

GFO: The General Formal Ontology (extended abstract)

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Abstract

This abstract in the journal-first track of FOIS 2024 presents the article “General Formal Ontology (GFO)” in Applied Ontology 17.1:71–106 (2022, doi:10.3233/AO-220264), written by the same authors. It highlights key aspects of GFO and provides a small glimpse into the cases of ontological analysis studied in the article.

1. Context

In February 2022, the Applied Ontology journal published a special issue devoted to actively developed and/or applied top-level ontologies and their analyses of five commonsense scenarios. One core idea behind that issue was to make top-level ontologies more easily approachable and mutually comparable via such sample analyses of small intuitive cases. The general relevance manifested for the contributions to the special issue is expounded in its editorial by S. Borgo, A. Galton, O. Kutz “Foundational ontologies in action” in Applied Ontology 17.1:1–16 (2022, doi:10.3233/AO-220265).

Until 2024, the article on the General Formal Ontology in that special issue is the latest broader work on GFO. Thereby, first it contributes a recent starting point regarding this ontology and our long-term endeavor of continuously (and often gradually) further developing and providing GFO. The GFO-based analyses of the five scenarios form the second major contribution of the article, while a third one is given by briefly surveying ten application projects based on GFO. In the remainder of this extended abstract, we focus on the introductory part on GFO, followed by brief teasers concerning the other contributions.

2. About GFO in a nutshell


With its origins dating back to 1999, a first phase of GFO development established the ontology as a conceptual and theoretical framework, presented in detail in a technical report, H. Herre,

Proceedings of the Joint Ontology Workshops (JOWO) – Episode X: The Tukker Zomer of Ontology, and satellite events co-located with the 14th International Conference on Formal Ontology in Information Systems (FOIS 2024), July 15-19, 2024, Enschede, The Netherlands.

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* <https://www.onto-med.de/ontologies/gfo>

B. Heller, P. Burek, R. Hoehndorf, F. Loebe, H. Michalek, “General Formal Ontology (GFO) – Part 1: Basic Principles [Version 1.0]”, Onto-Med Report 8, Leipzig University, Germany (2006). A later handbook chapter by Heinrich Herre, “General Formal Ontology (GFO): A Foundational Ontology for Conceptual Modelling”, in R. Poli, M. Healy, A. Kameas (Eds.), Theory and Applications of Ontology, Vol. 2: Computer Applications, p. 297–345, Heidelberg: Springer (2010, doi:10.1007/978-90-481-8847-5_14), yield a more compact introduction with novel aspects. The writings on GFO are accompanied by partial first-order and OWL axiomatizations, growing over time. Around 2020, we started an overhaul towards an expressly modular architecture outlined by P. Burek, F. Loebe, H. Herre in “Towards GFO 2.0: Architecture, Modules and Applications”, in B. Brodaric, F. Neuhaus (Eds.), Formal Ontology in Information Systems (FOIS 2020), FAIA Vol. 330, p. 32–45, Amsterdam: IOS Press (2020, doi:10.3233/FAIA200658), referring to GFO 2.0 in this connection.

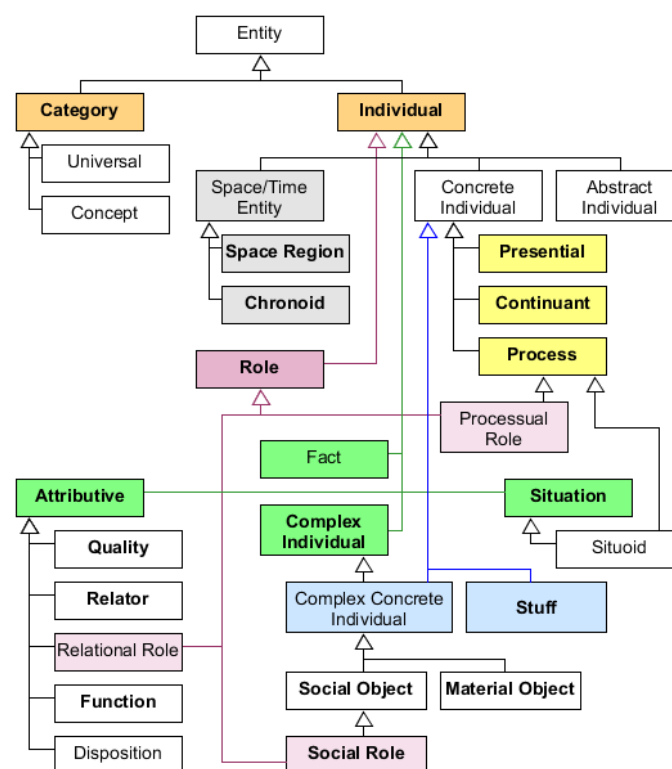


Figure 1: Selected core taxonomy & distinctions.

3. Principles and core taxonomy

GFO draws on principles from logic (e.g., the (onto)axiomatic method), symbolic artificial intelligence, cognitive science and philosophy. It subscribes to integrative realism, see Sect. 14.2.5 of the 2010 handbook chapter, which assumes both, objective, observer-independent reality on the one hand, but on the other hand the necessity of conceptions and concepts whenever (e.g. human) minds/subjects engage with that reality. On these grounds, GFO does

not only include categories in addition to individuals, but multiple kinds of categories (Fig. 1, upper left category branch).

Fig. 1 derives from the richer Fig. 1 in the 2022 special issue article as a further condensed taxonomy of core GFO categories, reflecting underlying distinctions in terms of coloring. For example, the yellow trichotomy of Process, Continuant and Presential enables a coherent approach to object-process integration, which is a central feature for many applications. The categories in boldface typesetting are those of major relevance in the article. Overall, the first third of the text of the 2022 article introduces the foundations of GFO in an instructive, topical and concise manner. Thus, it serves as a useful resource when newly approaching GFO.

4. GFO in action and applications

The remaining parts of the 2022 article equip the reader with an impression of how GFO behaves in connection with (1) object constitution and replacements, (2) roles, their adoption and potential vacancy in a social context, (3) changes, of qualities of objects as well as during processes, (4) dealing with goal-directed activities (and functions, in our view) and (5) the evolution of concepts. The first three scenarios are covered in the article with quite a detailed treatment that also illustrates first-order logic formalizations based on GFO. In the latter two cases, space and complexity of a detailed analysis led to a largely conceptual treatment.

Finally, a survey of applications primarily from industry-related projects in the biomedical and life sciences domains rounds off the 2022 article. Examples among the ten projects range from the biomedical core ontology GFO-Bio over the domains of surgery and cell tracking to data semantics. Some projects share overarching new methods, e.g., of engineering software. Altogether, we argue that the article exposed in this extended abstract constitutes a worthwhile read on GFO.