

Construction in the Formal Sciences (C-FORS)

Øystein Linnebo¹

¹*IFIKK, University of Oslo, Postboks 1020 Blindern, 0315 Oslo, Norway*

Keywords

constructional ontology, top-level ontology, intensional entities, paradox

1. Details of the project

Construction in the Formal Sciences (C-FORS) is a project funded by the European Union's Horizon 2020 research and innovation programme under grant agreement no. 101054836 (ERC Advanced Grant 2022). The project will run for five years, 2023–27, with Øystein Linnebo (University of Oslo) as the PI. In addition to Linnebo, the project involves:

- *five research fellows*: Stefano Borgo (Senior Researcher, Institute for Cognitive Sciences and Technologies, ISTC CNR), Salvatore Florio (Professor, University of Oslo), Jon Litland (Associate Professor, University of Texas at Austin), Louise McNally (Professor, Pompeu Fabra University), and Michael Rathjen (Professor, University of Leeds);
- *three postdoctoral researchers*: Ethan Brauer, Guendalina Righetti, and Eric Snyder;
- *two doctoral students*: Davide Sutto and one currently being recruited.

The project consists of four Work Packages. The first aims to develop a novel constructional approach to the foundations of mathematics. The second package applies constructional approaches to formal ontology and is the focus of the present contribution. The third one conceives a novel foundation for formal semantics. The fourth package seeks to apply the idea of construction more broadly in philosophy. More information about the project as well as its associated outputs and events can be found on the project's website: <http://cfors.org>.

2. The great promise of constructional ontology


The notion of *construction* figures prominently in mathematics and other formal sciences. An idealized, infinitary constructional approach is successfully applied to set theory, which provides the foundation for contemporary mathematics. C-FORS aims to develop new, similarly groundbreaking applications of the constructional approach. This will be the largest concerted effort to date to develop a foundation for the study of intensional entities, e.g. propositions and properties, where a variety of paradoxes still arise, with no agreed-upon solution—nearly a century after set theory received *its* proper foundation.

Joint Ontology Workshops (JOWO) and other events co-located with FOIS 2024

✉ oystein.linnebo@ifikk.uio.no (Ø. Linnebo)

🌐 <https://www.oysteinlinnebo.org/> (Ø. Linnebo)

🆔 0000-0002-0877-7063 (Ø. Linnebo)

 © 2022 Copyright for this paper by its authors. Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

3. Obstacles to progress and how to overcome them

Infinitary constructions are poorly understood, however, and there is no known way to apply the constructional approach to intensional entities. C-FORS aims to overcome these limitations by developing a critical but liberal conception of construction inspired by the PI's increasingly popular potentialist metaphysics and philosophy of mathematics [1, 2, 3, 4, 5], and by utilizing two theoretical tools developed by the PI, inspired by constructive mathematics, but only recently generalized to overcome various limitations and thus permit novel applications.

A non-instantial conception of generality What is it to generalize over a merely intensional domain? We develop a truthmaker semantics that permits a universal generalization to have a “generic” truthmaker, which is independent of the instances of the generalization and thus allows a truthmaker to be available even at stages of the constructional process where many of the instances are not yet available. E.g., “every set x has a singleton $\{x\}$ ” is true solely in virtue of the concepts of set and singleton. A unique feature of this tool is that the truth of universal generalizations with a non-instantial truthmaker (unlike others) is preserved as the constructional process unfolds (“upwards absoluteness”).

Liberalized forms of predicativity (“bottom-up constructions”) What intensional entities are there? The best extant answer is tied to the Vicious Circle Principle (VCP), which prohibits the definition of any entity from quantifying over a totality to which this entity belongs. Following Poincaré [6], the PI develops an alternative analysis, which takes the heart of predicativism to be the requirement that a legitimate definition be immune to disruption as a constructional process unfolds and the domain thus expands. VCP is now merely a means to an end, which leaves the door open to alternative and superior ways to ensure immunity to disruption. One of several such ways is based on non-instantial generality, which ensures immunity to disruption because of its upwards absoluteness.

4. Constructional approaches to formal ontology

The overarching aim in this Work Package is to provide a systematic and rigorous approach to constructed entities that figure in formal ontology, thus providing a provably consistent framework that can serve as a foundational ontology. More specifically, the outcomes of the project will pave the way to build constructive alternatives to today's approach to foundational ontologies, as described in [7], like DOLCE [8] and BFO[9]. We have three main objectives:

- (i) to develop a systematic and rigorous treatment of the spectrum of possible composition operations suggested by Fine [10] and to generalize further by allowing more coarse-grained forms of abstraction;
- (ii) to develop construction operations suitable for objects that are individuated intensionally, such as properties or collectives (e.g. organizations and social groups) [11, 12, 13, 14];
- (iii) to formulate a general theory of construction in which various construction operations can be deployed, clarifying the global structure of constructional possibilities (e.g., whether all the possibilities are compatible).

References

- [1] Ø. Linnebo, Pluralities and sets, *The Journal of Philosophy* 107 (2010) 144–164.
- [2] Ø. Linnebo, The potential hierarchy of sets, *The Review of Symbolic Logic* 6 (2013) 205–228.
- [3] Ø. Linnebo, S. Shapiro, Actual and potential infinity, *Noûs* 53 (2019) 160–191.
- [4] Ø. Linnebo, *Thin objects: An abstractionist account*, Oxford University Press, 2018.
- [5] S. Florio, Ø. Linnebo, *The many and the one: A philosophical study of plural logic*, Oxford University Press, 2021.
- [6] H. Poincaré, La logique de l’infini, *Revue de Métaphysique et de Morale* 17 (1909) 461–482.
- [7] S. Borgo, A. Galton, O. Kutz, Foundational ontologies in action. Understanding foundational ontology through examples, *Applied ontology* 17 (2022) 1–16.
- [8] S. Borgo, R. Ferrario, A. Gangemi, N. Guarino, C. Masolo, D. Porello, E. M. Sanfilippo, L. Vieu, Dolce: A descriptive ontology for linguistic and cognitive engineering, *Applied ontology* 17 (2022) 45–69.
- [9] J. N. Otte, J. Beverley, A. Ruttenberg, Bfo: Basic formal ontology, *Applied ontology* 17 (2022) 17–43.
- [10] K. Fine, Towards a theory of part, *The Journal of Philosophy* 107 (2010) 559–589.
- [11] K. Fine, Things and their parts, *Midwest Studies in Philosophy* 23 (1999) 61–74.
- [12] K. Fine, Class and membership, *The Journal of philosophy* 102 (2005) 547–572.
- [13] K. Fine, The identity of social groups, *Metaphysics* 3 (2020) 81–91.
- [14] R. Ferrario, C. Masolo, D. Porello, Organisations and variable embodiments, in: S. Borgo, P. Hitzler, O. Kutz (Eds.), *Formal Ontology in Information Systems - Proceedings of the 10th International Conference, FOIS 2018, Cape Town, South Africa, 19-21 September 2018*, volume 306 of *Frontiers in Artificial Intelligence and Applications*, IOS Press, 2018, pp. 127–140. URL: <https://doi.org/10.3233/978-1-61499-910-2-127>. doi:10.3233/978-1-61499-910-2-127.