enter the Dataspace.

128. Janna Hastings, Werner Ceusters, Barry Smith, Kevin Mulligan, "The Emotion Ontology: Enabling Interdisciplinary Research in the Affective Sciences", in *CONTEXT '11, The Seventh International and Interdisciplinary Conference on Modeling and Using Context*, Karlsruhe, Germany, September 26-30, 2011, Berlin/Heidelberg: Springer, 119-123.

Abstract: Affective science conducts interdisciplinary research into the emotions and other affective phenomena. Currently, such research is hampered by the lack of common definitions of terms used to describe, categorise and report both individual emotional experiences and the results of scientific investigations of such experiences. High quality ontologies provide formal definitions for types of entities in reality and for the relationships between such entities, definitions which can be used to disambiguate and unify data across different disciplines. Heretofore, there has been little effort directed towards such formal representation for affective phenomena, in part because of widespread debates within the affective science community on matters of definition and categorization. To address this requirement, we are developing an Emotion Ontology.

129. Cecilia N. Arighi, Darren A. Natale, Judith A. Blake, Carol J. Bult, Michael Caudy, Alexander D. Diehl, Harold J. Drabkin, Peter D'Eustachio, Alexei Evsikov, Hongzhan

Huang, Natalia V. Roberts, Alan Ruttenberg, Barry Smith, Jian Zhang, Cathy H. Wu, "Protein-Centric Connection of Biomedical Knowledge: Protein Ontology (PRO) Research and Annotation Tools", *Proceedings of the 2nd International Conference on Biomedical Ontology*, Buffalo, NY, July 28-30, 2011, 285-287.

> **Abstract:** The Protein Ontology (PRO) web resource provides an integrative framework for protein-centric exploration and enables specific and precise annotation of proteins and protein complexes based on PRO. Functionalities include: browsing, searching and retrieving, terms, displaying selected terms in OBO or OWL format, and supporting URIs. In addition, the PRO website offers multiple ways for the user to request, submit, or modify terms and/or annotation. We will demonstrate the use of these tools for protein research and annotation.

130. Patricia L. Whetzel, Natasha Noy, Nigam Shah, Paul Alexander, Michael Dorf, Ray Fergerson, Margaret-Anne Storey, Barry Smith, Chris Chute, Mark Musen, "Bioportal: Ontologies and Integrated Data Resources at the Click of a Mouse", *Proceedings of the 2nd International Conference on Biomedical Ontology*, Buffalo, NY, July 28-30, 2011, 292-293.

> **Abstract:** BioPortal is a Web portal that provides access to a library of biomedical ontologies and terminologies developed in OWL, RDF(S), OBO format, Protégé frames, and Rich Release Format. BioPortal functionality, driven by a service-oriented architecture, includes the ability to browse, search and visualize ontologies (Figure 1). The Web interface also facilitates community-based participation in the evaluation and evolution of ontology content.

131. Barry Smith, "On Classifying Material Entities in Basic Formal Ontology", in *Interdisciplinary Ontology. Proceedings of the Third Interdisciplinary Ontology Meeting,* Tokyo: Keio University Press, 2012, 1-13.

> **Abstract:** Basic Formal Ontology (BFO) was created in 2002 as an upper-level ontology to support the creation of consistent lower-level ontologies, initially in the subdomains of biomedical research, now also in other areas, including defense and security. BFO is currently undergoing revisions in preparation for the release of BFO version 2.0. We summarize some of the proposed revisions in what follows, focusing on BFO's treatment of material entities, and specifically of the category object.

132. Janna Hastings, Nicolas Le Novère, Werner Ceusters, Kevin Mulligan and Barry Smith, "Wanting What We Don't Want to Want: Representing Addiction in Interoperable Bio-Ontologies", *Proceeedings of the Third International Conference on Biomedical Ontology* (CEUR 897), Graz, July 23-25, 2012, 56-60.

> **Abstract:** Ontologies are being developed throughout the biomedical sciences to address standardization, integration, classification and reasoning needs against the background of an increasingly data-driven research paradigm. In particular, ontologies facilitate the translation of basic research into benefits for the patient by making research results more discoverable and by facilitating knowledge transfer across disciplinary boundaries. Addressing and adequately treating mental illness is one of our most pressing public health challenges. Primary research across multiple disciplines such as psychology, psychiatry, biology, neuroscience and pharmacology needs to be integrated in order to promote a more comprehensive understanding of underlying processes and mechanisms, and this need for integration only becomes more pressing with our increase in understanding of differences among individuals and populations at the molecular level concerning susceptibility to specific illnesses. Substance addiction is a particularly relevant public health challenge in the developed world, affecting a substantial percentage of the population, often co-morbid with other illnesses such as mood disorders. Currently, however, there is no straightforward automated method to combine data of relevance to the study of substance addiction across multiple disciplines and populations.
>
> In this contribution, we describe a framework of interlinked, interoperable bio-ontologies for the annotation of primary research data relating to substance addiction, and discuss how this framework enables easy integration of results across disciplinary boundaries. We describe entities and relationships relevant for the description of addiction within the Mental Functioning

Ontology, Chemical Entities of Biological Interest Ontology, Protein Ontology, Gene Ontology and the Neuroscience Information Framework ontologies.

133. Ramona Walls, Barry Smith, Justin Elser, Albert Goldfain, Dennis W. Stevenson and Pankaj Jaiswal, "A Plant Disease Extension of the Infectious Disease Ontology", *Proceeedings of the Third International Conference on Biomedical Ontology* (CEUR 897), Graz, July 23-25, 2012, 1-5.

Abstract: Plants from a handful of species provide the primary source of food for all people, yet this source is vulnerable to multiple stressors, such as disease, drought, and nutrient deficiency. With rapid population growth and climate uncertainty, the need to produce crops that can tolerate or resist plant stressors is more crucial than ever. Traditional plant breeding methods may not be sufficient to overcome this challenge, and methods such as highOthroughput sequencing and automated scoring of phenotypes can provide significant new insights. Ontologies are essential tools for accessing and analysing the large quantities of data that come with these newer methods. As part of a larger project to develop ontologies that describe plant phenotypes and stresses, we are developing a plant disease extension of the Infectious Disease Ontology (IDOPlant). The IDOPlant is envisioned as a reference ontology designed to cover any plant infectious disease. In addition to novel terms for infectious diseases, IDOPlant includes terms imported from other ontologies that describe plants, pathogens, and vectors, the geographic location and ecology of diseases and hosts, and molecular functions and interactions of hosts and pathogens. To encompass this range of data, we are suggesting in-house ontology development complemented with reuse of terms from orthogonal ontologies developed as part of the Open Biomedical Ontologies (OBO) Foundry. The study of plant diseases provides an example of how an ontological framework can be used to model complex biological phenomena such as plant disease, and how plant infectious diseases differ from, and are similar to, infectious diseases in other organism.

134. Albert Goldfain, Barry Smith and Lindsay Cowell, "Constructing a Lattice of Infectious Disease Ontologies from a Staphylococcus aureus Isolate Repository", *Proceeedings of the Third International Conference on Biomedical Ontology* (CEUR 897), Graz, July 23-25, 2012.

Abstract: A repository of clinically associated Staphylococcus aureus (Sa) isolates is used to semi-automatically generate a set of application ontologies for specific subfamilies of Sa-related disease. Each such application ontology is compatible with the Infectious Disease Ontology (IDO) and uses resources from the Open Biomedical Ontology (OBO) Foundry. The set of application ontologies forms a lattice structure beneath the IDO Core and IDO extension reference ontologies. We show how this lattice can be used to define a strategy for the construction of a new taxonomy of infectious disease incorporating genetic, molecular, and clinical data. We also outline how faceted browsing and query of annotated data is supported using a lattice application ontology.

135. Janna Hastings, Werner Ceusters, Mark Jensen, Kevin Mulligan and Barry Smith, "Representing Mental Functioning: Ontologies for Mental Health and Disease", *Towards an Ontology of Mental Functioning* (ICBO Workshop), *Third International Conference on Biomedical Ontology*, Graz, July 22, 2012.

Abstract: Mental and behavioral disorders represent a significant portion of the public health burden in all countries. The human cost of these disorders is immense, yet treatment options for sufferers are currently limited, with many patients failing to respond sufficiently to available interventions and drugs. High quality ontologies facilitate data aggregation and comparison across different disciplines, and may therefore speed up the translation of primary research into novel therapeutics. Realism-based ontologies describe entities in reality and the relationships between them in such a way that – once formulated in a suitable formal language – the ontologies can be used for sophisticated automated reasoning applications. Reference ontologies can be applied across different contexts in which different, and often mutually incompatible, domain-specific vocabularies have traditionally been used. In this contribution we describe the Mental Functioning Ontology (MF) and Mental Disease Ontology (MD), two realism-based ontologies currently under development for the description of humanmental functioning and

disease. We describe the structure and upper levels of the ontologies and preliminary application scenarios, and identify some open questions.

136. Alexander P. Cox, Mark Jensen, William Duncan, Bianca Weinstock-Guttman, Kinga Szigeti, Alan Ruttenberg, Barry Smith and Alexander D. Diehl, "Ontologies for the Study of Neurological Disease", *Towards an Ontology of Mental Functioning* (ICBO Workshop), *Third International Conference on Biomedical Ontology*, Graz, July 22, 2012.

Abstract: We have begun work on two separate but related ontologies for the study of neurological diseases. The first, the Neurological Disease Ontology (ND), is intended to provide a set of controlled, logically connected classes to describe the range of neurological diseases and their associated signs and symptoms, assessments, diagnoses, and interventions that are encountered in the course of clinical practice. ND is built as an extension of the Ontology for General Medical Sciences — a high-level candidate OBO Foundry ontology that provides a set of general classes that can be used to describe general aspects of medical science. ND is being built with classes utilizing both textual and axiomatized definitions that describe and formalize the relations between instances of other classes within the ontology itself as well as to external ontologies such as the Gene Ontology, Cell Ontology, Protein Ontology, and Chemical Entities of Biological Interest. In addition, references to similar or associated terms in external ontologies, vocabularies and terminologies are included when possible. Initial work on ND is focused on the areas of Alzheimer's and other diseases associated with dementia, multiple sclerosis, and stroke and cerebrovascular disease. Extensions to additional groups of neurological diseases are planned. The second ontology, the NeuroPsychological Testing Ontology (NPT), is intended to provide a set of classes for the annotation of neuropsychological testing data. The intention of this ontology is to allow for the integration of results from a variety of neuropsychological tests that assay similar measures of cognitive functioning. Neuropsychological testing is an important component in developing the clinical picture used in the diagnosis of patients with a range of neurological diseases, such as Alzheimer's disease and multiple sclerosis, and following stroke or traumatic brain injury. NPT is being developed as an extension to the Ontology for Biomedical Investigations.

137. Janna Hastings, Werner Ceusters, Kevin Mulligan and Barry Smith, "Annotating affective neuroscience data with the Emotion Ontology", *Towards an Ontology of Mental Functioning* (ICBO Workshop), *Third International Conference on Biomedical Ontology*, Graz, July 22, 2012.

Abstract: The Emotion Ontology is an ontology covering all aspects of emotional and affective mental functioning. It is being developed following the principles of the OBO Foundry and Ontological Realism. This means that in compiling the ontology, we emphasize the importance of the nature of the entities in reality that the ontology is describing. One of the ways in which realism-based ontologies are being successfully used within biomedical science is in the annotation of scientific research results in publicly available databases. Such annotation enables several objectives, including searching, browsing and cross-database data integration. A key benefit conferred by realism-based ontology is that suitably annotated research results are able to be aggregated and compared in a fashion that is based on the underlying reality that the science is studying. This has the potential of increasing the power of statistical analysis and meta-analysis in data-driven science. This aspect has been fruitfully exploited in the investigation of the functions of genes in molecular biology. Cognitive neuroscience uses functional neuroimaging to investigate the brain correlates of areas of mental functioning such as memory, planning and emotion. The use of functional neuroimaging to study affective phenomena such as the emotions is called 'affective neuroscience'. BrainMap is the largest curated database of coordinates and metadata for studies in cognitive neuroscience, including affective neuroscience (Laird et al., 2005). BrainMap data is already classified and indexed using a terminology for classification, called the 'Cognitive Paradigm Ontology' (CogPO), that has been developed to facilitate searching and browsing. However, CogPO has been developed specifically for the BrainMap database, and the data are thus far not annotated to a realism-based ontology which would allow the discovery of interrelationships between research results across different databases on the basis of what the research is about. In this contribution, we describe ongoing work that aims to annotate affective neuroscience data, starting with the BrainMap database,

using the Emotion Ontology. We describe our objectives and technical approach to the annotation, and mention some of the challenges.

138. Barry Smith, Tatiana Malyuta, William S. Mandrick, Chia Fu, Kesny Parent, Milan Patel, "Horizontal Integration of Warfighter Intelligence Data. A Shared Semantic Resource for the Intelligence Community", *Proceedings of the Conference on Semantic Technology in Intelligence, Defense and Security* (STIDS), George Mason University, Fairfax, VA, October 23-25, 2012, CEUR 996, 112-119.

Abstract: We describe a strategy that is being used for the horizontal integration of warfighter intelligence data within the framework of the US Army's Distributed Common Ground System Standard Cloud (DSC) initiative. The strategy rests on the development of a set of ontologies that are being incrementally applied to brcding about what we call the 'semantic enhancement' of data models used within each intelligence discipline. We show how the strategy can help to overcome familiar tendencies to stovepiping of intelligence data, and describe how it can be applied in an agile fashion to new data resources in ways that address immediate needs of intelligence analysts.

139. Barry Smith, "Diagrams, Documents, and the Meshing of Plans", in: András Benedek and Kristóf Nyíri (eds.), *How To Do Things With Pictures: Skill, Practice, Performance*, Frankfurt a. M.: Peter Lang Edition, 2013, 165-179.

Abstract: There are two important ways in which, when dealing with documents, we go beyond the boundaries of linear text. First, by incorporating diagrams into documents, and second, by creating complexes of intermeshed documents which may be extended in space and evolve and grow through time. The thesis of this paper is that such aggregations of documents are today indispensable to practically all complex human achievements from law and finance to orchestral performance and organized warfare. Documents provide for what we can think of as a division of intellectual, instructional, and deontic labour, allowing plans, orders, and obligations to be enmeshed together in a way that often involves the use of diagrammatic elements, as for example in a musical score.

Italian translation as "Diagrammi, documenti e l'intrecciarsi dei piani d'azione" in Tiziana Andina and Carola Barbero (eds.), *Ermeneutica, estetica, ontologia*, Bologna: Il Mulino, 2016, 249-266.

140. William R. Hogan, Mathias Brochhausen, Barry Smith, "A call to urgent action on standard ontologies for translational science", Presented at Translational Science 2013, Washington DC, April 18, 2013, *Clinical and Translational Science*, 6:2, 2013, 57 (Abstract).

Abstract: The Clinical and Translational Science Award (CTSA) Program has always emphasized data standards to promote sharing and comparison of data across the CTSA Consortium and beyond. Yet creation and adoption of such standards is still painfully slow. Urgent action remains necessary. History shows the high value of standard terms, definitions, and symbols (i.e. ontology) to science. But the creation and adoption of such standards often takes decades, as we show with two examples: chemical elements and units of measure. Translational science requires a consistent set of standard ontologies spanning all scales, from molecule to organism to population. But clinical terminologies at the macroscale – such as SNOMED and ICD – inhibit translational science. They are inconsistent with successful micro-scale ontologies such as the Gene Ontology, and they also cannot change rapidly with the advance of science. Translational science must settle on standards that evolve in a way that is closely tied to scientific advance. In the case of chemical symbols and SI Units adoption proceeded in three overlapping stages. First came widespread recognition and understanding of the problem. Second, influential stakeholders helped to develop, test, and select appropriate standards. Third, once scientifically useful standards emerged, the community enforced them via peer review. How can we accelerate progress on clinical ontologies through all three stages? The authors, all of whom are involved in the new CTS Ontology Affinity Group, sketch a plan for the Consortium to invest in and adopt standard clinical ontologies that are open and well disseminated, following the

strategies of the Open Biomedical Ontologies Foundry, Neuroscience Information Framework, and eagle-i/VIVO/CTSAconnect communities.

141. Albert Goldfain, Min Xu, Jonathan Bona and Barry Smith, "Ontology based annotation of contextualized vital signs", *Proceedings of the Fourth International Conference on Biomedical Ontology* (ICBO), Montreal, July 8-9, 2013, CEUR, vol. 1060, 28-33.

Abstract: Representing the kinetic state of a patient (posture, motion, and activity) during vital sign measurement is an important part of continuous monitoring applications, especially remote monitoring applications. In contextualized vital sign representation, the measurement result is presented in conjunction with salient measurement context metadata. We present an automated annotation system for vital sign measurements that uses ontologies from the Open Biomedical Ontology Foundry (OBO Foundry) to represent the patient's kinetic state at the time of measurement. The annotation system is applied to data generated by a wearable personal status monitoring (PSM) device. We demonstrate how annotated PSM data can be queried for contextualized vital signs as well as sensor algorithm configuration parameters.

142. Barry Smith, "Introduction to the logic of definitions", *International Workshop on Definitions in Ontologies*, organized in conjunction with the Fourth International Conference on Biomedical Ontology (ICBO), Montreal, July 7, 2013, CEUR, vol. 1061, 1-2.

Abstract: What follows is a summary of basic principles pertaining to the definitions used in constructing an ontology. A definition is a statement of necessary and sufficient conditions. What this means in the simplest case can be understood as follows. To say that ϕ-ing is a necessary condition for being an A is just another way of saying that every A ϕ's; to say that ϕ-ing is a sufficient condition for being an A is just another way of saying that everything that ϕ's is an A. The goal in writing a definition is to specify a set of conditions of this sort which are all necessary, and which are jointly sufficient.

143. Barry Smith, Tatiana Malyuta, Ron Rudnicki, William Mandrick, David Salmen, Peter Morosoff, Danielle K. Duff, James Schoening, Kesny Parent, "IAO-Intel: An Ontology of Information Artifacts in the Intelligence Domain", *Proceedings of the Eighth International Conference on Semantic Technologies for Intelligence, Defense, and Security*, *Fairfax, VA* (STIDS 2013), CEUR, vol. 1097, 33-40.

Abstract: We describe on-going work on IAO-Intel, an information artifact ontology developed as part of a suite of ontologies designed to support the needs of the US Army intelligence community within the framework of the Distributed Common Ground System (DCGS-A). IAO-Intel provides a controlled, structured vocabulary for the consistent formulation of metadata about documents, images, emails and other carriers of information. It will provide a resource for uniform explication of the terms used in multiple existing military dictionaries, thesauri and metadata registries, thereby enhancing the degree to which the content formulated with their aid will be available to computational reasoning.

144. Werner Ceusters, Chiun Yu Hsu and Barry Smith, "Clinical Data Wrangling Using Ontology and Referent Tracking", *Proceedings of the Fifth* International Conference on Biomedical Ontology (ICBO), Houston, 2014, (CEUR, 1327), 27-32.

Abstract: Ontological realism aims at the development of high quality ontologies that faithfully represent what is general in reality and to use these ontologies to render heterogeneous data collections comparable. To achieve this second goal for clinical research datasets presupposes not merely (1) that the requisite ontologies already exist, but also (2) that the datasets in question are faithful to reality in the dual sense that (a) they denote only particulars and relationships between particulars that do in fact exist and (b) they do this in terms of the types and type-level relationships described in these ontologies. Using Referent Tracking as basis, we describe a strategy for addressing issue (2), which consists in creating for each dataset a template that, when applied to each particular record in the dataset, leads to the generation of a collection of Referent Tracking Tuples (RTT) built out of unique identifiers for the entities

described by means of the data items in the record. The proposed strategy is based on (i) the distinction between data and what data are about, and (ii) the explicit descriptions of portions of reality which RTTs provide and which range not only over the particulars described by data items in a dataset, but also over these data items themselves. This last feature allows us to describe particulars that are only implicitly referred to by the dataset; to provide information about correspondences between data items in a dataset; and to assert which data items are unjustifiably or redundantly present in or absent from the dataset.

145. Albert Goldfain, Barry Smith, Lindsay Cowell, "Ontological Representation of CDC Active Bacterial Core Surveillance Case Reports", *Proceedings of the Fifth International Conference on Biomedical Ontology* (ICBO), Houston, 2014, (CEUR, 1327), 74-77.

Abstract: The Center for Disease Control and Prevention's Active Bacterial Core Surveillance (CDC ABCs) Program is a collaborative effort betweeen the CDC, state health departments, laboratories, and universities to track invasive bacterial pathogens of particular importance to public health. The year-end surveillance reports produced by this program help to shape public policy and coordinate responses to emerging infectious diseases over time. The ABC's case report form (CRF) data represents an excellent opportunity for data reuse beyond the original surveillance purposes. In this work, we focus on methicillin-resistant Staphylococcus aureus (MRSA), which has been tracked by the ABCs program since 2005. We use the Infectious Disease Ontology (IDO) Staphyloccocus aureus extension ontology (IDO-Staph), along with other ontologies following the principles of the Open Biomedical Ontologies Foundry (OBOF) to represent the entities referenced by the MRSA specific ABCs CRF. The goals of this effort are: (1) to demonstrate that infectious disease case report data can be positioned for reuse and linking to complementary data sources at the point of collection, (2) to identify any coverage gaps or limitations in the OBOF representation, and (3) to extend and reassess previous work in the ontology of infectious diseases.

146. Selja Seppälä, Barry Smith and Werner Ceusters, "Applying the Realism-Based Ontology-Versioning Method for Tracking Changes in the Basic Formal Ontology", *Formal Ontology in Information Systems. Proceedings of the Sixth International Conference (FOIS 2014)*, Amsterdam: IOS Press, 227-240.

Abstract: Changes in an upper level ontology have obvious consequences for the domain ontologies that use it at lower levels. It is therefore crucial to document the changes made between successive versions of ontologies of this kind. We describe and apply a method for tracking, explaining and measuring changes between successive versions of upper level ontologies such as the Basic Formal Ontology (BFO). The proposed change-tracking method extends earlier work on Realism-Based Ontology Versioning (RBOV) and Evolutionary Terminology Auditing (ETA). We describe here the application of this evaluation method to changes between BFO 1.0, BFO 1.1, and BFO 2.0. We discuss the issues raised by this application and describe the extensions which we added to the original evaluation schema in order to account for changes in an ontology of this type. Our results show that BFO has undergone eight types of changes that can be systematically explained by the extended evaluation schema. Finally, we discuss problematic cases, possible pitfalls and certain limits of our study that we propose to address in future work.

147. Neil Otte, Brian Donohue and Barry Smith. "An Ontological Approach to Territorial Disputes", *Proceedings of the Conference on Semantic Technology in Intelligence, Defense and Security* George Mason University, Fairfax, VA, (STIDS 2014), CEUR, vol. 1304, 2-9.

Abstract: Disputes over territory are a major contributing factor to the disruption of international relations. We believe that a cumulative, integrated, and continuously updated resource providing information about such disputes in an easily accessible form would be of benefit to intelligence analysts, military strategists, political scientists, and also to historians and others concerned with international disputes. We propose an ontology-based strategy for creating such a resource. The resource will contain information about territorial disputes, arguments for and against claims pertaining to sovereignty, proffered evidence for such claims,

political and military motives (overt or hidden), and associated conflicts. Our approach is designed to address several issues surrounding the representation of geopolitical conflict, including the tracking and individuation of disputes and the validation of disseminated information.

148. Erik Thomsen, Fred Read, William Duncan, Tatiana Malyuta and Barry Smith, "Ontological Support for Living Plan Specification, Execution and Evaluation", *Proceedings of the Conference on Semantic Technology in Intelligence, Defense and Security*, George Mason Ujniversity, Fairfax, VA, , CEUR, vol. 1304 (STIDS 2014), 10-17.

Abstract: Maintaining systems of military plans is critical for military effectiveness, but is also challenging. Plans will become obsolete as the world diverges from the assumptions on which they rest. If too many ad hoc changes are made to intermeshed plans, the ensemble may no longer lead to well-synchronized and coordinated operations, resulting in the system of plans becoming itself incoherent. We describe in what follows an Adaptive Planning process that we are developing on behalf of the Air Force Research Laboratory (Rome) with the goal of addressing problems of these sorts through cyclical collaborative plan review and maintenance. The interactions of world state, blue force status and associated plans are too complex for manual adaptive processes, and computer-aided plan review and maintenance is thus indispensable. We argue that appropriate semantic technology can 1) provide richer representation of plan-related data and semantics, 2) allow for flexible, non-disruptive, agile, scalable, and coordinated changes in plans, and 3) support more intelligent analytical querying of plan-related data.

149. Werner Ceusters and Barry Smith, "Biomarkers in the Ontology for General Medical Science", *Digital Healthcare Empowering Europeans*, R. Cornet et al. (eds.), Amsterdam: IOS Press, 2015, 155-159.

Abstract: A great deal of recent work has been devoted to the topic of biomarkers as aids to diagnosis, prognosis and treatment evaluation. Basing our work on the Ontology for General Medical Science (OGMS) and on the specifications provided by the Institute of Medicine (IOM), we propose definitions for biomarkers of various types. These definitions provide a formal representation of what biomarkers are in a way that allows us to remove certain ambiguities and inconsistencies in the documentation provided by the IOM.

150. Werner Ceusters and Barry Smith, "Aboutness: Towards Foundations for the Information Artifact Ontology", *Proceedings of the Sixth International Conference on Biomedical Ontology* (ICBO), Lisbon, Portugal (CEUR 1515), 2015, 1-5.

Abstract: The Information Artifact Ontology (IAO) was created to serve as a domain-neutral resource for the representation of types of information content entities (ICEs) such as documents, data-bases, and digital images. We identify a series of problems with the current version of the IAO and suggest solutions designed to advance our understanding of the relations between ICEs and associated cognitive representations in the minds of human subjects. This requires embedding IAO in a larger framework of ontologies, including most importantly the Mental Functioning Ontology (MFO). It also requires a careful treatment of the aboutness relations between ICEs and associated cognitive representa-tions and their targets in reality.

151. Jingshan Huang, Karen Eilbeck, Judith Blake, Dejing Dou, Darren Natale, Alan Ruttenberg, Barry Smith, Michael Zimmermann, Guoqian Jiang, Yu Lin, Bin Wu, Yongqun He, Shaojie Zhang, Xiaowei Wang, He Zhang, David Schmitt, and Ming Tan, "A domain ontology for the non-coding RNA field", *IEEE International Conference on Bioinformatics and Biomedicine* (IEEE BIBM 2015), 621-624.

Abstract: Identification of non-coding RNAs (ncRNAs) has been significantly enhanced due to the rapid advancement in sequencing technologies. On the other hand, semantic annotation of ncRNA data lag behind their identification, and there is a great need to effectively integrate discovery from relevant communities. To this end, the Non-Coding RNA Ontology (NCRO) is

being developed to provide a precisely defined ncRNA controlled vocabulary, which can fill a specific and highly needed niche in unification of ncRNA biology.

152. Jingshan Huang, Fernando Gutierrez, Dejing Dou, Judith Blake, Karen Eilbeck, Darren Natale, Barry Smith, Yu Lin, Xiaowei Wang, Zixing Liu, Bin Wu, Ming Tan and Alan Ruttenberg, "A semantic approach for knowledge capture of microRNA-target gene interactions," *IEEE International Conference on Bioinformatics and Biomedicine* (IEEE BIBM 2015), 975-982.

Abstract: Research has indicated that microRNAs (miRNAs), a special class of non-coding RNAs (ncRNAs), can perform important roles in different biological and pathological processes. miRNAs' functions are realized by regulating their respective target genes (targets). It is thus critical to identify and analyze miRNA-target interactions for a better understanding and delineation of miRNAs' functions. However, conventional knowledge discovery and acquisition methods have many limitations. Fortunately, semantic technologies that are based on domain ontologies can render great assistance in this regard. In our previous investigations, we developed a miRNA domain-specific application ontology, Ontology for MIcroRNA Target (OMIT), to provide the community with common data elements and data exchange standards in the miRNA research. This paper describes (1) our continuing efforts in the OMIT ontology development and (2) the application of the OMIT to enable a semantic approach for knowledge capture of miRNA-target interactions.

153. Peter Morosoff, Ron Rudnicki, Jason Bryant, Robert Farrell, Barry Smith, "Joint Doctrine Ontology: A Benchmark for Military Information Systems Interoperability", *Semantic Technology for Intelligence, Defense and Security* (STIDS), 2015, CEUR vol. 1523, 2-9.

Abstract: When the U.S. conducts warfare, elements of a force are drawn from different Services and work together as a single team to accomplish an assigned mission on the basis of joint doctrine. To achieve such unified action, it is necessary that specific Service doctrines be both consistent with and subservient to joint doctrine. Two less commonly addressed requirements flow from the ways in which, in an age of ever increasing flows of heterogeneous network data, unified action involves not only live forces but also automated systems. First, the information technology that is used in joint warfare must be aligned with joint doctrine. Second, the separate information systems used by the different elements of a joint force must be interoperable in the sense that data and information that is generated by each element must be usable (understandable, processible) by all the other elements which need them. Currently, such interoperability is impeded by multiple inconsistencies among different data and software standards. We describe here the on-going project of creating a Joint Doctrine Ontology (JDO), which uses joint doctrine to provide shared computer-accessible content valid for any field of military endeavor, organization, and information system. JDO addresses the two above-mentioned requirements of unified action by providing a widely applicable benchmark for use by developers of information systems that would both guarantee alignment with joint doctrine and support interoperability.

154. Brian Donohue, Douglas Kutach, Amardeep Bhattal, Dave Braines, Geeth de Mel, Robert Ganger, Tien Pham, Ron Rudnicki and Barry Smith, "Controlled and Uncontrolled English for Ontology Editing", *Semantic Technology for Intelligence, Defense and Security* (STIDS), 2015, CEUR vol. 1523, 74-81

Abstract: Ontologies formally represent reality in a way that limits ambiguity and facilitates automated reasoning and data fusion, but is often daunting to the non-technical user. Thus, many researchers have endeavored to hide the formal syntax and semantics of ontologies behind the constructs of Controlled Natural Languages (CNLs), which retain the formal properties of ontologies while simultaneously presenting that information in a comprehensible natural language format. In this paper, we build upon previous work in this field by evaluating prospects of implementing International Technology Alliance Controlled English (ITACE) as a middleware for ontology editing. We also discuss at length a prototype of a natural language conversational interface application designed to facilitate ontology editing via the formulation of CNL constructs.

155. Francesco Furini, Rahul Rai, Giorgio Colombo, Barry Smith, Venkat Krovi, "Development of a Manufacturing Ontology for Functionally Graded Materials", *Proceedings of International Design Engineering Technical Conferences & Computers and Information in Engineering Conference* (IDETC/CIE 2016), August 21-24, 2016, Charlotte, NC

> **Abstract:** The development of manufacturing technologies for new materials involves the generation of a large and continually evolving volume of information. The analysis, integration and management of such large volumes of data, typically stored in multiple independently developed databases, creates significant challenges for practitioners. There is a critical need especially for open-sharing of data pertaining to engineering design which together with effective decision support tools can enable innovation. We believe that ontology applied to engineering (OE) represents a viable strategy for the alignment, reconciliation and integration of diverse and disparate data. The scope of OE includes: consistent capture of knowledge pertaining to the types of entities involved; facilitation of cooperation among diverse group of experts; more effective ongoing curation, and update of manufacturing data; collaborative design and knowledge reuse. As an illustrative case study we propose an ontology focused on the representation of composite materials focusing in particular on the class of Functionally Graded Materials (FGM) in particular. The scope of the ontology is to provide information about the components of such materials, the manufacturing processes involved in creation, and diversity of application ranging from additive manufacturing to restorative dentistry. The ontology is developed using Basic Formal Ontology (BFO) and the Ontology for Biomedical Investigations (OBI).

156. Selja Seppälä, Alan Ruttenberg, Barry Smith, "The Functions of Definitions in Ontologies", *Formal Ontology in Information Systems. Proceedings of the Ninth International Conference* (FOIS 2016), Amsterdam: IOS Press, 2016, 37-50.

> **Abstract:** To understand what ontologies do through their definitions, we propose a theoretical explanation of the functions of definitions in ontologies backed by empirical neuropsychological studies. Our goal is to show how these functions should motivate (i) the systematic inclusion of definitions in ontologies and (ii) the adaptation of definition content and form to the specific context of use of ontologies.

157. Niels Grewe, Ludger Jansen and Barry Smith, "Permanent Generic Relatedness and Silent Change", *Formal Ontology in Information Systems. Proceedings of the Ninth International Conference* (FOIS 2016) *Ontology Competition*, (CEUR 1660), 1-5.

> **Abstract:** Given the assertion of a relation between two types such as: "Epidermis has part some Keratinocyte", we define silent change as any kind of change of the instance-relata of the relation in question that does not change the truth-value of the respective type-level assertion. Such assertions are notoriously difficult to model in OWL 2. To address this problem, we distinguish different modes of type-level relatedness giving rise to this problem and describe a conservative extension to the BFO top-level ontology that allows expressing these modes.

158. Alexander P. Cox, Christopher K. Nebelecky, Ronald Rudnicki, William A. Tagliaferri, John L. Crassidis, Barry Smith, "The Space Object Ontology", *19th International Conference on Information Fusion* (FUSION 2016), Heidelberg, Germany, July 5-8, 2016.

> **Abstract:** Achieving space domain awareness requires the identification, characterization, and tracking of space objects. Storing and leveraging associated space object data for purposes such as hostile threat assessment, object identification, and collision prediction and avoidance present further challenges. Space objects are characterized according to a variety of parameters including their identifiers, design specifications, components, subsystems, capabilities, vulnerabilities, origins, missions, orbital elements, patterns of life, processes, operational statuses, and associated persons, organizations, or nations. The Space Object Ontology provides

a consensus-based realist framework for formulating such characterizations in a computable fashion. Space object data are aligned with classes and relations in the Space Object Ontology and stored in a dynamically updated Resource Description Framework triple store, which can be queried to support space domain awareness and the needs of spacecraft operators. This paper presents the core of the Space Object Ontology, discusses its advantages over other approaches to space object classification, and demonstrates its ability to combine diverse sets of data from multiple sources within an expandable framework. Finally, we show how the ontology provides benefits for enhancing and maintaining long-term space domain awareness.

159. Fernanda Farinelli, Mauricio B. Almeida, Peter Elkin and Barry Smith, "OntONeo: The Obstetric and Neonatal Ontology", Fernanda Farinelli, Mauricio Almeida, Peter Elkin, Barry Smith", *International Conference on Biological Ontology* (ICBO), CEUR 1747, 2016.

Abstract: This paper presents the Obstetric and Neonatal Ontology (OntONeo). This ontology has been created to provide a consensus representation of salient electronic health record (EHR) data and to serve interoperability of the associated data and information systems. More generally, it will serve interoperability of clinical and translational data, for example deriving from genomics disciplines and from clinical trials. Interoperability of EHR data is important to ensuring continuity of care during the prenatal and postnatal periods for both mother and child. As a strategy to advance such interoperability we use an approach based on ontological realism and on the ontology development principles of the Open Biomedical Ontologies Foundry, including reuse of reference ontologies wherever possible. We describe the structure and coverage domain of OntONeo and the process of creating and maintaining the ontology.

160. Fernanda Farinelli, Mauricio B. Almeida, Peter Elkin and Barry Smith, "Dealing with elements of medical encounters: an approach based on ontological realism", *International Conference on Biological Ontology* (ICBO), CEUR 1747, 2016

Abstract: Electronic health records (EHRs) serve as repositories of documented data collected in a health care encounter. An EHR records information about who receives, who provides the health care and about the place where the encounter happens. We also observe additional elements relating to social relations in which the healthcare consumer is involved. To provide a consensus representation of common data and to enhance interoperability between different EHR repositories we have created a solution grounded in formal ontology. Here, we present how an ontology for the obstetric and neonatal domain deals with these general elements documented in health care encounters. Our goal is to promote the interoperability of information among EHRs created in different specialties. To develop our ontology, we used two main approaches: one based on ontological realism, the other based on the principles of the OBO Foundry, including reuse of reference ontologies.

161. Laurel Cooper, Austin Meier, Justin Elser, Justin Preece, Xu Xu, Ryan Kitchen, Botong Qu, Eugene Zhang, Sinisa Todorovic, Pankaj Jaiswal, Marie-Angélique Laporte, Elizabeth Arnaud, Seth Carbon, Chris Mungall, Barry Smith, Georgios Gkoutos and John Doonan, "The Planteome Project", *International Conference on Biological Ontology* (ICBO), CEUR 1747, 2016.

Abstract: The Planteome project is a centralized online plant informatics portal which provides semantic integration of widely diverse datasets and with the goal of plant improvement. Traditional plant breeding methods for crop improvement may be combined with next-generation analysis methods and automated scoring of traits and phenotypes to develop improved varieties. The Planteome project (www.planteome.org) develops and hosts a suite of reference ontologies for plants associated with a growing corpus of genomics data. Data annotations linking phenotypes and germplasm to genomics resources are achieved by data transformation and mapping species-specific controlled vocabularies to the reference ontologies. Analysis and annotation tools are being developed to facilitate studies of plant traits, phenotypes, diseases, gene function and expression and genetic diversity data across a wide range of plant species. The project database and the online resources provide researchers tools to search and browse and access remotely via APIs for semantic integration in annotation tools and data repositories providing resources for plant biology, breeding, genomics and genetics.

162. William Duncan, Travis Allen, Jonathan Bona, Olivia Helfer, Barry Smith, Alan Ruttenberg and Alexander D. Diehl, "The ImmPort Antibody Ontology", *International Conference on Biological Ontology* (ICBO), CEUR 1747, 2016.

> **Abstract:** Monoclonal antibodies are essential biomedical research and clinical reagents that are produced by companies and research laboratories. The NIAID ImmPort (Immunology Database and Analysis Portal) resource provides a long-term, sustainable data warehouse for immunological data generated by NIAID, DAIT and DMID funded investigators for data archiving and re-use. A variety of immunological data is generated using techniques that rely upon monoclonal antibody reagents, including flow cytometry, immunofluorescence, and ELISA. In order to facilitate querying, integration, and reuse of data, standardized terminology for describing monoclonal antibody reagents and their targets needs to be used for annotating data submitted to ImmPort.

163. Barry Smith, Mark Jensen, "The UNEP Ontologies and the OBO Foundry", *International Conference on Biological Ontology* (ICBO), CEUR 1747, 2016.

> **Abstract:** It is now generally accepted that wherever we need to address multiple different kinds of data deriving from multiple different kinds of sources, a strategy is required to ensure interoperability across the various systems involved. The United Nations Environmental Program (UNEP) is developing an ontology for use in their knowledge management platform – the Sustainable Development Goals Interface Ontology (SDGIO). The UNEP approach to achieving interoperability is modeled on the OBO (Open Biomedical Ontologies) Foundry, an initiative of ontology developers working in a range of life science domains who have been working since 2004 to develop a suite of ontologies which would work together consistently in such a way as to advance the integration of data. To serve such integration the OBO Foundry members formulated and tested an evolving set of principles for ontology development which are now being used by ontology developers also in other areas, including manufacturing, geology, transport and security.

164. José M Parente de Oliveira, Barry Smith, "A diagrammatic representation for entities and mereotopological relations in ontologies", *Ontobras*, Brasilia, August 28-30, 2017 (CEUR 1908).

> **Abstract:** In the graphical representation of ontologies, it is customary to use graph theory as the representational background. We claim here that the standard graph-based approach has a number of limitations. We focus here on a problem in the graph-based representation of ontologies in complex domains such as biomedical, engineering and manufacturing: lack of mereotopological representation. Based on such limitation, we proposed a diagrammatic way to represent an entity's structure and various forms of mereotopological relationships between the entities.

165. Anna Maria Masci, Shannon McCall, Alessandro Racioppi, Helena Judge Ellis, Jihad S. Obeid, Barry Smith, Christian Stoeckert and Jie Zheng, "Standardization of the Histopathology Cancer Report: An Ontological Approach", *Proceedings of the 9th International Conference on Biological Ontology* (ICBO 2018), Corvallis, OR, 2018.

> **Abstract:** In recent years, the complexity of cancer pathology reporting has increased significantly. The pathology report covers not only general information such as the presence or absence of cancer, but includes a collection of specific parameters such as tumor size, grade, margin, lymphatic or vascular involvement as well as molecular testing. Soon, biomarkers and immune profiling will play an increasingly important role in determining the eligibility for particular therapies, along with genetic predisposition and social risk factors. The increased use of digital pathology, which allows streamlined sharing of images, has highlighted the importance of clear communication of the information displayed in the pathology report. In the past years, significant effort has been devoted to redefining the way that histopathology report information is recorded. The College of American Pathologists (CAP) introduced synoptic cancer reports, a structured checklist to standardize clinical documentation. Despite continuous improvement and generation of electronic reports, formal representation is still lacking. This lack of standardization limits the ability to integrate pathology information with other genomic and proteomic data and often results in loss of information.

166. Werner Ceusters and Barry Smith, "On defining bruxism", *Medical Informatics Europe*, Gothenberg, Sweden (*Studies in Health Technology and Informatics*, 247), 2018, 551-555.

> **Abstract**: In a series of recent publications, orofacial researchers have debated the question of how 'bruxism'should be defined for the purposes of accurate diagnosis and reliable clinical research. Following the principles of realism-based ontology, we performed an analysis of the arguments involved. This revealed that the disagreements rested primarily on inconsistent use of terms, so that issues of ontology were thus obfuscated by shortfalls in terminology. In this paper, we demonstrate how bruxism terminology can be improved by paying attention to the relationships between (1) particulars and types, and (2) continuants and occurrents.

167. Evan Wallace, Dimitris Kiritsis, Barry Smith, Chris Will, "The Industrial Ontologies Foundry Proof-of-Concept Project", *APMS 2018: Advances in Production Management Systems. Smart Manufacturing for Industry 4.0* (IFIP International Conference on Advances in Production Management Systems, vol. 536), New York: Springer, 2018, 402-409.

> **Abstract:** The current industrial revolution is said to be driven by the digitization that exploits connected information across all aspects of manufacturing. Standards have been recognized as an important enabler. Ontology-based information standard may provide benefits not offered by current information standards. Although there have been ontologies developed in the industrial manufacturing domain, they have been fragmented and inconsistent, and little has received a standard status. With successes in developing coherent ontologies in the biological, biomedical, and financial domains, an effort called Industrial Ontologies Foundry (IOF) has been formed to pursue the same goal for the industrial manufacturing domain. However, developing a coherent ontology covering the entire industrial manufacturing domain has been known to be a mountainous challenge because of the multidisciplinary nature of manufacturing. To manage the scope and expectations, the IOF community kicked-off its effort with a proof-of-concept (POC) project. This paper describes the developments within the project. It also provides a brief update on the IOF organizational set up.

168. Barry Smith, "Ontology as Product-Service System: Lessons Learned from GO, BFO and DOLCE", *Proceedings of the International Conference on Biomedical Ontology* (ICBO), University at Buffalo, Buffalo NY, 2019 (CEUR 2931, published 2021).

> **Abstract:** This paper defends a view of the Gene Ontology (GO) and of Basic Formal Ontology (BFO) as examples of what the manufacturing industry calls product-service systems. This means that they are products bundled with a range of ontology services such as updates, training, help desk, and permanent identifiers. The paper argues that GO and BFO are contrasted in this respect with DOLCE, which approximates more closely to a scientific theory or a scientific publication. The paper provides a detailed overview of ontology services and concludes with a discussion of some implications of the product-service system approach for the understanding of the nature of applied ontology. Ontology developer communities are compared in this respect with developers of scientific theories and of standards (such as W3C). For each of these we can ask: what kinds of products do they develop and what kinds of services do they provide for the users of these products?

169. David Limbaugh, Barry Smith and Werner Ceusters, "Warranted Diagnosis", *Proceedings of the International Conference on Biomedical Ontology* (ICBO), University at Buffalo, NY, 2019 (CEUR 2931, published August 2021)

> **Abstract:** A diagnostic process is an investigative process that takes a clinical picture as input and outputs a diagnosis. We propose a method for distinguishing diagnoses that are warranted from those that are not, based on the cognitive processes of which they are the outputs. Processes designed and vetted to reliably produce correct diagnoses will output what we shall call 'warranted diagnoses'. The latter are diagnoses that should be trusted even if they later turn out to have been wrong. Our work is based on the recently developed Cognitive Process Ontology and further develops the Ontology of General Medical Science. It also has applications

in fields such as intelligence, forensics, and predictive maintenance, all of which rely on vetted processes designed to secure the reliability of their outputs.

170. Eric Merrell, David Limbaugh, Alex Anderson and Barry Smith, "Mental Capabilities", *Proceedings of the International Conference on Biomedical Ontology* (ICBO), University at Buffalo, NY, 2019, (CEUR 2931, published August 2021).

> **Abstract:** We propose capability as a universal or type intermediate between function and disposition. A capability is, broadly speaking, a disposition that is of a type whose instances can be evaluated on the basis of how well they are realized. A function, on the view we are proposing, is a capability the possession of which is the rationale for the existence of its bearer. To say for example that a water pump has the function to pump water is to say that the pump exists because something was needed that would pump water. A water pump may have many capabilities, including: to be weatherproof, to run without lubricant, to be transportable, and so forth. But its function is to pump water. We focus here on capabilities possessed by humans – such as piano playing or language using – and we explore the relation between capabilities of these sorts and structures in the brain.

171. David Kasmier, David Limbaugh and Barry Smith, "Foundation for a Realist Ontology of Cognitive Processes", *Proceedings of the International Conference on Biomedical Ontology* (ICBO), University at Buffalo, NY, 2019 (CEUR 2931, published August 2021).

> **Abstract:** What follows is a first step towards an ontology of conscious mental processes. We provide a theoretical foundation and characterization of conscious mental processes based on a realist theory of intentionality and using BFO as our top-level ontology. We distinguish three components of intentional mental process: character, directedness, and objective referent, and describe several features of the process character and directedness significant to defining and classifying mental processes. We arrive at the definition of representational mental process as a process that is the bringing into being, sustaining, modifying, or terminating of a mental representation. We conclude by outlining some benefits and applications of this approach.

172. Barry Smith, Farhad Ameri, Hyunmin Cheong, Dimitris Kiritsis, Dusan Sormaz, Chris Will, and J. Neil Otte, "A First-Order Logic Formalization of the Industrial Ontologies Foundry Signature Using Basic Formal Ontology", *Proceedings of the Joint Ontology Workshops (*JOWO*)* 2019, Medical University of Graz, Austria (CEUR 2518).

> **Abstract.** Basic Formal Ontology (BFO) is a top-level ontology used in hundreds of active projects in scientific and other domains. BFO has been selected to serve as top-level ontology in the Industrial Ontologies Foundry (IOF), an initiative to create a suite of ontologies to support digital manufacturing on the part of representatives from a number of branches of the advanced manufacturing industries. We here present a first draft set of axioms and definitions of an IOF upper ontology descending from BFO. The axiomatization is designed to capture the meanings of terms commonly used in manufacturing and is designed to serve as starting point for the construction of the IOF ontology suite.

173. Jonathan Vajda, Eric Merrell and Barry Smith, "Towards an Ontology of Commercial Exchange", SOLEE, *Proceedings of the Joint Ontology Workshops (*JOWO*)* 2019, Medical University of Graz, Austria (CEUR 2518)

> **Abstract.** In this paper we propose an Ontology of Commercial Exchange (OCE) based on Basic Formal Ontology. OCE is designed for re-use in the Industrial Ontologies Foundry (IOF) and in other ontologies addressing different aspects of human social behavior involving purchasing, selling, marketing, and so forth. We first evaluate some of the design patterns used in the Financial Industry Business Ontology (FIBO) and Product Types Ontology (PTO). We then propose terms and definitions that we believe will improve the representation of contractual obligations, sales processes, and their associated documents. A commercial exchange, for instance, involves mutual agreement to reciprocate actions, such as transferring money, performing a service, or transferring goods.

174. Jeremy R Chapman, David Kasmier, David Limbaugh, Stephen R Gagnon, John L Crassidis, James Llinas, Barry Smith, Alexander P Cox, "Conceptual Space Modeling for Space Event Characterization", *IEEE 23rd International Conference on Information Fusion (FUSION)*, July 6, 2020, 1-8.

> **Abstract.** A method for space event characterization using the framework of conceptual spaces will be illustrated in this paper. The focus of this paper is on estimating the likelihood of a collisions between space objects. Specifically, an approach is developed for anticipatory decision support for space operators so that preventative actions can be taken based on the assessment of relative risk. The conceptual space approach will draw on fusion of both hard and soft data into a single decision framework. The fusion-based approach presented in this paper for decision support extends the conceptual space framework with a set of ontologies by drawing on the space domain ontologies, which is a large system of ontologies designed to support aspects of space situational awareness. This framework is coupled with a mathematical optimization approach, providing a quantitative basis for ranking the potential for collision across multiple satellite pairs. The goal is to provide the broadest possible information foundation for critical assessments of collision likelihood.

175. Asiyah Yu Lin, Stephan Gebel, Qingliang Leon Li, Sumit Madan, Johannes Darms, Evan Bolton, Barry Smith, Martin Hofmann-Apitius, Yongqun Oliver He, Alpha Tom Kodamullil, "CTO: A Community-Based Clinical Trial Ontology and Its Applications in PubChemRDF and SCAIViewH", *Proceedings of the 11th International Conference on Biomedical Ontologies (ICBO) and 10th Workshop on Ontologies and Data in Life Sciences (ODLS)*, Bolzano, September 17, 2020.

> **Abstract.** Driven by the use cases of PubChemRDF and SCAIView, we have developed a first community-based clinical trial ontology (CTO) by following the OBO Foundry principles. CTO uses the Basic Formal Ontology (BFO) as the top level ontology and reuses many terms from existing ontologies. CTO has also defined many clinical trial-specific terms. The general CTO design pattern is based on the PICO framework together with two applications. First, the PubChemRDF use case demonstrates how a drug Gleevec is linked to multiple clinical trials investigating Gleevec's related chemical compounds. Second, the SCAIView text mining engine shows how the use of CTO terms in its search algorithm can identify publications referring to COVID-19-related clinical trials. Future opportunities and challenges are discussed.

176. Jeremy R Chapman, John L Crassidis, David Kasmier, David Limbaugh, Stephen Gagnon, James Llinas, Barry Smith, Alexander P Cox, "Conceptual Spaces for Space Event Characterization via Hard and Soft Data Fusion", *American Institute of Aeronautics and Astronautics (Sensor Systems and Information Fusion) Proceedings* (AIAA 2021), 4 January 2021, https://doi.org/10.2514/6.2021-1163.

> **Abstract:** The overall goal of the approach developed in this paper is to estimate the likelihood of a given kinetic kill scenario between hostile spacebased adversaries using the mathematical framework of Complex Conceptual Spaces - Single Observation. Conceptual spaces are a cognitive model that provide a method for systematically and automatically mimicking human decision making. For accurate decisions to be made, the fusion of both hard and soft data into a single decision framework is required. This presents several challenges to this data fusion framework. The first is the challenge involved in handling multiple complex terminologies, which is addressed by drawing on a set of Space Domain Ontologies. Another challenge is the complex combinatorics involved when considering all possible feature combinations. This can be mitigated by using integer linear programming optimization that is outlined by the Complex oConceptual Spaces - Single Observation mathematical model framework. A third challenge is the complicated physics that is involved in a spacecraft collision that must be addressed to obtain a better understanding of threat assessment. Overcoming these various challenges allows for a quantitative ranking for the potential of a kinetic kill collision across multiple spacecraft pairs. In addition to overcoming these challenges this paper will break down threat assessment into four domains and identify a ranking of threat both for each individual domain and for the four domains combined. Simulation results are shown to verify the developed concepts.

177. Mohamed H. Karray, Neil Otte, Rahul Rai, Farhad Ameri, Boonserm Kulvatunyou, Barry Smith, Dimitris Kiritsis, Chris Will, Rebecca Arista, "The Industrial Ontologies Foundry (IOF) perspectives", *Industrial Ontology Foundry (IOF) – Achieving Data Interoperability Workshop*, International Conference on Interoperability for Enterprise Systems and Applications, Tarbes, France, March 3, 2021 (CEUR 2900).

> **Abstract:** In recent years there has been a number of promising technical and institutional developments regarding use of ontologies in industry. At the same time, however, most industrial ontology development work remains within the realm of academic research and is without significant uptake in commercial applications. In biomedicine, by contrast, ontologies have made significant inroads as valuable tools for achieving interoperability between data systems whose contents derive from widely heterogeneous sources. In this position paper, we present a set of principles learned from the successful Open Biomedical Ontologies (OBO) Foundry initiative to guide the design and development of the Industrial Ontologies Foundry (IOF), which is a counterpart to the OBO Foundry initiative for the manufacturing industry. We also illustrate the potential utility of these principles by sketching the conceptual design of a framework for sustainable IOF development.

178. Eric C. Merrell, Olivier Massin, Barry Smith, "Common Core Conformant Definitions for an Ontology of Commercial Exchange", *Proceedings of the 2nd International Workshop on the Ontology of Social, Legal and Economic Entities (SoLEE)*, Bolzano, September 11-18, 2021 (CEUR 2969), 1-8.

> **Abstract:** In "Toward an Ontology of Commercial Exchange" [11], we proposed human readable definitions for terms that are central to an ontology of commercial exchange. This paper furthers that project in two ways. First, the definitions have been modified to be compatible with the Common Core Ontologies (CCO). CCO is used in a wide variety of domains including the industrial and military domains. Having a commerce ontology compatible with CCO allows data about the exchange of goods relevant to those domains to be tagged with compatible ontologies. Second, we propose preliminary formalizations of these definitions, with the aim of informing the creation of an ontology which can be used to assist in reasoning over business-related data.

179. Eric C. Merrell, Robert M. Kelly, David Kasmier, Barry Smith, Marc Brittain, Ronald Ankner, Evan Maki, Curtis W. Heisey, and Kevin Bush, "Benefits of Realist Ontologies to Systems Engineering", *8th International Workshop on Ontologies and Conceptual Modelling (OntoCom)*, September 11-18, 2021 (CEUR 2969), 1-10.

> **Abstract:** Applied ontologies have been used more and more frequently to enhance systems engineering. In this paper, we argue that adopting principles of ontological realism can increase the benefits that ontologies have already been shown to provide to the systems engineering process. Moreover, adopting Basic Formal Ontology (BFO), an ISO standard for top-level ontologies from which more domain specific ontologies are constructed, can lead to benefits in four distinct areas of systems engineering: (1) interoperability, (2) standardization, (3) testing, and (4) data exploitation. Reaping these benefits in a model-based systems engineering (MBSE) context requires utilizing an ontology's vocabulary when modeling systems and entities within those systems. If the chosen ontology abides by the principles of ontological realism, a semantic standard capable of uniting distinct domains, using BFO as a hub, can be leveraged to promote greater interoperability among systems. As interoperability and standardization increase, so does the ability to collect data during the testing and implementation of systems. These data can then be reasoned over by computational reasoners using the logical axioms within the ontology. This, in turn, generates new data that would have been impossible or too inefficient to generate without the aid of computational reasoners.

180. Alexander P. Cox, Christopher K. Nebelecky, Ron Rudnicki, William A. Tagliaferri, John L. Crassidis, Barry Smith, "The Space Domain Ontologies," *National Symposium on Sensor & Data Fusion* (NSSDF), Military Sensing Symposia (MSS), October 2021. Cox AP, Crassidis JL, Smith B, Nebelecky CK, Tagliaferri WA, and Rudnicki R. (2021) "The Space Domain Ontologies". MSS-JOINT-21-001 *Proceedings of the 2021 MSS Virtual Joint (BAMS and NSSDF) Conference, Volume 1*. Available from AnaVation, LLC,

5003 Westfields Blvd, #231837, Centreville, VA 20120. Classified. Available on https://www.dtic.mil.

> **Abstract:** Achieving space situational awareness requires, at a minimum, the identification, characterization, and tracking of space objects. Leveraging the resultant space object data for purposes such as hostile threat assessment, object identification, and conjunction assessment presents major challenges. This is in part because in characterizing space objects we reference a variety of identifiers, components, subsystems, capabilities, vulnerabilities, origins, missions, orbital elements, patterns of life, operational processes, operational statuses, and so forth, which tend to be defined in highly heterogeneous and sometimes inconsistent ways. The Space Domain Ontologies are designed to provide a consensus-based realist framework for formulating such characterizations in a way that is both consistent and computable. Space object data are aligned with classes and relations in a suite of ontologies built around the existing Space Object Ontology. They are stored in a dynamically updated Resource Description Framework triple store, which can be queried to support space situational awareness and the needs of spacecraft operators and analysts. This paper provides an overview of the Space Domain Ontologies and their development and use. It presents the motivation for and advantages of the Space Domain Ontologies, including the benefits they provide for enhancing and maintaining long-term space situational awareness.

181. Jeremy R. Chapman, David Kasmier, John L. Crassidis, James Llinas, Barry Smith, Alexander P. Cox, "An Introduction to Hard and Soft Data Fusion via Conceptual Spaces Modeling for Space Event Characterization", *National Symposium on Sensor & Data Fusion* (NSSDF), Military Sensing Symposia (MSS), October 2021.

> **Abstract:** This paper describes an AFOSR-supported basic research program that focuses on developing a new framework for combining hard with soft data in order to improve space situational awareness. The goal is to provide, in an automatic and near real-time fashion, a ranking of possible threats to blue assets (assets trying to be protected) from red assets (assets with hostile intentions). The approach is based on Conceptual Spaces models, which combine features from traditional associative and symbolic cognitive models. While Conceptual Spaces are revolutionary, they lack an underlying mathematical framework. Several such frameworks have attempted to represent Conceptual Spaces, but by far the most robust is the model developed by Holender. His model utilizes integer linear programming in order to obtain an overall similarity value between observations and concepts that support the formation of hypotheses. This paper will describe a method for building Conceptual Spaces models for threats that utilizes ontologies as a means to provide a clear semantic foundation for this inferencing process; in particular threat ontologies and space domain ontologies are developed and employed in this approach. A space situational awareness use-case is presented involving a kinetic kill scenario and results are shown to assess the performance of this fusion-based inferencing framework.

182. David Kasmier, Eric Merrell, Robert Kelly, Barry Smith, Curtis Heisey, Donald Maki, Marc Brittain, Ronald Ankner and Kevin Bush, "Ontology of Plays for Autonomous Teaming and Collaboration", *Proceedings of the 14th Seminar on Ontology Research in Brazil* (ONTOBRAS, November 2021), CEUR 3050, 9-22.

> **Abstract**: We propose a domain-level ontology of plays for the facilitation of play-based collaborative autonomy among unmanned and manned-unmanned aircraft teams in the Army's Unmanned Aircraft System (UAS) mission domain. We define a play as a type of plan that prescribes some pattern of intentional acts that are intended to reliably result in some goal in some competitive context, and which specifies one or more roles that are realized by those prescribed intentional acts. The ontology is well suited to be extended to other types of military and nonmilitary unmanned vehicle operations.

183. Jeremy R. Chapman, John L. Crassidis, James Llinas, Barry Smith, David Kasmier, Alexander P. Cox, "Implementing Dampster-Shafer Theory for property similarity in Conceptual Spaces modeling", Sensor Systems and Information Systems IV, American Institute of Aeronautics and Astronautics (AIAA) SCITECH Forum 2022, January 3-7, 2022, San Diego.

Abstract: Previous work has shown that the Complex Conceptual Spaces – Single Observation Mathematical framework is a useful tool for event characterization. This mathematical framework is developed on the basis of Conceptual Spaces and uses integer linear programming to find the needed similarity values. The work of this paper is focused primarily on space event characterization. In particular, the focus is on the ranking of threats for malicious space events such as a kinetic kill. To make the Conceptual Spaces framework work, the similarity values between the contents of observations on the one hand and the properties of the entities observed on the other needs to be found. This paper shows how to exploit Dempster-Shafer theory to implement a statistical approach for finding these similarities values. This approach will allow a user to identify the uncertainty involved in similarity value data, which can later be propagated through the developed mathematical model in order for the user to know the overall uncertainty in the observation-to-concept mappings needed for space event characterization.

184. Mohamed H. Karray, Neil Otte, Rahul Rai, Farhad Ameri, Boonserm Kulvatunyou, Barry Smith, Dimitris Kiritsis, Albert Jones, "Industrial Ontologies Foundry (IOF) Core*", FOMI 2022: 12th International Workshop on Formal Ontologies meet Industry*, September 12-15, 2022, Tarbes, France, CEUR, Vol. 3240.

Abstract: The Industrial Ontologies Foundry (IOF) was formed to create a suite of interoperable ontologies. Ontologies that would serve as a foundation for data and information interoperability in all areas of manufacturing. To ensure that each ontology is developed in a structured and mutually coherent manner, the IOF has committed to the tiered architecture of ontology building based on the Basic Formal Ontology (BFO) as top level. One of the critical elements of a successful tiered architecture build is the domain mid-level ontologies. However, thus far there has been no mid-level manufacturing ontology that is based on BFO. The IOF has recently released the IOF Core version 1 beta to fill this gap. This paper documents the development process and gives an overview of the current content of the IOF Core. Finally, the paper describes how the IOF Core can be used as the basis for a more domain-specific Supply Chain Ontology.

185. Charles Clark, Mayur Gosai, Terry Janssen, Melissa LaDuke, Jobst Landgrebe, Lawrence Pace, Barry Smith, "Quantum sensing and quantum engineering: a strategy for acceleration via metascience", *SPIE Quantum West Proceedings Volume 12447: Quantum Sensing, Imaging, and Precision Metrology* (February 2023), https://doi.org/10.1117/12.2650568.

186. Peter Koch and Barry Smith, "Beyond the Goods-Services Continuum", *Proceedings of the International Conference on Biomedical Ontologies*, Brasilia, Brazil, 2023, 173-178.

Abstract: Governments standardly deploy a distinction between goods and services in assessing economic health and tracking national income statistics, of which medical goods and services carry significant importance. In what follows we draw on Basic Formal Ontology (BFO) to introduce a third kind of entity called *patterns*, which help capture the various ways in which goods and services are intertwined and help also to show how many services generate a new kind of non-goods-related products. Patterns are an overlooked yet essential features of many economic sectors including medicine. Studying patterns offers new insights into various components of economic analysis, including outcomes-oriented evaluations of medical services and the value of human capital in the medical sphere.

STANDARDS

1. International Standard ISO/IEC 21838-1:2021(E), First edition, August 2021: Information technology — Top-level ontologies (TLO) — Part 1:Requirements

2. International Standard ISO/IEC 21838-2:2021(E), First edition, August 2021: Information technology — Top-level ontologies (TLO) — Part 2: Basic Formal Ontology (BFO)

3. International Standard ISO/IEC 21838-2:2021(E), Electronic Insert, November 2021.

PREPRINTS

1. Jobst Landgrebe and Barry Smith, "There is no General Artificial Intelligence", https://arxiv.org/pdf/1906.05833.pdf, November 28, 2019.

> **Abstract:** The goal of creating Artificial General Intelligence (AGI) – or in other words of creating Turing machines (modern computers) that can behave in a way that mimics human intelligence – has occupied AI researchers ever since the idea of AI was first proposed. One common theme in these discussions is the thesis that the ability of a machine to conduct convincing dialogues with human beings can serve as at least a sufficient criterion of AGI. We argue that this very ability should be accepted also as a necessary condition of AGI, and we provide a description of the nature of human dialogue in particular and of human language in general against this background. We then argue that it is for mathematical reasons impossible to program a machine in such a way that it could master human dialogue behaviour in its full generality. This is (1) because there are no traditional explicitly designed mathematical models that could be used as a starting point for creating such programs; and (2) because even the sorts of automated models generated by using machine learning, which have been used successfully in areas such as machine translation, cannot be extended to cope with human dialogue. If this is so, ∗Electronic address: jobst.landgrebe@cognotekt.com; Corresponding author †Electronic address: phismith@buffalo.edu 1 then we can conclude that a Turing machine also cannot possess AGI, because it fails to fulfil a necessary condition thereof. At the same time, however, we acknowledge the potential of Turing machines to master dialogue behaviour in highly restricted contexts, where what is called "narrow" AI can still be of considerable utility.

2. John Beverley, Shane Babcock, Gustavo Carvalho, Lindsay Cowell, Sebastian Duesing, Regina Hurley, Barry Smith, "Coordinating Coronavirus Research: The COVID-19 Infectious Disease Ontology", Open Science Foundation Preprints, https://osf.io/5bx8c/, September 13, 2020.

> **Abstract:** Rapidly, accurately and easily interpreting generated data is of fundamental concern. Ontologies – structured controlled vocabularies – support interoperability and prevent the development of data silos which undermine interoperability. The Open Biological and Biomedical Ontologies (OBO) Foundry serves to ensure ontologies remain interoperable through adherence by its members to core ontology design principles. For example, the Infectious Disease Ontology (IDO) Core includes terminological content common to investigations of all infectious diseases. Ontologies covering more specific infectious diseases in turn extend from IDOCore, such as the Coronavirus Infectious Disease Ontology (CIDO). The growing list of virus-specific IDO extensions has motivated construction of a reference ontology covering content common to viral infectious disease investigations: the Virus Infectious Disease Ontology (VIDO) (https://bioportal.bioontology.org/ontologies/VIDO). Additionally the present pandemic has motivated construction of a more specific extension of CIDO covering terminological contents specific to the pandemic: the COVID-19 Infectious Disease Ontology (IDO-COVID-19) (https://bioportal.bioontology.org/ontologies/IDO-COVID-19). We report here the development of VIDO and IDO-COVID-19. More specifically we examine newly minted terms for each ontology, showcase reuse of terms from existing OBO ontologies, motivate choice points for ontological decisions based on research from relevant life sciences, apply ontology terms to explicate viral pathogenesis, and discuss the annotating power of virus ontologies for use in machine-learning projects.

3. Rebecca C Jackson, Nicolas Matentzoglu, James A Overton, Randi Vita, James P Balhoff, Pier Luigi Buttigieg, Seth Carbon, Melanie Courtot, Alexander D Diehl, Damion Dooley, William Duncan, Nomi L Harris, Melissa A Haendel, Suzanna E Lewis, Darren A Natale, David Osumi-Sutherland, Alan Ruttenberg, Lynn M Schriml, Barry Smith, Christian J Stoeckert, Nicole A Vasilevsky, Ramona L Walls, Jie Zheng, Christopher J Mungall, Bjoern Peters, "OBO Foundry in 2021: Operationalizing Open

Data Principles to Evaluate Ontologies", bioRxiv, Cold Spring Harbor Laboratory, January 1, 2021. Now published as https://doi.org/10.1093/database/baab069 (above).

> Biological ontologies are used to organize, curate, and interpret the vast quantities of data arising from biological experiments. While this works well when using a single ontology, integrating multiple ontologies can be problematic, as they are developed independently, which can lead to incompatibilities. The Open Biological and Biomedical Ontologies (OBO) Foundry was created to address this by facilitating the development, harmonization, application, and sharing of ontologies, guided by a set of overarching principles. One challenge in reaching these goals was that the OBO principles were not originally encoded in a precise fashion, and interpretation was subjective. Here we show how we have addressed this by formally encoding the OBO principles as operational rules and implementing a suite of automated validation checks and a dashboard for objectively evaluating each ontology's compliance with each principle. This entailed a substantial effort to curate metadata across all ontologies and to coordinate with individual stakeholders. We have applied these checks across the full OBO suite of ontologies, revealing areas where individual ontologies require changes to conform to our principles. Our work demonstrates how a sizable federated community can be organized and evaluated on objective criteria that help improve overall quality and interoperability, which is vital for the sustenance of the OBO project and towards the overall goals of making data FAIR.

4. Jobst Landgrebe and Barry Smith, "An argument for the impossibility of machine intelligence", *arXiv*:2111.07765, October 20, 2021, 1-13.

   > **Abstract:** Since the noun phrase `artificial intelligence' (AI) was coined, it has been debated whether humans are able to create intelligence using technology. We shed new light on this question from the point of view of themodynamics and mathematics. First, we define what it is to be an agent (device) that could be the bearer of AI. Then we show that the mainstream definitions of `intelligence' proposed by Hutter and others and still accepted by the AI community are too weak even to capture what is involved when we ascribe intelligence to an insect. We then summarise the highly useful definition of basic (arthropod) intelligence proposed by Rodney Brooks, and we identify the properties that an AI agent would need to possess in order to be the bearer of intelligence by this definition. Finally, we show that, from the perspective of the disciplines needed to create such an agent, namely mathematics and physics, these properties are realisable by neither implicit nor explicit mathematical design nor by setting up an environment in which an AI could evolve spontaneously.

5. Jobst Landgrebe and Barry Smith, "Why machines do not understand: A response to Søgaard, *arXiv*: 2307.04766, July 7, 2023, 1-5.

   > **Abstract:** Some defenders of so-called 'artificial intelligence' believe that machines can understand language. In particular, Søgaard has argued in (Søgaard, 2022) for a thesis of this sort, on the basis of the idea (1) that where there is semantics there is also understanding and (2) that machines are not only capable of what he calls 'inferential semantics', but even that they can (with the help of inputs from sensors) 'learn' referential semantics. We show that he goes wrong because he pays insufficient attention to the difference between language as used by humans and the sequences of inert of symbols which arise when language is stored on hard drives or in books in libraries.

6. Jobst Landgrebe and Barry Smith, "Ontologies of common sense, physics and mathematics"

   > **Abstract:** The view of nature we adopt in the natural attitude is determined by common sense, without which we could not survive. Classical physics is modelled on this common-sense view of nature, and uses mathematics to formalise our natural understanding of the causes and effects we observe in time and space when we select subsystems of nature for modelling. But in modern physics, we do not go beyond the realm of common sense by augmenting our knowledge of what is going on in nature. Rather, we have measurements that we do not understand, so we know nothing about the ontology of what we measure. We help ourselves by using entities from mathematics, which we fully understand ontologically. But we have no ontology of the reality of modern physics; we have only what we can assert mathematically. In

this paper, we describe the ontology of classical and modern physics against this background and show how it relates to the ontology of common sense and of mathematics.

INVITED TALKS, INTERVIEWS AND PODCASTS

1. Interview with Barry Smith, *COSIT Features*, 2003 (on-line interview series on spatial information theory).

2. Barry Smith, "Die Ontologie als Grundlagenwissenschaft der Informatik", interview in *Information Philosophie*, 3 (2003), 120–123.

3. *An interview with the Editor of The Monist*, May 31, 2015, OUPblog.

4. "Faculty Interview: Barry Smith", NousLetter, 21, Summer 2015, 13-17.

5. "Conversation on Systems Engineering" with Dr Oliver Gao, Director, Systems Engineering, Cornell University, September 2, 2022.

6. Careers in Ontology: An Interview with Professor Barry Smith by Charlie Taben, American Philosophical Association Blog, September 15, 2022

7. Machines Will Never Rule Us!, *LocoFoco*, September 27, 2022

> Machines don't learn — "Machine learning" is a misnomer! Artificial General Intelligence is impossible — in the same way socialism is impossible! No physicist or mathematician or even AI specialist really believes that AI will become conscious and rule the world! So don't worry. But these aren't just assertions. Join host Timothy Virkkala and author David Ramsay Steele as they talk to Jobst Landegrebe and Barry Smith — experts who know something about the subject. A fascinating discussion, and a good occasion to revive the LocoFoco Netcast from its year of silence.

8. APA Book Spotlight on *Why Machines Will Never Rule the World,* Interview with Charlie Taben, American Philosophical Association Blog, September 23, 2022

9. Why AI Will Never Rule the World, Interview with Luke Dormehl, *Digital Trends*, September 25, 2022.

10. Interview with Walid Saba on *Why Machines Will Never Rule the World*, Machine Learning Street Talk, December 15, 2022 (review starts half way through)

11. Will Machines Rule the World? Interview with J. Scott Turner, National Association of Scholars *Restoring the Sciences Webinar Series*, October 4, 2022 Youtube

12. Barry Smith, "Ontocommons in the standardization environment", interview by Rita Giuffrida, *Ontocommons. Ontology-driven data integration for industry commons*, April 2022.

> **Abstract:** Ontologies and standards are strongly interrelated and can often be seen as two sides of the same coin. Indeed, standards reflect consensus on the semantics of terms, though different standards might employ different ways to explain the same or very similar concepts semantically. Given the crucial role played by both aspects in OntoCommons, we have interviewed Barry Smith, SUNY Distinguished Professor of Philosophy at the University at Buffalo and one of the External Advisory Board (EAB) members of the OntoCommons project, to better understand what are the challenges and priorities to focus on in this context.

13. Luke Dormehl, Jobst Landgrebe and Barry Smith, "Why AI will never rule the world" (interview transcription), *Digital Trends* (September 2022)

14. Why Machines Will Never Rule the World – On AI and Faith, Conversation between Jobst Landgrebe, Barry Smith and Rev. Jamie Franklin, *Irreverend*, November 30, 2022

15. Why the Singularity Might Never Come. Interview with Richard Hanania, Center for the Study of Partisanship and Ideology, January 30, 2023. Twitter link

16. Alex Thomson, Jobst Landgrebe and Barry Smith, "Where there's no will there's no way" (interview transcription), *UKCommons* (April 2023)

17. Jobst Landgrebe and Barry Smith, Interview with Alex Thomson, "Where there's no will there's no way," *UKCommons* (April 2023)

18. Conversation with Jobst Landgrebe and Barry Smith: Why AI won't rule the world, The Pangburn Hangout, May 5, 2023.

19. AI and ChatGPT: Should we be worried? Stever Peterson, Jobst Landgrebe and Barry Smith, National Association of Scholars, May 19, 2023

20. Jobst Landgrebe and Barry Smith, Interview with Kyle Polich, Why Machines Will Never Rule the World, Data Sceptic, May 29, 2023 (Youtube, Apple, Spotify)

21. Jobst Landgrebe, Skynet Will Not Become Self-Aware, AGI Is Impossible!, *Geopolitics & Empire*, April 17, 2024.

22. Pierangelo Soldavini, "L'intelligenza artificiale non dominerà il mondo", interview with Barry Smith, *Il sole de 24 ore*, April 27, 2024.

REPORTS

1. Barry Smith, "Palaeontological Reflections on the Tractatus", extended version of a paper presented at the Wittgenstein Colloquium of the Seminar for Austro-German Philosophy, held in Oxford in January 1978.

2. Barry Smith, *Foundations of Formal Geography*, Department of Geoinformation, Technical University of Vienna, 1995, 143pp.

3. Thomas Carroll and Barry Smith, *SUNY's Core Curricula: The Failure to Set Consistent and High Academic Standards*, New York: Empire Foundation for Policy Research, 1996, xiv + 34pp.

4. Donna Peuquet, Barry Smith and Berit O. Brogaard, *The Ontology of Fields: Report of the Specialist Meeting held under the auspices of the Varenius Project*, Bar Harbor, Maine, June 1998, Santa Barbara: NCGIA, vi + 42pp.

> **Abstract:** In the specific case of geography, the real world consists on the one hand of physical geographic features (bona fide objects) and on the other hand of various fiat objects, for example legal and administrative objects, including parcels of real estate, areas of given soil types, census tracts, and so on. It contains in addition the beliefs and actions of human beings directed towards these objects (for example, the actions of those who work in land registries or in census bureaux), and the relations between these beliefs and actions and their targets.

5. Applied Ontology. An International Conference on Law and Institutions in Society (Proceedings), University at Buffalo, 1998

6. David Mark, Max Egenhofer, Stephen Hirtle and Barry Smith, *UCGIS Emerging Research Theme: Ontological Foundations for Geographic Information Science* (University Consortium for Geographic Information Science White Paper), 2000.

7. Barbara Heller, Heinrich Herre, Barry Smith, "A Unified Framework for Building Ontological Theories with Application and Testing in the Field of Clinical Trials", Institute for Formal Ontology and Medical Information Science (IFOMIS) Report No. 2, University of Leizpig, 2001.

The objective of this research programme is to contribute to the establishment of the emerging science of Formal Ontology in Information Systems via a collaborative project involving researchers from a range of disciplines including philosophy, logic, computer science, linguistics, and the medical sciences. The researchers will work together on the construction of a unified formal ontology, which means: a general framework for the construction of ontological theories in specific domains. The framework will be constructed using the axiomatic-deductive method of modern formal ontology. It will be tested via a series of applications relating to on-going work in Leipzig on medical taxonomies and data dictionaries in the context of clinical trials. This will lead to the production of a domain-specific ontology which is designed to serve as a basis for applications in the medical field.

8. Thomas Bittner and Barry Smith, Formal Ontologies for Space and Time, IFOMIS Reports, 2003.

Abstract: We propose an ontological theory that is powerful enough to describe both complex spatio-temporal processes (occurrents) and the enduring entities (continuants) that participate in such processes. For this purpose we distinguish between meta-ontology and token ontologies. Token ontologies fall into two major categories: ontologies of type SPAN and ontologies of type SNAP. These represent two complementary perspectives on reality and result in distinct though compatible systems of categories. The meta-ontological level then describes the relationships between the different token ontologies. In a SNAP (snapshot) ontology we have enduring entities such as substances, qualities, roles, functions as these exist to be inventoried at a given moment of time. In a SPAN ontology we have perduring entities such as processes and their parts and aggregates. We argue that both kinds of ontological theory are required, together with the metaontology which joins them together, in order to give a non-reductionistic account of both static and dynamic aspects of the geospatial world.

9. Thomas Bittner and Barry Smith, "Directly Depicting Granular Ontologies", IFOMIS Reports, 2004. Published in revised and expanded form as Thomas Bittner, Maureen Donnelly and Barry Smith, "Endurants and Perdurants in Directly Depicting Ontologies", *AI Communications*, 13: 4 (2004), 247–258.

Abstract: We propose an ontological theory that is powerful enough to describe both complex spatio-temporal processes and the enduring entities that participate in such processes. For this purpose we distinguish between ontologies and metaontology. Ontologies are based on very simple directly depicting languages and fall into two major categories: ontologies of type SPAN and ontologies of type SNAP. These represent two complementary perspectives on reality and result in distinct though compatible systems of categories. In a SNAP (snapshot) ontology we have the enduring entities in a given domain as they exist to be inventoried at some given moment of time. In a SPAN ontology we have perduring entities such as processes and their parts and aggregates. We argue that both kinds of ontology are required, together with the meta-ontology which joins them together. On the level of meta-ontology we are able to impose constraints on ontologies of a sort which can support efficient processing of large amounts of data.

10. Werner Ceusters, Barry Smith, George De Moor, Ontology-Based Integration of Medical Coding Systems and Electronic Patient Records, IFOMIS Reports, 2004.

Abstract: In the last two decades we have witnessed considerable efforts directed towards making electronic healthcare records comparable and interoperable through advances in record architectures and (bio)medical terminologies and coding systems. Deep semantic issues in general, and ontology in particular, have received some interest from the research communities. However, with the exception of work on so-called 'controlled vocabularies', ontology has thus far played little role in work on standardization. The prime focus has been rather the rapid population of terminologies at the level of fine detail. In this paper, we argue that more efforts are needed on the side of both research and standardization to ensure that the coding systems used in electronic healthcare records enjoy a semantics that is coherent with the semantics of the record. We propose realist ontology as a method to bring about this coherence by means of a robust system of top-level ontological categories.

11. Anand Kumar, Matteo Piazza, Barry Smith, Silvana Quaglini, Mario Stefanelli, Formalizing UMLS Relations Using Semantic Partitions in the Context of a Task-Based Clinical Guidelines Model, IFOMIS Reports, 2004.

> **Abstract**: An important part of the Unified Medical Language System (UMLS) is its Semantic Network, consisting of 134 Semantic Types connected to each other by edges formed by one or more of 54 distinct Relation Types. This Network is however for many purposes over-complex, and various groups have thus made attempts at simplification. Here we take this work further by simplifying the relations which involve the three Semantic Types – Diagnostic Procedure, Laboratory Procedure and Therapeutic or Preventive Procedure. We define operators which can be used to generate terms instantiating types from this selected set when applied to terms designating certain other Semantic Types, including almost all the terms specifying clinical tasks. Usage of such operators thus provides a useful and economical way of specifying clinical tasks. The operators allow us to define a mapping between those types within the UMLS which do not represent clinical tasks and those which do. This mapping then provides a basis for an ontology of clinical tasks that can be used in the formulation of computer-interpretable clinical guideline models.

12. Lowell Vizenor, Barry Smith and Werner Ceusters, Foundation for the Electronic Health Record: An ontological analysis of the HL7 Reference Information Model, IFOMIS Reports, 2004.

> **Abstract**: Despite the recent advances in information and communication technology that have increased our ability to store and circulate information, the task remains of ensuring that the right sorts of information reach the right sorts of people. In what follows we defend the thesis that efforts to develop efficient means for sharing information across healthcare systems and organizations would benefit from a careful analysis of human action in healthcare organizations, and that the communication of healthcare information and knowledge needs to rest on a sound ontology of social interaction. We illustrate this thesis in relation to the HL7 RIM, which is one centrally important tool for communication in the healthcare domain.

13. Barry Smith, Anand Kumar, Thomas Bittner, Basic Formal Ontology for bioinformatics, IFOMIS Reports, 2005.

> **Abstract**: Two senses of 'ontology' can be distinguished in the current literature. First is the sense favored by information scientists, who view ontologies as software implementations designed to capture in some formal way the consensus conceptualization shared by those working on information systems or databases in a given domain. [Gruber 1993] Second is the sense favored by philosophers, who regard ontologies as theories of different types of entities (objects, processes, relations, functions) [Smith 2003]. Where information systems ontologists seek to maximize reasoning efficiency even at the price of simplifications on the side of representation, philosophical ontologists argue that representational adequacy can bring benefits for the stability and resistance to error of an ontological framework and also for its extendibility in the future. In bioinformatics, however, a third sense of 'ontology' has established itself, above all as a result of the successes of the Gene Ontology (hereafter: GO), which is a tool for the representation and processing of information about gene products and their biological functions [Gene Ontology Consortium 2000]. We show how Basic Formal Ontology (BFO) has established itself as an overarching ontology drawing on all three of the strands distinguished above, and describe applications of BFO especially in the treatment of biological granularity.

14. Anand Kumar, Anita Burgun, Werner Ceusters, James J. Cimino, James Davis, Peter Elkin, Ira Kalet, Alan Rector, Jim Rice, Jeremy Rogers, Stephan Schulz, Kent Spackman, Davide Zaccagini, Pierre Zweigenbaum and Barry Smith, "Six questions on the construction of ontologies in biomedicine", assembled for the Workshop of the AMIA Working Group on Formal Biomedical Knowledge Representation in connection with AMIA Symposium, Washington DC, 2005.

> **Abstract**: Best practices in ontology building for biomedicine have been frequently discussed in recent years. However there is a range of seemingly disparate views represented by experts in

the field. These views not only reflect the different uses to which ontologies are put, but also the experiences and disciplinary background of these experts themselves. We asked six questions related to biomedical ontologies to what we believe is a representative sample of ontologists in the biomedical field and came to a number conclusions which we believe can help provide an insight into the practical problems which ontology builders face today.

15. Nicola Guarino and Barry Smith, Engineering Ontologies: Foundations and Theories from Philosophy and Logical Theory, Semantic Interoperability and Data Mining in Biomedicine (SemanticMining, European Union Network of Excellence 507505, Deliverable D.21.2), 2006.

16. Barry Smith, Mark Musen and Michael Schröder (eds.) Towards Interoperability of Biomedical Ontologies: Proceedings of the Dagstuhl Seminar Nr. 07132, Schloss Dagstuhl, Wadern, Germany, Mar 27-30, 2007.

17. L. Obrst, M. Musen, B. Smith, F. Neuhaus, F. Olken, M. Gruninger, M. Raymond, P. Hayes, R. Sharma (eds.), Towards an Open Ontology Repository. Communiqué. Ontology Summit 2008.

18. William Mandrick, James Schoening and Barry Smith, Command and Control (C2) Core Extended to Net-Enabled Command Capability, Briefing to Department of Defense (DoD) Net-Enabled Command Capability, September 14, 2009.

19. Bernard de Bono, Mathias Brochhausen, Sybo Dijkstra, Dipak Kalra, Stephan Keifer, Barry Smith, Biomedical Terminologies and Ontologies: Enabling Biomedical Semantic Interoperability and Standards in Europe, White Paper, ELSA (European Large Scale Action on Electronic Health) Consultation Meeting, September 29, 2009.

20. William Mandrick, James Schoening and Barry Smith, NATO Briefing on Command and Control (C2) Core Ontology, October 11, 2009.

21. Ron Rudnicki, James Schoening and Barry Smith, Aligning Legacy Data Models using UCore-SL, Department of Defense Briefing, November 2009.

22. James Schoening, Barry Smith and William Mandrick, UCore and UCore Semantic Layer. Briefing to US Army Training and Doctrine Command (TRADOC) HQ, November 9, 2009.

23. Barry Smith, James Schoening and Dan Brennan, UCore 2.0 Change Request, US Department of the Army, November 2009.

24. Werner Ceusters and Barry Smith, Semantic Interoperability in Healthcare: State of the Art in the US. A Position Paper with Background Materials, prepared for the European Union ARGOS Project: Transatlantic Observatory for Meeting Global Health Policy Challenges through ICT-Enabled Solutions, March 3, 2010.

Abstract: Semantic interoperability can be defined as the ability of two or more computer systems to exchange information in such a way that the meaning of that information can be automatically interpreted by the receiving system accurately enough to produce useful results to the end users of both systems. Several activities are currently being performed by a variety of stakeholders to achieve semantic interoperability in healthcare. Many of these activities are not beneficial, because they place too great a focus on business aspects and not enough on involvement of the right sorts of researchers, in particular those that are able to see how the data and information relate to the entities of concern on the side of the patient. The lack of a central focus on the patient, and the associated focus on 'concepts', have spawned a variety of mutually incompatible terminologies exhibiting non-resolvable overlap. The predominance of the healthcare IT industry in the writing and selection of semantic interoperability standards mitigates against the benefits that standards, when well designed, can bring about.

25. Fabian Neuhaus and Barry Smith, Ontology Summit 2010 Communiqué: Creating the Ontologists of the Future, Gaithersburg, MD: National Institute for Standards and Technology, March 2010.

Abstract: Increasingly, major national and international projects and systems centered on ontology technology are being developed and deployed by governments and by scientific and commercial organizations. This brings a growing need for ontology expertise and thus for new methods and organizations for the education and training of ontologists. The goal of the Ontology Summit 2010 was to develop a strategy for the education of ontologists. To achieve this goal we studied how ontologists are currently trained, the requirements by organizations that hire ontologists, and developments that might impact the training of ontologists in the future.

The main findings and results of the Ontology Summit 2010 are: (1) That there is already a large demand for trained ontologists, and the demand is expected to increase as ontology-based technologies become more successful and as the quantities and number of different types of data continues to expand. (2) That there are very few formal training opportunities for ontologists, and they often do not meet the needs of trainees or of those who would hire them. (3) That organizations wanting to hire ontologists often have difficulties in identifying qualified candidates since there are so few formal qualifications in ontology, and there is no professional organization that certifies ontologists.

We developed recommendations for the body of knowledge that should be taught and the skills that should be developed by future ontologists; these recommendations are intended as guidelines for institutions and organizations that may consider establishing a program for training ontologists. Further, we recommend a number of specific actions for the community to pursue as a follow-up to the Ontology Summit 2010 that will improve the education of ontologists

26. Mark Phillips, Barry Smith, Lowell Vizenor, Scott Streit, Independent Review of Emerging Semantic Web Technologies Supporting the Defense Training Environment, United States Joint Forces Command, Joint Warfighting Center, September 2010, 27 pp.

27. Mark Phillips, Barry Smith, Lowell Vizenor, Scott Streit, White Paper: Realizing the Next Generation Defense Training Environment (DTE) through Semantic Web Technologies and Best Practices, United States Joint Forces Command, Joint Warfighting Center, November 2010, 60pp.

28. Barry Smith, Suzanne Lewis, Judith Blake, Chris Mungall, *Disease Ontology: Report of the Scientific Advisory Board*, February 2011.

29. Barry Smith, Tatiana Malyuta, and William Mandrick, Methodology for Semantic Enhancement of Intelligence Data, Intelligence and Information Warfare Directorate (I2WD), March 2013.

30. Barry Smith, Mauricio Almeida, Jonathan Bona, Mathias Brochhausen, Werner Ceusters, Melanie Courtot, Randall Dipert, Albert Goldfain, Pierre Grenon, Janna Hastings, William Hogan, Leonard Jacuzzo, Ingvar Johansson, Chris Mungall, Darren Natale, Fabian Neuhaus, James Overton, Anthony Petosa, Robert Rovetto, Alan Ruttenberg, Mark Ressler, Ron Rudniki, Selja Seppälä, Stefan Schulz, Jie Zheng, BFO 2.0 Specification and User's Guide, June 26, 2015

31. Ron Rudnicki, Barry Smith, Tanya Malyuta, William Mandrick, Best Practices of Ontology Development, CUBRC, October 2016

32. J. Neil Otte, Ron Rudnicki, and Barry Smith, Coordinated Holistic Alignment of Manufacturing Processes (CHAMP) Final Report, January 2018.

33. Neil Otte, Rahul Rai, Clare Paul & Barry Smith, Wind Turbine Analysis, Final Project Report, Digital Manufacturing and Design Innovation Institute (DMDII), May 2018.

> **Abstract:** The report describes an application of ontologies to the analysis of wind turbine manufacturing data. We show how applying ontologies to composite materials data may facilitate the discovery of optimum composite material designs that will deliver maximum wind turbine blade performance within environmental constraints.

34. Barry Smith, Ontologies for Space and Ground Systems, Ground System Architectures Workshop, Los Angeles, CA, March 2020.

35. Robert Kelly, David Limbaugh, and Barry Smith, Peer Review Report: "Ontologies relevant to behaviour change interventions: A method for their development", *Wellcome Open Research* 2020, 5:126, 39004.

> Version 1 DOI: 10.12688/wellcomeopenres.15908.3.
>
> Version 2 DOI: 10.21956/wellcomeopenres.18177.r41884.
>
> **Abstract:** In "Ontologies Relevant to behaviour change interventions: A Method for their Development" Wright, et al. outline a step by step process for building ontologies of behaviour modification – what the authors call the Refined Ontology Developmental Method (RODM) – and demonstrate its use in the development of the Behaviour Change Intervention Ontology (BCIO). RODM is based on the principles of good ontology building used by the Open Biomedical Ontology (OBO) Foundry in addition to those outlined in (Arp, Smith, and Spear 2015). BCIO uses as its top-level ontology Basic Formal Ontology (BFO). The methods outlined in Wright, et al. are a valuable contribution to the field, especially the use of formal mechanisms for literature annotation and expert stakeholder review, and the BCIO will certainly play an important role in the extension of OBO Foundry ontologies into the behavioural domain.

POSTERS AND ABSTRACTS

1. Albert Goldfain, Barry Smith and Lindsay Cowell, "BFO Dispositions and their Bases: Two Shortcut Relations", *Seventh International Conference on Formal Ontology in Information Systems* (FOIS 2012).

2. Barry Smith, Anand Kumar and Steffen Schulze-Kremer, "Revising the UMLS Semantic Network," in M. Fieschi, *et al*. (eds.), *Medinfo* 2004, Amsterdam: IOS Press, 1700. Expanded version.

> **Abstract:** The integration of standardized biomedical terminologies into a single, unified knowledge representation system has formed a key area of applied informatics research in recent years. The Unified Medical Language System (UMLS) is the most advanced and most prominent effort in this direction, bringing together within its Metathesaurus a large number of distinct source-terminologies. The UMLS Semantic Network, which is designed to support the integration of these source-terminologies, has proved to be a highly successful combination of formal coherence and broad scope. We argue here, however, that its organization manifests certain structural problems, and we describe revisions which we believe are needed if the network is to be maximally successful in realizing its goals of supporting terminology integration.

3. Lee Sam, Tara Borlawsky, Ying Tao, Jianrong Li, Barry Smith and Yves Lussier, "Information-Theoretic Classification of SNOMED Improves the Organization of Context-Sensitive Excerpts from Cochrane Reviews" (Poster), *Proceedings of the Annual Symposium of the American Medical Informatics Association*, Chicago, 2007, 645. PMC2655812

> **Abstract:** The emphasis on evidence based medicine (EBM) has placed increased focus on finding timely answers to clinical questions in presence of patients. Using a combination of natural language processing for the generation of clinical excerpts and information theoretic

distance based clustering, we evaluated multiple approaches for the efficient presentation of context-sensitive EBM excerpts.

4. Yongqun He, Zuoshuang Xiang, Boyang Zhao, David States, Brian Athey, Gil Omenn, Steve Qin, Harry Mobley, Howard Rush, Lindsay Cowell, Barry Smith, "Vaccine Ontology Development and its Application on Vaccine Data Standardization and Exchange", ISMB, Toronto, July 19-23, 2008.

5. Yongqun He, Lindsay Cowell, Alexander D. Diehl, Harry Mobley, Bjoern Peters, Alan Ruttenberg, Richard H. Scheuermann, Ryan R. Brinkman, Melanie Courtot, Chris Mungall, Zuoshuang Xiang, Fang Chen, Thomas Todd, Lesley Colby, Howard Rush, Trish Whetzel, Mark A. Musen, Brian D. Athey, Gilbert S. Omenn and Barry Smith. "VO: Vaccine Ontology", *ICBO 2009: Proceedings of the First International Conference on Biomedical Ontology*, 2009, 164.

6. Patricia L. Whetzel, Nigam H. Shah, Natalya F. Noy, Benjamin Dai, Michael Dorf, Nicholas B. Griffith, Clement Jonquet, Cherie H. Youn, Adrien Coulet, Chris Callendar, Daniel L. Rubin, Barry Smith, Margaret-Anne Storey, Christopher G. Chute, and Mark A. Musen. BioPortal: Ontologies and Integrated Data Resources at the Click of a Mouse", in *Bio-Ontologies: Knowledge in Biology, SIG*, Poster session, ISMB/ECCB, Stockholm, Sweden, July 2009.

7. Albert Goldfain, Lindsay Cowell and Barry Smith. "Clonal Complexes in Biomedical Ontologies", *ICBO 2009: Proceedings of the First International Conference on Biomedical Ontology*, 2009, 168.

8. Patricia L Whetzel, Nigam H. Shah, Natalya F. Noy, Benjamin Dai, Michael Dorf, Nicholas Griffith, Clement Jonquet, Cherie Youn, Adrien Coulet, Chris Callendar, Barry Smith, Margaret-Anne Storey, Christopher G. Chute, Daniel L. Rubin and Mark A. Musen. "BioPortal: Ontologies and Integrated Data Resources at the Click of the Mouse", *ICBO 2009: Proceedings of the First International Conference on Biomedical Ontology*, 2009, 197.

9. Bjoern Peters and the OBI Consortium, "Ontology for Biomedical Investigations". *Nature Precedings* (2009), First International Conference on Biomedical Ontology, 2009 doi:10.1038/npre.2009.3623.

Abstract: The goal of OBI is to enable a formal representation of biomedical investigations that captures the experimental evidence on which their findings are based. The scope of OBI includes: materials made in and produced for investigations, research objectives, experimental protocols, roles of people in investigations and processing and publication of data gathered in investigations. Use of OBI will allow comparison of experimental data from the wide array of scientific disciplines represented by domain experts in the OBI consortium. OBI follows the principles laid out by the OBO foundry, and integrates tightly with other foundry candidate ontologies, such as GO (www.geneontology.org) and ChEBI (www.ebi.ac.uk/chebi/) whose terms are used to describe biological reality. The use of OBI by the scientific community to represent or annotate their investigations within electronic data resources will facilitate interdisciplinary data synthesis, enable access to their data on the semantic web and improve third-party understanding of information related to life-science and clinical investigations.

10. He Y, Cowell L, Diehl AD, Mobley H, Peters B, Ruttenberg A, Scheuermann RH, Xiang Z, Athey BD, Omenn GS, Smith B. "Development of the Community-based Vaccine Ontology (VO)", *109th American Society of Microbiologists (ASM) General Meeting*. May 17-21, 2009, Philadelphia, PA, USA.

11. A. Patrice Seyed, Stuart C. Shapiro, and Barry Smith, "Integrating BFO with OntoClean: Towards a Method for Evaluating and Correcting Ontologies", Presented at Formal Ontology in Information Systems, Toronto, May 11-14, 2010.

12. Ramona L. Walls, Laurel D. Cooper, Justin Elser, Dennis W. Stevenson, Barry Smith, Chris Mungall, Maria A. Gandolfo, Pankaj Jaiswal, "The Plant Ontology: A Common Reference Ontology for Plants", *Proceedings of the Workshop on Bio-Ontologies*, ISMB, Boston, July, 2010.

13. Laurel D. Cooper, Justin Elser, Ramona Walls, Dennis W. Stevenson, Barry Smith, Chris Mungall, Maria A. Gandolfo, Pankaj Jaiswal, "The Plant Ontology: A Database for Plant Genomics", *Plant Biology 2010*, Montreal, July 30-August 4, 2010, P14010.

14. Robert Williams, A. Keith Dunker, Barry Smith, Darren Natale, An OBO Foundry ontology for intrinsically disordered proteins, *Pacific Symposium on Biocomputing*, 2011, P835.

15. Mauricio Almeida, Anna Barbara Proietti, Jiye Ai, Barry Smith, "The Blood Ontology: An Ontology in the Domain of Hematology", *Proceedings of the Second International Conference on Biomedical Ontology*, Buffalo, NY, July 28-30, 2011, (CEUR Workshop Proceedings, 833), 227-229.

16. Laurel Cooper, Ramona Walls, Justin Elser, Justin Preece, Barry Smith, Chris Mungall, Stefan A. Rensing, Manuel Hiss, Péter Szöevényi, Daniel Lang, Maria A. Gandolfo, Dennis W. Stevenson, Pankaj Jaiswal, "Expanding the Plant Ontology: Linking Plant Anatomy and Development to Genomics Across Plant Taxa" (Abstract), Plant Biology 2011, Minneapolis, MI.

17. Ramona L. Walls, Laurel D. Cooper, Justin Elser, Chris Mungall, Neeral Beladia, Justin Preece, Maria A. Gandolfo, Dennis W. Stevenson, Barry Smith, Pankaj Jaiswal, "Using the Plant Ontology to improve the interoperability of genomic and phenomic data sets", Plant Genomes and Biotechnology: From Genes to Networks, Cold Spring Harbor Laboratories, November 30-December 3, 2011.

18. Laurel Cooper, Ramona Walls, Justin L. Elser, Justin Preece, Barry Smith, Chris Mungall Marie A. Gandolfo, Dennis W. Stevenson, Pankaj Jaiswal, The Plant Ontology: Linking Plant Anatomy and Development to Genomics Across Plant Taxa, *Proceedings of Plant and Animal Genome XX*, San Diego, California, 2012.

> **Abstract:** The Plant Ontology (PO: http://www.plantontology.org) is a structured vocabulary and database resource for all plant scientists that links plant anatomy, morphology and development to the rapidly expanding field of plant genomics. The primary purpose of the PO is to facilitate cross-database querying and to foster consistent use of vocabularies in annotation. Originally designed to span the monocot-dicot divide in flowering plants, the PO has been redesigned to encompass a wider variety of angiosperm species, as well as gymnosperms, pteridophytes (ferns), lycophytes (lycopods) and bryophytes (liverworts, mosses and hornworts). Recent changes in the PO include the addition of more than 80 new terms to accommodate non-seed plants, with an emphasis on those needed to annotate gene expression from the *Physcomitrella patens* genome. An essential feature of the PO is the set of freely accessible web links from terms to associated annotations, which are structure- or development-specific genes, proteins and phenotypes sourced from numerous plant genomics datasets. Currently, the PO includes over 2 million such annotations associated with over 1,300 terms. Outreach activities include workshops, conference presentations and outreach booths. Also, image libraries are being created through PlantSystematics.org and linked to PO terms to provide reference images for plant structure terms. The PO is a valuable resource for both research and teaching that can be used as a guide to plant structures and growth and developmental landmarks in life cycles of plants across many taxa.

19. Walls RL, Elser JL, Preece J, Smith B, Mungall CJ, Rensing S, Hiss M, Szövényi P, Lang D, Gandolfo MA, Stevenson DW, Jaiswal P, "Annotating Gene Expression in *Physcomitrella patens* using the Plant Ontology: Facilitating Cross-Taxa

Comparisons", *Proceedings of Plant and Animal Genome XX*, San Diego, California, 2012.

> **Abstract:** The Plant Ontology is a structured vocabulary and database resource for all plant scientists that links plant anatomy, morphology and development to the rapidly expanding field of plant genomics. Recent changes in the PO include the addition of more than 80 new terms to accommodate non-seed plants, with an emphasis on those needed to annotate gene expression from the Physcomitrella patens genome. The primary purpose of the PO is to facilitate cross-database querying and to foster consistent use of vocabularies in annotation. The use of ontologies ensures consistent annotations within and across species, enabling both prediction of gene function and cross-species comparisons of gene expression. An essential, powerful feature of the PO is the set of links from terms to associated annotations, which are structure- or development-specific genes, proteins and phenotypes sourced from numerous plant genomics datasets. Currently, the PO includes over 2 million annotations associated with over 1,300 terms. We will give a brief tutorial on how to access the PO and associated data, and demonstrate the utility of linking Physcomitrella gene expression data to PO terms. The combination of ontology terms and the annotation of diverse gene expression and phenotype data sets facilitates diverse analyses, including assessing the similarity between genes of inter- or intra-specific origin and the exploration of structural homologies among organs, tissues and cell types.

20. Alexander C. Yu, Barry Smith, Stanley Schwartz, "Formal and Computable Representations of Allergic Diseases in the Electronic Health Record: An Approach Based on the Ontology of General Medical Science", 2012 Annual Meeting of the American College of Allergy, Asthma & Immunology (ACAAI), November 8-13, 2012, Anaheim, California (Poster).

21. Pankaj Jaiswal, Barry Smith, Ruth Bastow, Paul J. Kersey, Elizabeth Arnaud, Laurel Cooper, Christopher Rawlings, "A Resource for a Common Reference Ontology for Plants", *Proceedings of Plant and Animal Genome XXI*, San Diego, CA, January 12, 2013 (Poster).

22. Brian Atkinson, Laurel Cooper, Laura Moore, Justin Preece, Justin Elser, Nikhil Lingutla, Sinisa Todorovic, Ramona Walls, Ruth Stockey, Gar Rothwell, Barry Smith, Maria A, Gandolfo, Dennis Stevenson, Pankaj Jaiswal, "Plant Ontology, A Controlled and Structured Plant Vocabulary for All Botanical Disciplines", *Botany 2013*, New Orleans, July 17-21, 2013.

> **Abstract:** Recently, plant genome sequencing has expanded to different species of plants. This has dramatically expanded our knowledge of gene expression in plant structures and development, as well as plant evolution. However, due to the vast phylogenetic diversity within the plant kingdom some inconsistencies with terminology have occurred. These conflicting plant vocabularies challenge advancement in the plant sciences; therefore, it is important to have a consistent plant structure vocabulary that encompasses all green plants. The Plant Ontology (PO) has been constructed as a well-structured vocabulary whether the terms are anatomical or developmental. The PO also annotates gene expression data to a wide diversity of plant parts and stages of development, for example, terms can be linked with relevant genes that are expressed during the development of a certain structure. Terms are arranged in a hierarchical structure in which taxon-specific annotations occur; this provides the opportunity for users to compare gene expression in homologous structures across clades. This serves as a critical aid for plant scientists who incorporate large data sets to engage questions on genomics, development, and comparative genetics across different plant groups. The Plant Ontology also provides other resources for plant biologists to use such as the Annotation of Image Segments with Ontologies program (AISO), allowing users to annotate plant structures with relevant terminology and genes from images from digital photography or scanned copies.

23. Mark Jensen, Alexander P. Cox, Barry Smith, Alexander D. Diehl, "Representing Disease Courses: An Application of the Neurological Disease Ontology to Multiple

Sclerosis Typology", *Proceedings of the Fourth International Conference on Biomedical Ontology* (ICBO), Montreal, July 8-9, 2013, (CEUR, 1060), 121.

24. Jie Zheng, Marcelline R. Harris, Anna Maria Masci, Yu Lin, Alfred Hero, Barry Smith and Yongqun He, "OBCS: The Ontology of Biological and Clinical Statistics", *Proceedings of the Fifth International Conference on Biomedical Ontology* (ICBO), Houston, 2014, (CEUR, 1327), 65.

> **Abstract:** Statistics play a critical role in biological and clinical research. To promote logically consistent representation and classification of statistical entities, we have developed the Ontology of Biological and Clinical Statistics (OBCS). OBCS extends the Ontology of Biomedical Investigations (OBI), an OBO Foundry ontology supported by some 20 communities. Currently, OBCS contains 686 terms, including 381 classes imported from OBI and 147 classes specific to OBCS. The goal of this paper is to present OBCS for community critique and to describe a number of use cases designed to illustrate its potential applications.

25. Laurel D. Cooper, Justin Elser, Justin Preece, Elizabeth Arnaud, Dennis W Stevenson, Sinisa Todorovic, Eugene Zhang, Christopher J. Mungall, Barry Smith, Pankaj Jaiswal, "Common Reference Ontologies for Plant Biology: A Platform for Integrative Plant Genomics", *Proceedings of Plant and Animal Genome XXII*, San Diego, CA, 2014 (Poster).

> **Abstract:** Around the world, a small number of plant species serve as the primary source of food for the human population, yet these crops are vulnerable to multiple stressors, such as diseases, nutrient deficiencies and unfavorable environmental conditions. Traditional breeding methods for plant improvement may be combined with next-generation methods such as automated scoring of traits and phenotypes to develop improved varieties. Linking these analyses to the growing corpus of genomics data generated by high-throughput sequencing, transcriptomics, proteomics, phenomics and genome annotation projects requires common, interoperable, reference vocabularies (ontologies) for the description of the data. The 'Common Reference Ontologies for Plant Biology' (cROP) initiative is building the needed suite of reference ontologies, together with enhanced data storage and visualization technologies. The cROP will assume the further development of the existing Plant Ontology (PO), Plant Trait Ontology (TO), and Plant Environment Ontology (EO) and will develop the Plant Stress Ontology (PSO) for abiotic and biotic stresses. It will also include relevant aspects of ontologies such as Gene Ontology (GO), Cell Type (CL), Chemical Entities of Biological Interest (ChEBI), Protein Ontology (PRO) and the Phenotypic Qualities Ontology (PATO). It will include a centralized platform where reference ontologies for plants will be used to access cutting-edge data resources for plant traits, phenotypes, diseases, genomes and semantically-queried gene expression and genetic diversity data across a wide range of plant species. cROP will unify and streamline a fragmented semantic framework and will support allele discovery, advance the understanding of crop evolution, and facilitate crop development.

26. Pankaj Jaiswal, Laurel Cooper, Justin L. Elser, Austin Meier, Marie-Angélique Laporte, Christopher Mungall, Barry Smith, Ethan K. S. Johnson, Megan Seymour, Justin Preece, Xu Xu, Ryan S. Kitchen, Botong Qu, Eugene Zhang, Elizabeth Arnaud, Seth Carbon, Sinisa Todorovic and Dennis Wm. Stevenson, "Planteome: A resource for Common Reference Ontologies and Applications for Plant Biology", *Proceedings of Plant and Animal Genome XXIV,* 2016.

> **Abstract:** Around the world, a small number of plant species serve as the primary source of food for the human population, yet these crops are vulnerable to multiple stressors, such as diseases, nutrient deficiencies and unfavorable environmental conditions. Traditional breeding methods for plant improvement may be combined with next-generation methods such as automated scoring of traits and phenotypes to develop improved varieties. Linking these analyses to the growing corpus of genomics data generated by high-throughput sequencing, transcriptomics, proteomics, phenomics and genome annotation projects requires common, interoperable, reference vocabularies (ontologies) for the description of the data. The Planteome initiative (www.planteome.org) is developing the needed suite of common reference ontologies

that describe anatomy and development in Plant Ontology (PO), Plant Trait Ontology (TO), and Plant Environment Ontology (EO) and the Plant Stress Ontology (PSO) for describing the abiotic and biotic stresses. The project will also host ontologies such as Gene Ontology (GO), Chemical Entities of Biological Interest (ChEBI), Protein Ontology (PRO) and the Phenotypic Qualities Ontology (PATO) developed by collaborators. The project database and the online resources will provide researchers tools to search and browse and remote access via APIs for semantic integration in annotation tools and data repositories providing resources for plant traits, phenotypes, diseases, genomes, gene expression and genetic diversity data across a wide range of plant species.

27. Edison Ong, Zuoshuang Xiang, Jie Zheng, Barry Smith and Yongqun He, "Ontobull and BFOConvert: Web-based programs to support automatic ontology conversion", *International Conference on Biological Ontology* (ICBO), CEUR 1747, 2016.

> **Abstract:** When a widely reused ontology appears in a new version which is not compatible with older versions, the ontologies reusing it need to be updated accordingly. Ontobull (http://ontobull.hegroup.org) has been developed to automatically update ontologies with new term IRI(s) and associated metadata to take account of such version changes. To use the Ontobull web interface a user is required to (i) upload one or more ontology OWL source files; (ii) input an ontology term IRI mapping; and (where needed) (iii) provide update settings for ontology headers and XML namespace IDs. Using this information, the backend Ontobull Java program automatically updates the OWL ontology files with desired term IRIs and ontology metadata. The Ontobull subprogram BFOConvert supports the conversion of an ontology that imports a previous version of BFO. A use case is provided to demonstrate the features of Ontobull and BFOConvert.

28. Fernanda Farinelli, Mauricio B. Almeida, Peter L. Elkin, Barry Smith, "Interoperability Among Prenatal EHRs: A Formal Ontology Approach", *Proceedings AMIA Symposium 2017*. DOI10.13140/RG.2.2.16743.34729

29. Michael Grüninger, Alan Ruttenberg, Barry Smith", "Tutorial: ISO/IEC 21838", *Proceedings of the Joint Ontology Workshops 2019 (JOWO)*, Graz.

30. Barry Smith, "Ontologies for Space and Ground Systems", *Ground System Architectures Workshop*, Los Angeles, CA, March 2-5, 2020.

DATABASES AND ONTOLOGIES

1. Buffalo Norms for Geographic Categories, November 1999.
2. Basic Formal Ontology (BFO), May 2004.
3. Relation Ontology (RO), April 2006.
4. Common Anatomy Reference Ontology (CARO), September 2008.
5. Protein Ontology (PRO), with the University of Delaware, October 2009.
6. Infectious Disease Ontology (IDO), with Duke University, October 2009.
7. Information Artifact Ontology (IAO), November 2009
8. Ontology for General Medical Science (OGMS), November 2009.
9. Universal Core Semantic Layer (UCore SL), March 2010.
10. Biometrics Upper Ontology (US Army), March 2010.
11. Mental Functioning Ontology, 2009
12. Mental Disease Ontology, 2010
13. Document Act Ontology, September 2012
14. Joint Doctrine Ontology, 2015

15. Space Object Ontology, 2017

16. Manufacturing Ontology for Functionally Graded Materials, 2016

17. Cognitive Process Ontology, March 2019

18. Intel Cognitive Process Ontology, March 2019

19. Medical Cognitive Process Ontology, March 2019

20. Product Life Cycle Ontology, 2019

LETTERS TO EDITORS

1. "Derrida Degree: A Question of Honour", Letter to *The Times* (London) of 9 May 1992 on the award by Cambridge University of an honorary degree to Jacques Derrida. Co-signatories: Hans Albert (University of Mannheim), David Armstrong (Sydney), Ruth Barcan Marcus (Yale), Keith Campbell (Sydney), Richard Glauser (Neuchâtel), Rudolf Haller (Graz), Massimo Mugnai (Florence), Kevin Mulligan (Geneva), Lorenzo Peña (Madrid), Willard van Orman Quine (Harvard), Wolfgang Röd (Innsbruck), Karl Schuhmann (Utrecht), Daniel Schulthess (Neuchâtel), Peter Simons (Salzburg), René Thom (Burs-sur-Yvette), Dallas Willard (Los Angeles), Jan Woleński (Cracow).

Reprinted *inter alia* in: *Silenus Laughed* (Sydney), July 1992; *The Cambridge Review*, October 1992 (special issue on "The Derrida Affair"), p. 138-139; J. Derrida, *Points ... Interviews, 1974–1994*, Stanford: Stanford University Press, 1995, 419-421; *English Studies* 94 (30), 2013; *Digressions&Impressions* (2016); *Metaphilosophy*, June 5, 2020

Italian translation in *La Stampa* (Milan), 12 May 1992

Chinese translation in 豆瓣小组, 22 August 2008

Czech translation in Filosofie Dnes, 8 (2), 2016.

See also Niall Gildea, "'Fanciful associations'. The Perverse Endurance of Derrida's [sic] 'logical phallusies'", in *Critical Survey*, 34(1), March 2022.

DOI: https://doi.org/10.3167/cs.2021.340107

2. Mark A. Musen, Suzanna Lewis and Barry Smith, "Wrestling with SUMO and bio-ontologies", *Nature Biotechnology*, 24, 1 (2006), p. 21. PMC2768033

3. Field, Dawn, Morrison, Norman, Glockner, Frank Oliver, Kottmann, Renzo, Cochrane, Guy, Vaughan, Robert, Garrity, George, Cole, Jim, Hirschman, Lynette, Schriml, Lynn, Mizrachi, Ilene, Federhen, Scott, Schindel, David, Miller, Scott, Hebert, Paul, Ratnasingham, Sujeevan, Hanner, Robert, Amaral-Zettler, Linda, Sogin, Mitchell, Ashburner, Michael, Lewis, Suzanna, Smith, Barry, "Working together to put molecules on the map", *Nature*, 453 (7198), June 2008, 978.

4. David Koepsell and Barry Smith, "Dealing with socially constructed concepts in an ontology", *Journal of Empirical Research on Human Research Ethics*, Vol. 4, No. 2, June 2009, 75-6.

4. Barry Smith, Louis J. Goldberg, Alan Ruttenberg and Michael Glick, Ontology and the Future of Dental Research Informatics, *The Journal of the American Dental Association* (JADA), 141 (10) October 2010, 1173-1175.

5. Barry Smith, Louis J. Goldberg, Alan Ruttenberg and Michael Glick, "Regarding Ontology and the Future of Dental Research Informatics", *The Journal of the American Dental Association (JADA)*, January 2011, 142 (1), 2011, 252-254.

ARTICLES IN DICTIONARIES AND IN ENCYCLOPEDIAS

1. "Art", in N. Ashford and S. Davies (eds., *A Dictionary of Conservative and Libertarian Thought*, London and New York: Routledge, 1991, 9–11, reprinted 2011.

    Spanish translation in: *Diccionario del Pensamiento Conservador y Liberal*, Buenos Aires: Ediciones Nueva Vision, 1992, 22-24.

2. "Conservative Theory", in N. Ashford and S. Davies (eds.), *A Dictionary of Conservative and Libertarian Thought*, London and New York: Routledge, 1991, 49–51.

    Spanish translation in: *Diccionario del Pensamiento Conservador y Liberal*, Buenos Aires: Ediciones Nueva Vision, 1992, 313-315.

3. "Nationalism", in N. Ashford and S. Davies (eds.), *A Dictionary of Conservative and Libertarian Thought*, London and New York: Routledge, 1991, 180–183.

    Spanish translation in: *Diccionario del Pensamiento Conservador y Liberal*, Buenos Aires: Ediciones Nueva Vision, 1992, 229-233.

4. "Introduction" to Hans Burkhardt and Barry Smith (eds.), *Handbook of Metaphysics and Ontology*, Munich/Philadelphia/Vienna: Philosopia, 1991, xix–xxiii.

5. "Naive Physics", in Hans Burkhardt and Barry Smith (eds.), *Handbook of Metaphysics and Ontology*, Munich/Philadelphia/Vienna: Philosopia, 1991, 585–586.

6. "Meinong and the Graz School", in Hans Burkhardt and Barry Smith (eds.), *Handbook of Metaphysics and Ontology*, Munich/Philadelphia/Vienna: Philosopia, 1991, 519–522.

7. "Sachverhalt", Article in *Historisches Wörterbuch der Philosophie*, J. Ritter and K. Gründer (eds.), Stuttgart and Basel: Schwabe, vol. 8, 1992, 1102–1113.

    Abstract: Both '*Sachverhalt*' and 'state of affairs' seem to have been derived from the juridical 'status' in the sense of 'status rerum' meaning: state or constitution of things. 'Status' signifies also in an extended sense 'the way things stand, the condition or peculiarity of a thing in regard to its circumstances, position, order'. We describe the history of usage of '*Sachverhalt*' from these beginnings, addressing the role of Goclenius, Lotze, Stumpf, Husserl and Adolf Reinach, whose theory of the relations between judgment and *Sachverhalt* served as one starting point for the development of Reinach's theory of speech acts in 1913.

    Preprinted in: "Sachverhalt: eine begriffsgeschichtliche Untersuchung" (includes an extensive English summary), *Forschungsberichte und Mitteilungen des Forschungsinstituts Philosophie/Technik/Wirtschaft*, Universität Salzburg, 9 (1988), 41pp.

8. "Aristotelianism, apriorism, essentialism", in P. Boettke (ed.), *The Elgar Companion to Austrian Economics*, Cheltenham: Edward Elgar Publishing, 1994, 33–37.

9. "Brentano", in J. Kim and E. Sosa (eds.), *A Companion to Metaphysics*, Oxford: Blackwell, 1995, 61–63.

10. "Ingarden", in J. Kim and E. Sosa (eds.), *A Companion to Metaphysics*, Oxford: Blackwell, 1995, 241–242.

11. "Ontology", in J. Kim and E. Sosa (eds.), *A Companion to Metaphysics*, Oxford: Blackwell, 1995, 373–374.

12. Dallas Willard and Barry Smith, "British Moral Theory" in: L. Embree (ed.), *Encyclopedia of Phenomenology*, Dordrecht/Boston/London: Kluwer, 1997, 81-85.

> **Abstract**: There is an inherent phenomenological tendency in British moral theory, especially from John Locke onward. The purpose of his *Essay* is to consider the discerning faculties of a man, as they are employed about the objects which they have to do with. This is language that might serve well in a general description of the work of Husserl and other phenomenologists.

13. "Realistic phenomenology", in L. Embree (ed.), *Encyclopedia of Phenomenology*, Dordrecht/Boston/London: Kluwer, 1997, 586–590.

> **Abstract:** The tradition of realist phenomenology was founded in around 1902 by a group of students in Munich interested in the newly published *Logical Investigations* of Edmund Husserl. Initial members of the group included Johannes Daubert, Alexander Pfänder, Adolf Reinach and Max Scheler. With Reinach's move to Göttingen the group acquired two new prominent members – Edith Stein and Roman Ingarden. The group's method turned on Husserl's idea that we are in possession *a priori* (which is to say: non-inductive) knowledge of entities (for example, colors, tones, values, shapes) of a range of different sorts. Pfänder applied this method in his descriptive psychology of willing and motivation, Reinach (anticipating the later speech act theory) to what he called 'social acts', Stein to the ontology of communities, and Ingarden to works of art and aesthetic phenomena. The movement latter, through Ingarden, lived on in Poland, where it influenced the young Karol Wojtyła.

14. "Austria" in L. Embree (ed.), *Encyclopedia of Phenomenology*, Dordrecht/Boston/London: Kluwer, 1997, 43–48.

> **Abstract:** Philosophy in the German-speaking world can be divided inlo two loose traditions, which we might refer to as the German and the Austrian (or Austro-Hungarian), respectively. The main line of the first begins with Kant, Fichte, Hegel and Scheling and ends with Heidegger and his contemporary followers. The main line of the second embraces the philosophy of Prague, Lemberg (now Lwiv), and Cracow as much as that of Vienna and Graz. It begins with Bolzano, Mach, Brentano, Meinong and Twardowski and ends with Willgenstein, Neurath and Popper. Here we describe the evolution of this Austrian tradition, paying special attention to the role of phenomenology therein.

15. "Gestalt psychology" in Edward Craig (ed.), *Routledge Encyclopedia of Philosophy,* London: Routledge 1998, vol. 4, 51–54.

> **Abstract:** An outline of the history of Gestalt psychology, beginning with Christian von Ehrenfels and Ernst Mach, the Austro-Italian school of Benussi, Musatti and Kanizsa, and concluding with the Berlin School of Stumpf, Wertheimer, Köhler and Koffka and the ontological theory of Gestalt morphologies advanced by Edwin Rausch.

16. "Reinach" in Edward Craig (ed.), *Routledge Encyclopedia of Philosophy*, London: Routledge, 1998, vol. 8, 180–182.

17. "Axiology" in Edward Craig (ed.), *Routledge Encyclopedia of Philosophy*, London: Routledge 1998, vol. 1, 271-273 (with Alan Watson).

18. "Witasek", in Monika Betzler and Julian Nida-Rümelin (eds.), *Ästhetik und Kunstphilosophie von der Antike bis zur Gegenwart in Einzeldarstellungen,* Stuttgart: Alfred Kröner Verlag, 1998, 821–824.

19. "Ingarden", in Robert Audi (ed.), *The Cambridge Dictionary of Philosophy*, Cambridge: Cambridge University Press, 1999, p. 437.

20. "Brentano", in *MIT Encyclopedia of Cognitive Science*, Cambridge, MA: MIT Press, 1999, 94–95.

21. "Daubert", in *Powszechna Encyklopedia Filozofii*, Lublin: Polskie Towarzystwo Tomasza z Akwinu, 2001, 415-418. English version.

22. Steffen Schulze-Kremer and Barry Smith, "Ontologies for the Life Sciences", *Encyclopedia of Genetics, Genomics, Proteomics and Bioinformatics*, New York and London: John Wiley and Sons, vol. 4, 2005.

> **Abstract:** Where humans can manipulate and integrate the information they receive in subtle and ever-changing ways from context to context, computers need structured and context-free background information of a sort which ontologies can help to provide. A domain ontology captures the stable, highly general and commonly accepted core knowledge for an application domain. The domain at issue here is that of the life sciences, in particular molecular biology and bioinformatics. Contemporary life science research includes components drawn from physics, chemistry, mathematics, medicine and many other areas, and all of these dimensions, as well as fundamental philosophical issues, must be taken into account in the construction of a domain ontology. Here we describe the basic features of domain ontologies in the life sciences and show how they can be used.

23. Barry Smith "John Searle", *Les sciences humaines*, ed. Patrick Savidan, Paris: Presses Universitaires de France, 2006, 1061-62.

24. James DuBois and Barry Smith, "Reinach", *Stanford Encyclopedia of Philosophy*, 2008.

25. Barry Smith, "Biometaphysics", *Routledge Companion to Metaphysics,* Robin Le Poidevin, *et al*. (eds.), London and New York: Routledge, 2009, 537-544.

> **Abstract:** While Darwin is commonly supposed to have demonstrated the inapplicability of the Aristotelian ontology of species to biological science, recent developments, especially in the wake of the Human Genome Project, have given rise to a new golden age of classification in which ontological ideas – as for example in the Gene Ontology, the Cell Ontology, the Protein Ontology, and so forth – are once again playing an important role. In regard to species, on the other hand, matters are more complex. We provide a brief overview of recent proposals concerning the ontology of species, dealing with species as sets, classes and as collections, the views of Ernst Mayr, and mereological views.

26. Alessandro Salice, James DuBois, Barry Smith, "Reinach" (revised version), *Stanford Encyclopedia of Philosophy*, 2024.

TRANSLATIONS

1. Translation of Adolf Reinach, "On the Theory of the Negative Judgment", in Barry Smith (ed.), *Parts and Moments*. *Studies in Logic and Formal Ontology*, Munich: Philosophia, 1982, 315–377.

2. Translation of Adolf Reinach, "William James and Pragmatism", in K. Mulligan (ed.), *Speech Act and Sachverhalt*. *Reinach and the Foundations of Realist Phenomenology*, Dordrecht/Boston/Lancaster: Nijhoff, 1987, 291–298.

3. Franz Brentano, *Philosophical Investigations on Space*, *Time and the Continuum*, English translation by Barry Smith, London/Sydney: Croom Helm, 1988, xxiv + 202pp. Reprinted Abingdon/New York: Routledge, 2010.

> Reviewed by Jonathan Barnes, *Philosophy and Phenomenological Research*, 51 (2), 468-470.

4. Translation of Christian von Ehrenfels, "On 'Gestalt-Qualities'" and other writings on Gestalt theory, in Barry Smith (ed.), *Foundations of Gestalt Theory*, Munich and Vienna: Philosophia, 1988, 82–123.

5. "A Note on Brentano's Terminology", translator's preface to Franz Brentano, *Philosophical Investigations on Space, Time and the Continuum*, London/Sydney: Croom Helm, 1988, xxii–xxiv.

BIBLIOGRAPHIES

1. "Annotated Bibliography of Writings on Part-Whole Relations since Brentano", in Barry Smith (ed.), *Parts and Moments. Studies in Logic and Formal Ontology*, Munich: Philosophia, 1982, 481–552.

2. "Addenda to: Annotated Bibliography of Writings on Part-Whole Relations since Brentano", in P. Sällström (ed.), *An Inventory of Present Thinking about Parts and Wholes*, vol. III, Stockholm: Forskningsrådsnämnden, 1985, 74–86.

3. "Chronicle"/"Husserl Bibliography", cumulative bibliography of literature on and by Edmund Husserl, in *Husserl Studies*, triennially from issue 3/2, 1986 to 8/3, 1991.

4. "Adolf Reinach: An Annotated Bibliography", in K. Mulligan (ed.), *Speech Act and Sachverhalt*, Dordrecht/Boston/Lancaster: Nijhoff, 1987, 299–332.

> **Abstract**: Ever since its appearance in 1913, Reinach's work on a The A Priori Foundations of the Civil Law has served as the principal representative of phenomenological, aprioristic and ontological/realist approaches to the philosophy of law. This annotated bibliography provides an overview of the reception of Reinach's thinking, which has been of influence also in the realm of speech act theory.

5. "Gestalt Theory and Its Reception: An Annotated Bibliography", in Barry Smith (ed.), *Foundations of Gestalt Theory*, Munich and Vienna: Philosophia, 1988, 231–478.

6. "Bibliography" in Barry Smith and David W. Smith (eds.), *The Cambridge Companion to Husserl*, Cambridge and New York: Cambridge University Press, 1995, 487–508.

REVIEWS AND REVIEW ARTICLES

1. Roman Ingarden, The *Literary Work of Art* (Evanston 1973), *Journal of the British Society for Phenomenology*, 6 (1975), 141–144.

2. Reinhardt Grossmann, *Meinong* (London 1974), *Journal of the British Society for Phenomenology*, 4 (1976), 147–148.

3. Michael Dummett, *Truth and Other Enigmas* (London 1978), *Philosophischer Literaturanzeiger*, 32 (1979), 365–368 (in German).

4. Martin Heidegger, *Metaphysische Anfangsgründe der Logik* (Frankfurt 1978), *Annals of Science*, 36 (1979), 103–105.

5. Alexius Meinong, *Gesamtausgabe* (Graz 1971–79), *Annals of Science*, 36 (1979), 636–38. German version in *Philosophischer Literaturanzeiger*, 33 (1980), 236–240.

6. Jacques Derrida, *Edmund Husserl's 'Origins of Geometry.' An Introduction* (London 1979), *Annals of Science*, 36 (1979), 638–641.

7. R. M. Chisholm and R. Haller (eds.), *Die Philosophie Franz Brentanos* (Amsterdam 1978), *Journal of the British Society for Phenomenology*, 11 (1980), 194–199.

8. Alexius Meinong, *On Objects of Higher Order and Husserl's Phenomenology* (M. L. Schubert-Kalsi (ed.), The Hague 1978), *The Philosophical Quarterly*, 30 (1980), 252–254.

9. Edmund Husserl, *Aufsätze und Rezensionen 1890–1910* (The Hague 1979), *Philosophischer Literaturanzeiger*, 33 (1980), 313–315 (in German).

10. David Wiggins, *Sameness and Substance* (Oxford 1979), *History and Philosophy of Logic*, 2 (1981), 150–151.

11. Paul Gochet, *Outline of a Nominalist Theory of Propositions* (Dordrecht 1980), *Grazer Philosophische Studien*, 14 (1981), 216–217.

12. Edmund Husserl, *Phantasie, Bildbewußtsein, Erinnerung. Zur Phänomenologie der anschaulichen Vergegenwärtigung* (The Hague 1980), *Philosophischer Literaturanzeiger*, 35 (1982), 14–17 (in German).

13. Ludwig Landgrebe, *The Phenomenology of Edmund Husserl* (Ithaca 1981), *History and Philosophy of Logic*, 4 (1983), 111.

14. Roger Schmit, *Husserls Philosophie der Mathematik*. *Platonistische und konstruktivistische Momente in Husserls Mathematikbegriff* (Bonn 1981), *History and Philosophy of Logic*, 4 (1983), 230–234.

15. Kurt Lewin, *Wissenschaftstheorie I* (Bern/Stuttgart 1981), *History and Philosophy of Logic*, 4 (1983), 235–238.

16. "Phänomenologie und angelsächsische Philosophie" [Review article on recent publications in phenomenology], *Philosophischer Literaturanzeiger*, 37 (1984), 387–405.

17. Kevin Mulligan and Barry Smith, "Traditional vs. Analytic Philosophy" [Review article on E. Tugendhat, *Traditional and Analytic Philosophy*], *Grazer Philosophische Studien*, 21 (1984), 193–202.

Abstract: We review an influential series of lectures on analytic philosophy published in 1976 by the West German philosopher Ernst Tugendhat focusing on Tugendhat's treatment of Husserl, and particularly on issues connected with the notion of dependence or *Abhängigkeit* central to Husserl's philosophy. These issues are of interest not only because Tugendhat's work is one of the few contributions to contemporary analytic philosophy in which they are confronted explicitly, but also because what he has to say about Husserl and dependence illustrates well both the positive and the negative thrust of his argument.

19. Edmund Husserl, *Studien zur Arithmetik und Geometrie* (The Hague 1983), *History and Philosophy of Logic*, 5 (1985), 228–230.

20. P. Jaeger and R. Lüthe (eds.), *Distanz und Nähe. Reflexionen und Analysen zur Kunst der Gegenwart* (Würzburg 1983), *Journal of the British Society for Phenomenology*, 16 (1985), 320–322.

21. Harald Delius, *Self-Awareness: A Semantical Inquiry* (Munich 1981), *Philosophy and Phenomenological Research*, 46 (1985), 170–173.

Abstract: The thesis of Delius's book is that statements of self-awareness such as "I am aware that I see a cat" possess what he calls 'Cartesian characteristics' of indubitability or absolute self-evidence. He argues that this is the case in virtue of the fact that such statements are not about anything independent of themselves. The book is described as a 'semantical inquiry', but it is not by any means a contribution to the philosophy of language of the predictable sort. Statements of self-awareness express what Delius calls 'egological experiences', and the subject of the book is most accurately described as consisting in the relations between egological statements and egological experiences, in a sense made clear in the course of the book.

22. J. N. Mohanty, *The Possibility of Transcendental Philosophy* (Dordrecht 1985), *Journal of the British Society for Phenomenology*, 18 (1987), 299–301.

23. Paul Gochet, *Ascent to Truth: A Critical Examination of Quine's Philosophy* (Munich/Vienna 1986), *Grazer Philosophische Studien*, 30 (1987), 212–213.

24. J. Macnamara, *A Border Dispute. The Place of Logic in Psychology* (Cambridge, Mass. 1987), *History and Philosophy of Logic*, 9 (1988), 126–128.

25. R. Bernet, I. Kern and E. Marbach, *Edmund Husserl. Darstellung seines Denkens* (Hamburg, 1989), *History and Philosophy of Logic,* 11 (1990), 260.

26. bb

27. L. B. Puntel, *Grundlagen einer Theorie der Wahrheit* (Berlin/New York 1990), *Philosophy and Phenomenological Research*, 52 (1992), 494–496.

28. Mark A. Notturno, (ed.) *Perspectives on Psychologism* (Leiden 1989), *History and Philosophy of Logic,* 12 (1991), 249–251.

29. Felix Kaufmann, *L'infinito in matematica* (Gardolo di Trento 1990), *History and Philosophy of Logic*, 13 (1992), 131.

30. "The Philosophy of Austrian Economics" [Review article on David Gordon, *The Philosophical Origins of Austrian Economics* (Auburn 1993)], *Review of Austrian Economics*, 7 (1994), 127–132.

31. Ernest Davis, *Representations of Commonsense Knowledge* (San Mateo 1990), *Minds and Machines*, 4/2 (1994), 245–249.

32. Kenneth J. Perszyk, *Nonexistent Objects: Meinong and Contemporary Philosophy* (Dordrecht/Boston/London 1993), *History and Philosophy of Logic*, 16 (1995), 154–155.

33. Werner Stelzner (ed.), *Philosophie und Logik. Frege-Kolloquien Jena 1989/1991* (Berlin/New York 1993), *History and Philosophy of Logic*, 16 (1995), 155–156.

34. Edmund Husserl, *Briefwechsel* (10 volumes, Dordrecht/Boston/London 1994), *Husserl Studies*, 12 (1995), 98–104.

Abstract: This edition of Husserl's correspondence comprises 10 volumes. Its philosophical core is contained in the first four volumes, which correspond to the four phases of Husserl's philosophical career: as follower of Brentano, as mentor of the realist phenomenologists in Munich (the founders of the 'phenomenological movement'), and as professor, successively, in Göttingen and Freiburg. The remaining five volumes pertain to HusserI's correspondence with philosophers and other scholars outside the inner circle of the phenomenological movement, with institutions and editors, and with family members and friends. Volume 10 comprises a masterly introduction to the edition by the editors, Karl and Elisabeth Schuhmann, together with chronological tables and seven separate indexes enabling the user to trace references in the letters to Husserl's own publications, manuscripts and lectures, as well as to persons, institutions and places.

35. Arnold Heidsieck, *The Intellectual Contexts of Kafka's Fiction: Philosophy*, *Law*, *Religion* (Columbia, SC 1994) in *Nachrichten der Forschungsstelle und des Dokumentationszentrums für Österreichische Philosophie*, 6 (1995), 47–49.

36. Gustav Bergmann, *New Foundations of Ontology* (Madison and London 1992), in *Vienna Circle Institute Yearbook*, 3 (1995), Dordrecht: Kluwer, 304–306.

37. Aurel Kolnai, *The Utopian Mind* (London 1995), *Journal of the British Society for Phenomenology*, 27/2 (1996), 208–210.

38. Steven S. Pollard and Norman M. Martin, *Closure Spaces and Logic* (Dordrecht 1996), *History and Philosophy of Logic*, 17 (1996), 176–177.

39. Peter A. Burrough and Andrew U. Frank (eds.), *Geographic Objects with Indeterminate Boundaries* (London and Bristol, PA. 1996), *Dialectica*, 55: 1 (2001), 72–74.