

CURRICULUM VITAE

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Employment

Research Director, Institute for Cognitive Sciences and Technologies (ISTC-CNR), 2007-present

Senior Researcher, Institute for Cognitive Sciences and Technologies (ISTC-CNR), 2003-2006

Senior Researcher, Institute for Systems Science and Biomedical Engineering (ISIB-CNR), 1999-2002

Researcher, Institute for Systems Science and Biomedical Engineering (ISIB-CNR), 1984-1999

Researcher, Institute for Ionized Gases (IGI-CNR), 1982-1984

Educational Background

Laurea degree in electronic engineering (5-years university degree), 1978, University of Padua.

Research topics

- Ontological foundations of knowledge representation and conceptual modelling
- Ontological analysis and knowledge engineering
- Relationships between ontology, cognition, and natural language
- Semantic interoperability and enterprise integration
- Ontology of services and organizations, service science
- Ontology of socio-technical systems

Scientific bio

I graduated in Electronic Engineering at the University of Padua in 1978, with a thesis on biomedical engineering. Soon I got the opportunity to collaborate with the Institute of Ionised Gases (IGI-CNR) in Padua, where I have been in charge of the data acquisition and monitoring system of a nuclear fusion experiment (1979–1984). Then I moved back to biomedical engineering, joining the Institute of Systems Theory and Biomedical Engineering (now ISIB-CNR), where dr. Rosanna Degani, expert in ECG recognition, asked me to explore the emerging field of medical expert systems, with a focus on arrhythmia management. I immediately realised the huge representation problems of medical knowledge. After a couple of months spent at the MIT Clinical Decision Making Lab struggling with capturing anatomical and physiological knowledge in Prolog (and building my own representation language – ITL), I decided I needed a stronger background in logic and the foundations of KR, and discovered that philosophical logic was much more useful for my purposes than mathematical logic. Around 1988 I started frequenting the local circle of analytic philosophy at Padua University, and slowly a whole new world opened to me. The key to formal ontology where the seminal works by Peter Simons and Barry Smith. In the States, people had just started talking of ontologies for knowledge sharing and reuse, and I realised that formal ontology was the right way to approach those problems, helping people (not just computers) to make explicit their conceptualisations. In the same period I also discovered the importance of linguistic analysis in KR, thanks to the work of Reind van der Riet. In 1993 I organised in Padua (with Roberto Poli) the first International Workshop on Formal Ontology in Conceptual Analysis and Knowledge Representation, which had a strong impact on a large interdisciplinary community. Starting to work together with philosophers, I presented my first ideas on the ontological level at the 16th Wittgenstein Symposium, where I met Achille Varzi, who introduced me to the beauties of ontological analysis and the elegance of mereotopology. After some passionate years spent discussing the role of ontologies mainly with the knowledge acquisition and KR communities, I organised the first Int. Conf. on Formal Ontology in Information Systems (FOIS) in 1998, which marked the beginning of a new research area. The sabbatical spent by Chris Welty in my lab in Padua allowed me to “popularise” the first technical results of my theory through the OntoClean methodology, and the move to Trento in 2003, to found the new Lab for Applied Ontology, allowed me to set up the small, beautiful group of people which produced the DOLCE foundational ontology, one of our best known results. Since then, balancing my time with increasing management and community service commitments, I focused my interests more and more on social ontology, working in particular on eGovernment applications, on the notion of social role, and, more recently, on socio-technical systems and service science.

Teaching and academic duties

Lecturer in various PhD, master and undergraduate courses at the Universities of Trento and Padua, and in various international summer schools and conference tutorials. Member of Trento Doctoral School in Information and Communication Technology. PhD committee member at Universities of Trento, Torino, Leipzig, Zurich, Melbourne, Free University of Amsterdam, Tilburg, UMIT University (Austria). Member of habilitation committees at the Universities of Toulouse 3 and Grenoble. Guest professor at the Universities of Osaka, Japan, Institute for Scientific and Industrial Research, in April-May 2010, and Addis Ababa, Dept. of Computer Science, October 2011.

Responsibilities

- Founder and director of the *ISTC-CNR Laboratory for Applied Ontology* in Trento (2003-_)
- Founder and co-editor in chief (with Mark Musen, Stanford University) of the ISI-indexed journal *Applied Ontology* (IOS Press) (2005-_)
- Founder and co-director (with Laure Vieu) of *ILIKS – Interdisciplinary Laboratory for Interacting Knowledge Systems*, a French-Italian joint initiative with 90+ researchers involved (www.loa.istc.cnr.it/iliks) (2005-2011)
- General chair of the international conference series *Formal Ontology in Information Systems* (1998-2010)
- Editorial board member of *Journal of Data Semantics*, *International Journal of Semantic Web and Information Systems*, *Frontiers of Computer Science in China*, and editor of the IOS Press Book series *Frontiers in AI and Applications*
- Founder and president of the *International Association for Ontology and its Applications (IAOA)* (2009-2012)
- Scientific consultant of BPE srl - small company in Rovereto focusing on business process engineering and enterprise modelling
- Scientific consultant of IBM Italy on eGovernment services interoperability
- Project reviewer for *EU (FP5, ERC 2012 AdG)*, *Swiss National Fund on Scientific Research*, *Estonian Science Foundation*, *Council of Physical Sciences of the Netherlands Organization for Scientific Research*, *UK Engineering and Physical Sciences Research Council*, *France Ministry for Education, Research and Technology*.
- Member of scientific committee of the *FuturICT Italian Hub* (www.futurict.it)
- Member of scientific committee of the *Semantic Valley* consortium, Trento (www.semanticvalley.org)
- General co-chair of *Ontology Summit 2011* and *Ontology Summit 2012* at NIST, Baltimore, USA (an international event supported by NIST, IAOA and other ontology organizations)
- CNR representative in the coordinating unit concerning the agreement between CNR and the Bruno Kessler Foundation (FBK).
- Scientific coordinator of the *Data and Knowledge Engineering* group of the Trento RISE consortium (www.trentorise.eu), involving 80+ researchers and students from University of Trento, FBK and CNR.

Awards and honors

- *ECCAI fellow*, in recognition of pioneering work in the field of Artificial Intelligence and outstanding service for the European Artificial Intelligence community (2012-)
- *Best paper award* (with
- *Best paper award* (with Giancarlo Guizzardi, Gerd Wagner, and Marten van Sinderen at *CaiSE 2004*, 16th *International Conference on Advanced Information Systems Engineering*, Riga, Latvia, June 7-11 2004
- *Thomson-ISI recognition of an “Emerging Research Front” in Computer Science*, acknowledging CACM work on OntoClean with Chris Welty among the most cited papers in June 2004

Scientific Leadership Profile

Ability to productively change research fields or to establish new interdisciplinary approaches

Since my discovery of the role of analytic philosophy, linguistics and cognitive science in knowledge engineering and conceptual modelling around 1988, a number of events I was in charge of (or directly influenced) paved the way to the establishment of a new interdisciplinary area of research: *Applied Ontology*.

1993. 1st Int. *Workshop on Formal Ontology in Conceptual Analysis and Knowledge Representation*. Padua, March 1993. Speakers include John Sowa, Barry Smith, Peter Simons, Jerry Hobbs.
1998. 1st Int. Conf. on *Formal Ontology in Information Systems* (FOIS 1998), Trento. Since then, FOIS will be held almost every two years. Chairs are always two people from different disciplines.
2003. The *ISTC-CNR Laboratory of Applied Ontology* (LOA) is founded, located in Trento (with a branch in Rome which will later get autonomous). The DOLCE ontology will become one of its most well known results.
2004. New journal launched (with M. Musen, Stanford University): *Applied Ontology: an interdisciplinary journal on ontological analysis and conceptual modelling* (IOS Press).
2006. *Upper Ontology Summit* at NIST, Gaithersburg, Maryland, USA. Foundational ontology work gets wide recognition also in the industry setting.

2009. The *International Association for Ontology and its Applications* (www.iaoa.org) is founded in Trento. Elected President Nicola Guarino.
2010. The 2010 Ontology Summit at NIST, co-organised by IAOA, discusses curricula for “Creating Ontologists of the Future”, under an interdisciplinary perspective.
2012. The 2012 Ontology Summit, whose theme is *Ontology and big systems*, marks a milestone in Applied Ontology: from contributing to interoperability and mutual understanding to contributing to understanding the nature, structure and behaviour of complex techno-socio-economical systems.

Content and impact of major scientific contributions

The core of my research is an interdisciplinary approach to formal ontological analysis, which combines Computer Science, Philosophy and Linguistics. I am recognised especially for the following contributions:

1. A formal definition of the *nature of computational ontologies*, with special attention to the relationships to KR and conceptual modelling, which marked a milestone in the knowledge acquisition and KR community, with the establishment of task ontologies.
2. An analysis of the *ontological distinctions among unary properties*, and a related methodology, **OntoClean**, which was the first formal methodology for ontology engineering, applying scientific principles to a field whose practice was mostly art.
3. A formal analysis of the ubiquitous notion of *role* from different points of view, including the linguistic, social, and engineering aspects. (Incorporated into the latest versions of WordNet).
4. The **DOLCE ontology**, a rigorous axiomatic theory of upper-level concepts and relations, inspired by cognitive and linguistic considerations, adopted –often after careful comparison– in multiple projects and applications worldwide. A query with “DOLCE ontology” returns 30,100 hits.
5. A thorough analysis of the various kinds of *part-whole relations* and their use in conceptual modelling.
6. A novel ontological analysis of the notion of service from the socio-economic perspective, intended to establish the basis for a **foundational approach to service science**, aimed at bridging the gap between the business view and the ICT view. Adopted by SAP as the basis for extending their USDL .

Citation analysis

1 paper with 3600+ citations, 7 papers with 500+ citations, 26 papers with 100+ citations each, among **15000+** citations according to Google Scholar; 2 papers among the 10 best cited of *Int. J. Human and Computer Studies*; 2 papers among the 10 best cited of *Data and Knowledge Engineering*. **H-index=40**.

A citation analysis based on the ISI Web of science and Google Scholar returns **173 different journals** citing my papers, including at least **26** journals outside the field of computer science. Perhaps this is the best evidence of the wide impact of my research in computer science and beyond.

Current and recent research grants (funds concern my lab only)

1. Brazilian Government, Special Visiting Researcher Fellowship hosted by the Federal University of Espirito Santo at Vitória on *Ontological Foundations of Service Science* (80 K€, 2013-2016)
2. EC/FP7-People Marie Curie Intra-European Fellowship – ODASP, *Ontology driven analysis of nominal systematic polysemy in WordNet* (180 K€, 2013-2015)
3. Autonomous Province of Trento - Grant to Roberta Ferrario for a new research unit on *Detection of crises in socio-material systems via visual-cognitive-social processes* (600 K€, 2012-2015)
4. Autonomous Province of Trento - Post-doc grant to Emanuele Bottazzi *The Civil Status of Contradiction* (147 K€, 2012-2015)
5. EC/FP7 Marie Curie Action COFUND. *Logical Analysis of Socio-Technical Systems* (LASTS) (191 K€, 2011-2014)
6. EC/FP7 Marie Curie Action *European-Japanese Ontology Interaction* (EUJOINT)(11 K€, 2010-2012)
7. SOGEI (company owned by the Italian Ministry for Economy and Finance) – *Ontological restructuring of integrated fiscal dictionary* (80 K€, 2012-2013)
8. BPE - Business Process Engineering srl, Rovereto – *System for Interactive Ontology-Driven Conceptual Modelling* (90 K€, 2012-2013).
9. Ministry of Research and University – *TOCAI – Knowledge Oriented Technologies for Enterprise Integration on Internet* (223 K€, 2006-2010).
10. Piedmont Region – *ICT4LAW – ICT Converging on Law: Next Generation Services for Citizens, Enterprises, Public Administration and Policymakers* (100 K€, 2009-2011).
11. Autonomous Province of Trento – *CSS, integration of clinical and social records* (31 K€, 2009-2010).
12. Autonomous Province of Trento, post-doc research grant. *A Foundational Ontology for Semantic Interoperability in eGovernment*. (150 K€=
13. SAP Research – *OFSS – Ontological Foundations of Service Science* (30 K€, 2010).

Selected Publications

- Guarino, N. and Poli, R. (guest eds.), *International Journal of Human and Machines Studies (special issue on The Role of Formal Ontology in the Information Technology)*. **43**(5/6), 1995.
- Guarino, N. and Giaretta, P. 1995. Ontologies and Knowledge Bases: Towards a Terminological Clarification. In N. Mars (ed.) *Towards Very Large Knowledge Bases: Knowledge Building and Knowledge Sharing 1995*. IOS Press, Amsterdam: 25-32.
- Guarino, N., Pribbenow, S., and Vieu, L. (guest eds.), *Data and Knowledge Engineering (special issue on Modelling Parts and Wholes)*, **30**(3), 1996.
- Artale, A., Franconi, E., Guarino, N., and Pazzi, L. 1996. Part-Whole Relations in Object-Centered Systems: an Overview. *Data and Knowledge Engineering*, **20**(3): 347-383.
- Borgo, S., Guarino, N., and Masolo, C. 1996. A Pointless Theory of Space based on Strong Connection and Congruence. In *Proceedings of Principles of Knowledge Representation and Reasoning (KR96)*. Boston, MA, Morgan Kaufmann: 220-229.
- Guarino N. Semantic matching: formal ontological distinctions for information organization, extraction, and integration. In *Information Extraction: A Multidisciplinary Approach to an Emerging Information Technology*. Lecture Notes in Artificial Intelligence 1299, M.T. Pazienza (Ed.) Springer Verlag, Berlin, 1997, p.139-170.
- Guarino N. Understanding, building, and using ontologies. *International Journal of Human and Computer Studies* **46**: 293-310, 1997.
- Guarino, N. 1997. Ontologia Formale, Modellazione Concettuale e Ingegneria della Conoscenza. *Paradigmi*, **15**(44): 285-299.
- Guarino N. Some ontological principles for designing upper level lexical resources. In *Language Resources and Evaluation*, A. Rubio, N. Gallardo, R. Castro, A. Tejada (Eds.), European Language Resources Association (ELRA), Granada, Spain, 1998, vol.1, p.527-534.
- Guarino N. Formal ontology in information systems. In *Formal Ontology in Information Systems*, N. Guarino (Ed.), IOS Press, Amsterdam, 1998, p.3-15.
- Guarino, N. (guest ed.), *Data and Knowledge Engineering (special issue on Formal Ontology and Conceptual Modelling)*, **31**(2), 1999
- Guarino, N. The Role of Identity Conditions in Ontology Design. In C. Freksa and D. M. Mark (eds.), *Spatial Information Theory - Cognitive and Computational Foundations of Geographic Information Science*. Proceedings of International Conference COSIT '99. Springer Verlag, Berlin, 1999, p. 221-234.
- Guarino, N., Masolo, C., and Vetere, G. OntoSeek: Content-Based Access to the Web. *IEEE Intelligent Systems*, **14**(3), 1999, p. 70-80.
- Masolo, C. and Vieu, L. Atomicity vs. Infinite Divisibility of Space. In C. Freksa and D. M. Mark (eds.), *Spatial Information Theory: Cognitive and Computational Foundations of Geographic Information Systems*. Proceedings of International Conference COSIT'99, Stade, Germany, August 1999. Springer, Berlin, 1999, p. 233-250.
- Guarino, N. 1999. Panini al prosciutto e altri trabocchetti ontologici. Commenti all'articolo di Casati e Varzi "I trabocchetti della rappresentazione spaziale". *Sistemi Intelligenti*, **11**(1): 42-53.
- Guarino N., Welty, C. Towards a methodology for ontology-based model engineering. In Bezivin, J. and Ernst, J., eds, *Proceedings of the ECOOP-2000 Workshop on Model Engineering*, June, 2000.
- Guarino N., Welty, C. Identity, Unity, and Individuation: Towards a Formal Toolkit for Ontological Analysis. In W. Horn, ed., *Proceedings of ECAI-2000: The European Conference on Artificial Intelligence*. IOS Press, Amsterdam. August, 2000.
- Guarino N., Welty, C. Ontological analysis of taxonomic relationships. In *Proceedings of 19th International Conference on Conceptual Modeling (ER2000)*. October 9-12, 2000, Salt Lake City, USA
- Gangemi, A., Guarino, N., and Oltramari, A. 2001. Conceptual Analysis of Lexical Taxonomies: The Case of WordNet Top-Level. In C. Welty and S. Barry (eds.), *Formal Ontology in Information Systems. Proceedings of FOIS2001*. ACM Press: 285-296.
- Guarino, N. 2001. Review of John Sowa's "Knowledge Representation: Logical, Philosophical, and Computational Foundations". *AI Magazine*, **22**(3): 123-125.
- Schulten, E., Akkermans, H., Guarino, N., and Doerr, M. 2001. The eCommerce Product Classification Challenge. *IEEE Intelligent Systems*(August): 86-89.
- Welty, C. and Guarino, N. 2001. Supporting Ontological Analysis of Taxonomic Relationships. *Data and Knowledge Engineering*, **39**(1): 51-74.
- Guarino, N. and Welty, C. 2001. Evaluating Ontological Decisions with OntoClean. *Communications of the ACM* **45**(2): 61-65
- Guarino, N. and Welty, C. 2002. Identity and subsumption. In R. Green, C. Bean and S. Myaeng (eds.), *The Semantics of Relationships: an Interdisciplinary Perspective*. Kluwer:111-126.
- Gangemi, A., Guarino, N., Masolo, C., Oltramari, A., & Schneider, L. 2002. Sweetening Ontologies with DOLCE. In A. Gomez Perez & V. R. Benjamins (Eds.), *Knowledge Engineering and Knowledge Management. Ontologies and the Semantic Web*. Proceedings of 13th International Conference, EKAW 2002. Berlin: Springer Verlag:166-181.

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- Guarino, N., and Welty, C. 2003. An overview of OntoClean. In R. Studer and S. Staab (eds.), *Handbook of Ontologies in Information Systems*, Springer Verlag: 151-172.
- Masolo, C., Oltramari, A., Gangemi, A., Guarino, N., Vieu, L. 2003. La prospettiva dell'ontologia applicata. *Rivista di Estetica* (22): 170-183.
- Oltramari, A., Borgo, S., Catenacci, C., Ferrario, R., Gangemi, A., Guarino, N., Masolo, C., Pisanelli, D. 2003. Negoziati di significato. *Sistemi Intelligenti* 15(3): 419-428
- Guizzardi, G., Wagner, G., Guarino, N., van Sinderen, M. An Ontologically Well-Founded Profile for UML Conceptual Models. *Proc. of 16th Conf. on Advanced Information Systems Engineering (CAISE'04)*, Latvia
- Masolo, C., Vieu, L., Bottazzi, E., Catenacci, C., Ferrario, R., Gangemi, A., Guarino, N. 2004. Social Roles and their Descriptions. To appear on *Proc. of 9th Int. Conf. On Principles of Knowledge Representation and Reasoning (KR2004)*, Whistler, Canada, June 2004, June 2004.
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- Guarino, N., and Musen, M. Focusing on Content. *Applied Ontology*, 1 (2005):1-6.
- Guarino, N. and Guizzardi, G. 2006. In Defense of Ontological Foundations for Conceptual Modeling. *Scandinavian Journal of Information Systems*, **18**(1): 115-126.
- Calvanese, D. and Guarino, N. 2006. Ontologies and description logics. *Intelligenza Artificiale*, **3**(1/2): 19-25.
- Artale, A., Guarino, N., & Keet, M. C. 2008. Formalizing Temporal Constraints on Part-Whole relations. In G. Brewka, J. Lang (eds.): *KR 2008: Eleventh International Conference on Principles of Knowledge Representation and Reasoning*, Sydney, Australia. AAAI Press, pp. 673-683. ISBN 978-1-57735-384-3
- Ferrario R., Guarino N. 2008. A New Ontological Perspective for Social Services. In Corradini, F., and Polzonetti, A. (eds.), *MeTTeG08, Proceedings of the 2nd International Conference on Methodologies, Technologies and Tools Enabling e-Government*, Halley, pp.41-51.
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- Oltramari, A., Gangemi A., Guarino N., Masolo C. 2010. Restructuring WordNet's Top-Level: the OntoClean Approach. In C.-R. Huang, N. Calzolari, A. Gangemi, A. Lenci, A. Oltramari, L. Prevot (eds.), *Ontologies and Lexical Resources for Natural Language Processing*, Cambridge University Press 2010: 36-52
- Ferrario, R., Guarino, N., Fernandez Barrera, M. 2011. Ontological Foundations for Services Science: the Legal Perspective. In Sartor, G., Casanovas, P., Biasiotti, M, Fernandez Barrera, M. (eds.), *Approaches to Legal Ontologies. Theories, Domains, Methodologies*. Springer Verlag, pp. 235-258
- Ferrario, R., Guarino, N., Janiesch, C., Kiemes, T., Oberle, D., and Probst, D. 2011. Towards an Ontological Foundation of Services Science: The General Service Model. In Proceedings of the 10. Internationale Tagung Wirtschaftsinformatik (WI), Zürich, pp. 675-684.
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- Guarino, N. 2013. Local Qualities, Quality Fields, and Quality Patterns: A Preliminary Investigation. In O. Kutz, M. Bhatt, S. Borgo, and P. Santos (eds.), *Proc. of 2nd Interdisciplinary Workshop on SHAPES*, Rio de Janeiro, Brazil, March 3-4, 2013. Available online at ceur-ws.org

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- Guarino, N. 2013. Services and Service Systems under a Mesoscopic Perspective. In Gummesson, E., Mele, C., Polese, F. (eds.). Service Dominant Logic, Network and Systems Theory, and Service Science: Integrating three Perspectives for a New Service Agenda. Giannini, Napoli 2013. ISBN: 9788874316847.
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