

Chapter 1.5

Exceptions in Ontologies: A Theoretical Model for Deducing Properties from Topological Axioms

Christophe Jouis
Université Paris III, France

Julien Bourdaillet
Université de Montréal, Canada

Bassel Habib
LIP6, France

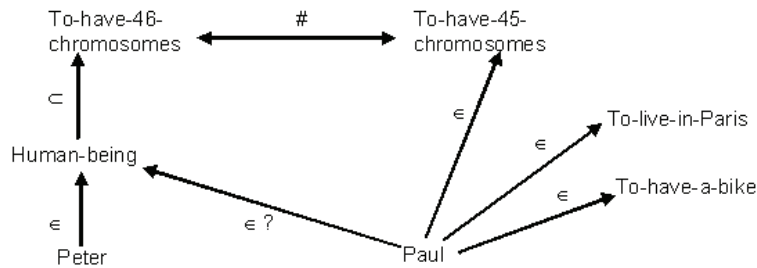
Jean-Gabriel Ganascia
LIP6, France

ABSTRACT

This chapter is a contribution to the study of formal ontologies. It addresses the problem of atypical entities in ontologies. The authors propose a new model of knowledge representation by combining ontologies and topology. In order to represent atypical entities in ontologies, the four topological operators of interior, exterior, border and closure are introduced. These operators allow to specify whether an entity, belonging to a class, is typical or not. The authors define a system of topological inclusion and membership relations into the ontology formalism, by adapting the four topological operators with the help of their mathematical properties. These properties are used as a set of axioms which allows to define the topological inclusion and membership relations. Further, the authors define combinations of the operators of interior, exterior, border and closure that allow the construction of an algebra. Their model is implemented in AnsProlog, a recent logic programming language that allows negative predicates in inference rules.

DOI: 10.4018/978-1-61350-456-7.ch1.5

Figure 1. The element [paul] does not satisfy all the properties of the class [human-being]



INTRODUCTION

Some entities belong more or less to a class. In particular, some individual entities are attached to classes whereas they do not check all the properties of the class. To illustrate this phenomenon, let us consider the ontological network below (see Figure 1). This network corresponds to the seven following declarative statements:

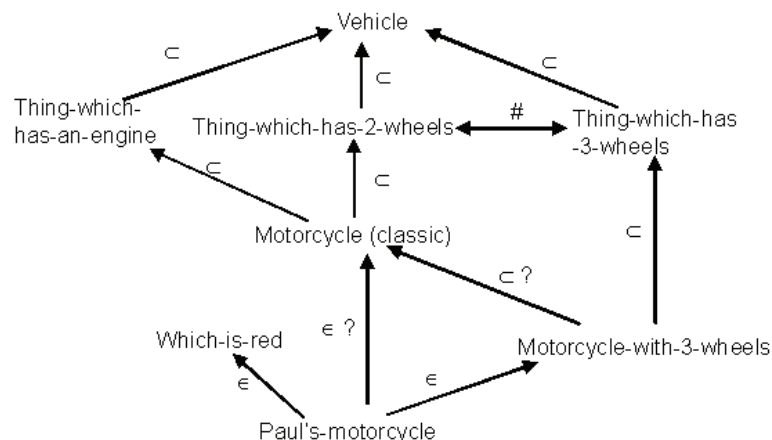
1. A human being has 46 chromosomes
2. Peter is a human being
3. Paul is a human being
4. Paul has 45 chromosomes
5. Paul lives in Paris
6. Paul has a bike

7. One thing can not have at the same time 46 chromosomes and 45 chromosomes

Because [Paul] is a [Human-being], he inherits all the typical properties of [Human-being], in particular [To-have-46-chromosomes]. A paradox is introduced by the statement (7) because “A human-being has 46 chromosomes” is a general fact but not a universal fact. The statement (1) means “In general, human beings have 46 chromosomes but there are some exceptions to this rule”.

A similar phenomenon can be observed with distributive classes. Some subclasses are attached more or less to a general class because some of their elements may not check all the properties of this general class. To illustrate this phenomenon,

Figure 2. The individual entity [paul's motorcycle] does not satisfy all the properties of the class [motorcycle]. The subclass [motorcycle-with-3-wheels] does not satisfy all the properties of the class [motorcycle]



19 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/exceptions-ontologies-theoretical-model-deducing/62435

Related Content

Towards a Model of Social Media Impacts on Cybersecurity Knowledge Transfer: An Exploration

Nainika Patnayakuni, Ravi Patnayakuni and Jatinder N. D. Gupta (2018). *Cyber Security and Threats: Concepts, Methodologies, Tools, and Applications* (pp. 521-543).

www.irma-international.org/chapter/towards-a-model-of-social-media-impacts-on-cybersecurity-knowledge-transfer/203522

Wireless Sensor and Actuator Networks-Based Reliable Data Acquisition Mechanism

Anil Sharma, Dankan Gowda V., A. Yasmine Begum, D. Nageswari and S. Lokesh (2023). *Energy Systems Design for Low-Power Computing* (pp. 187-213).

www.irma-international.org/chapter/wireless-sensor-and-actuator-networks-based-reliable-data-acquisition-mechanism/319996

MCOQR (Misuse Case-Oriented Quality Requirements) Metrics Framework

Chitresh Banerjee, Arpita Banerjee and Santosh K. Pandey (2021). *Research Anthology on Recent Trends, Tools, and Implications of Computer Programming* (pp. 554-579).

www.irma-international.org/chapter/mcoqr-misuse-case-oriented-quality-requirements-metrics-framework/261042

Understanding the Influence of R&D Collaboration on Organizational Innovation: Empirical Evidences

Lurdes Simao and Mário Franco (2020). *Disruptive Technology: Concepts, Methodologies, Tools, and Applications* (pp. 1983-2005).

www.irma-international.org/chapter/understanding-the-influence-of-rd-collaboration-on-organizational-innovation/231275

Cyber-Security Intelligence Gathering: Issues With Knowledge Management

Ezer Osei Yeboah-Boateng and Elvis Akwa-Bonsu (2018). *Cyber Security and Threats: Concepts, Methodologies, Tools, and Applications* (pp. 1454-1478).

www.irma-international.org/chapter/cyber-security-intelligence-gathering/203571