# **UFO**, **OntoUML** and its associated **Tools**

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# Foundational Theories

# Engineering Tools

Domain Specific Theories

Domain Specific Applications

# Foundational Theories

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Types and Taxonomic Structures, Dependence, Events, (Part-Whole) Relations, Relations, Causality, Multi-Level Modeling, Dependence, etc...

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Modeling Languages,





















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Fig 1. Representing the possibility of change for Endurants

This model of figure 1 is represented in a conceptual modeling language termed toUML [9]. This language has been design to reflect the ontological distinctions axiomatization put forth by the Unified Foundational Ontology (UFO) [9,13]. In ticular, this language has as modeling primitives those that represent ontological tinctions between all the aforementioned sorts of types (e.g., kinds, phase, roles, mixins, relators). Figure 1 represents the possibility of change, i.e., how things c possibly be for the entities that are assumed to exist in this domain (i.e., people ganizations, cars and car rentals). In this approach, the OntoUML model of figure and the automatically translated to knowledge representation languages such as C

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#### gUFO: A Lightweight Implementation of the Unified Foundational Ontology (UFO)

#### IRI

http://purl.org/nemo/gufo#

#### Creator(s)

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#### **Ontology Source**

RDF (Turtle)

#### Description

The objective of gUFO is to provide a lightweight implementation of the Unified Foundational Ontology (UFO) [1-5] suitable for Semantic Web OWL 2 DL applications.

Intended users are those implementing UFO-based lightweight ontologies that reuse gUFO by specializing and instantiating its elements.

There are three implications of the use of the term lightweight. First of all, we have employed little expressive means in an effort to retain computational properties for the resulting OWL ontology. Second, we have selected a subset of UFO-A [1, 2] and UFO-B [3] to include here. In particular, there is minimalistic support for UFO-B (only that which is necessary to establish the participation of objects in events and to capture historical dependence between events). Third, a lightweight ontology, differently from a reference ontology, is designed with the purpose of providing an implementation artifact to structure a knowledge base (or knowledge graph). This has driven a number of programtic

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### The Emerging Anti-Pattern: Relation Between Overlapping Types (**RelOver**)



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# https://github.com/ OntoUML/ontouml-vpplugin

# Some References

- Guizzardi, G., Wagner, G., Almeida, J.P.A., Guizzardi, R.S.S., Towards Ontological Foundation for Conceptual Modeling: The Unified Foundational Ontology (UFO) Story, Applied Ontology, IOS Press, 2015.
- Guizzardi, G., Ontological Patterns, Anti-Patterns and Pattern Languages for Next-Generation Conceptual Modeling, invited companion paper to the Keynote Speech delivered at the 33rd International Conference on Conceptual Modeling (ER 2014), Atlanta, USA.
- Guizzardi, G., Ontological Foundations for Structural Conceptual Models, Telematica Instituut Fundamental Research Series No. 15, ISBN 90-75176-81-3, 2005.
- Ruy, F., Guizzardi, G., Falbo, R., Reginato, C.C., Santos, V.A., From Reference Ontologies to Ontology Patterns and Back, Data & Knowledge Engineering, Elsevier, 2017.
- Sales. T.P., Guizzardi, G., Ontological Anti-Patterns: Empirically Uncovered Error-Prone Structures in Ontology-Driven Conceptual Models, Data & Knowledge Engineering, Elsevier, 2015.
- Almeida, J.P.A., Guizzardi, G., Sales, T.P., Falbo, R.A., "gUFO: A Lightweight Implementation of the Unified Foundational Ontology (UFO)", Technical Report, 2020.
- Guizzardi, G., Fonseca, C., Almeida, J.P., Sales, T.P., Benevides, A.B., Porello, D., Types and Taxonomic Structures in Conceptual Modeling: A Novel Ontological Theory and Engineering Support, Data & Knowledge Engineering, Elsevier (accepted, forthcoming, 2021).
- Guizzardi, G., Sales, T.P., Almeida, J.P., Poels, G., Relational Contexts and Conceptual Model Clustering, 13th IFIP WG 8.1 working conference on the Practice of Enterprise Modelling (PoEM 2020), Riga, 2020.
- Guizzardi, G., Figueredo, G., Hedblom, M., Poels, G., Ontology-Based Model Abstraction, IEEE 13th International Conference on Research Challenges in Information Science (RCIS 2019), Brussels, Belgium, 2019.
- Guizzardi, G.; Wagner, G.; Guarino, N.; van Sinderen, M., An Ontologically Well-Founded Profile for UML Conceptual Models, 16th International Conference on Advances in Information Systems Engineering (CAiSE), Latvia, 2004.Springer-Verlag, Berlin, Lecture Notes in Computer Science



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