BFO/DOLCE Primitive Relation Comparison

A. Patrice Seyed
Department of Computer Science and Engineering, University at Buffalo, Buffalo, NY

Abstract

This paper examines the primitive relations (dependence, quality, and constitution) of the BFO and DOLCE upper ontologies, employed in developing domain ontologies of the biomedical sciences. The strengths in both upper ontologies are examined, which sets a framework for developing a common upper ontology that utilizes the assets of both.

Introduction

Cross-domain reasoning with data can be achieved through successful integration of domain with upper ontology types. Basic Formal Ontology (BFO)[1] and Descriptive Ontology for Linguistic and Cognitive Engineering (DOLCE)[2] are two widely used upper ontologies, especially for the development of ontologies in the biomedical sciences. BFO is based in realism, whose primitive relations are defined in the Relation Ontology (RO)[3]. DOLCE attempts to capture ontological categories presupposed by natural language and commonsense. The purpose of this paper is to provide a comparison of the primitive relations defined for BFO and DOLCE. Note that BFO uses the terms continuant and occurrent–while DOLCE uses endurant and perdurant–to denote entities that are wholly present in an instant of time and those that have temporal parts, respectively.

Dependence and Quality

Specializations of dependence include 'function of' and 'role of', the domain of which are internally and externally grounded realizable entities, respectively[4]. This is not the case for 'quality of', since qualities are not dependent on a process or activity to be manifested. DOLCE defines 'quality of' as a relation between a quality, and another quality, endurant, or perdurant. As with BFO, a quality cannot be present unless the particular it inheres in is also present. However unlike BFO, in DOLCE this relation can hold between two qualities, or between qualities and occurrents. BFO observes that describing qualities as inhering in events is convenient for explanation, but represents knowledge and not ontological reality. DOLCE also includes a relation 'quale of' holding between qualities and qualia, the latter of which only exists as a reflection of human cognition.

Constitution

Constitution is a more general sense of composition– which denotes 'is made of'– and helps describe particulars that are naturally in flux[5]. x constitutes y when there are properties of x (e.g., heartbeat) which are accidental to x (e.g., body) but essential to y (e.g., person)[6]. DOLCE includes constitution as a primitive relation, but according to BFO two things cannot exist at the same time and space. However a relation in BFO similar to constitution is 'role of'.

Conclusion

BFO holds that qualities can only inhere in continuants, and entities that are only available through the human perceptual lens are not bona fide, falling to subjectivism. DOLCE applies the notion of quality more liberally, and allows for objects of thought to be basic units of its ontology. Future work should investigate how entities of a conceptualist-centric upper ontology can fit into the theory and hierarchy of a realist one, in a manner that does not contradict its philosophical underpinnings.

References

1. Barry Smith. The basic tools of formal ontology. In Formal Ontology in Information Systems. 1998; 19–28.
2. Claudio Masolo, Stefano Borgo, Aldo Gangemi, Nicola Guarino, and Alessandro Oltramari. WonderWeb deliverable D18 ontology library. 2003.
3. B. Smith, W. Ceusters, B. Klagges, J. Köhler, A. Kumar, J. Lomax, C. Mungall, F. Neuhaus, A. L. Rector, and C. Rosse. Relations in biomedical ontologies. Genome Biology, 2005; 6(5).
4. Robert Arp and Barry Smith. Realizable entities in basic formal ontology. Nature Proceedings. 2008.
5. Peter Simons. Parts: A study in ontology. Oxford Clarendon Press. 1987.