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ONTOLOGY IN SEMANTIC WEB TECHNOLOGIES – RE-INVENTING THE WHEEL?

Abstract

This contribution deals with the following issues related to ontology: the polysemic nature of the term and its application in philosophy of science, information technology, and terminology, as well as the viability of creating a common meta-ontology for terminology and information science, a meta-ontology which might build on Alwin Diemer's general ontology as described in Gerhard Budin's doctoral thesis.

INTRODUCTION

The question I have asked in the title is in my opinion an extremely relevant one. However, it has become more than just relevant and interesting to me because it is related to a discipline I have to teach in the very near future. It is one of several disciplines of a new master's programme in Web communication at the University of Southern Denmark, which is intended to provide students with 'relevant cross-disciplinary qualifications' in web-based communication, information structuring, and IT design strategies, and among the career opportunities suggested are those of information architect or knowledge manager.

The discipline in question is called Knowledge Modelling. According to the description, two of its main aims are to provide students with

1. Understanding of how **conceptual hierarchies** or **ontologies** can support knowledge structuring and knowledge sharing
2. Competence in applying **terminological** and other methods and tools appropriate for semantic **modelling** and representation of knowledge

Of course the coupling of conceptual hierarchies and ontologies will not come as a surprise to this target group. But what is ontology and ontologies, both from a terminological and from an information technology point of view, and is it possible to establish a common theoretical basis for the creation of conceptual hierarchies and ontologies without, as it says in my title, re-inventing the wheel?

ONTOLOGY AS A BRANCH OF PHILOSOPHY OF SCIENCE

The etymology of the word ontology is Greek. According to Sowa (2000: 55 – 57), the first element **tó on**: (what is, Being) stems from Aristotle, the second one from Heraclitus: **lógos** (word, reason, principle, plan, doctrine). In spite of the ambiguity of the latter word, there seems to be general agreement that ontology can be rendered **the doctrine of what exists**.

Today the investigations of Aristotle (c. 384 – 322 b.C.) and of Porphyry (c. 234 – 305 a.C.) would be ranked under the label of ontology, but according to Robering (2004: 8), ontology as a branch of philosophy is an invention dating from the Enlightenment, defined by the German philosopher Christian Wolff (1679 – 1754) as the **general science of being**.

After a long period of neglect during the reign of Empiricism and Positivism, ontology was 'rehabilitated' a few decennia ago.

TERMINOLOGY AND ONTOLOGY

Wüster's famous 'Word model' illustrates, inter alia, the relationship between concepts and individual entities in extra-linguistic reality (Wüster 1959: 303), and the title of his programmatic speech (Wüster 1974), held in May 1972 at the University of Vienna, comprises the following definition of terminology:

> a field in the borderland of linguistics, logic, **ontology**, information science, and the subject fields

However, Wüster found that terminologists need not concern themselves with ontology unless in so far as it is necessary in order to ascertain what conceptual relations are possible (Wüster 1974: 360 – 61). The necessity, he found, arose whenever logic did not suffice to describe all conceptual relations; some relations based on contiguity in space and/or time had to be defined using ontological categories.

To sum up, in Wüster's time ontology was viewed simply as a branch of philosophy which must be 'consulted' because logic does not suffice to explain the nature of all conceptual relations, whereas in 2004 it is viewed by most as an information technology engineering field applying concepts and methods extremely similar to those of terminology.

In Budin's words, terminologies and ontologies are the intellectual (conceptual) infrastructures of content (Budin 2002: 100), and terminology theory has become a major foundation of recent ontology engineering and provides a solid basis for designing knowledge organization systems for the Semantic Web (Budin 2003: 78). I shall return to Budin's ideas of ontological organisation below.

From the beginning, terminology followed a formal course; in Alexeeva's words, it came under the influence of logic (Alexeeva 2003: 66ff). I also agree with her that terminology has now taken a philosophical turn in that formal and logical aspects of terminology are gradually substituted by theoretical and cognitive ones, and that we need a philosophy of terminology.

In fact, I suggest that we divide a new, scientifically updated discipline of terminology into the following subdisciplines or components:

(1) A **philosophy of science and language component**, including ontology, epistemology, conceptology, and sign theory. Combining philosophy of science with philosophy of language makes perfect sense, not least in connection with terminology

(2) A metascientific component dealing with relationships among sciences and between terminology and science

(3) A linguistic component

(4) A **pragmatic component** dealing with terminography, modelling, and representation of conceptual structures in various media

Of the above components, (1) and (4) comprise issues of clear relevance to information technology. In what follows, I shall concentrate on the elements of (1), which is a prerequisite to seriously dealing with the issues in (4) — a fact which is often neglected, particularly in information technology.

ONTOLOGY IN INFORMATION TECHNOLOGY

Today, every discipline dealing with the management of information or content of some kind or other seems to be searching for the grand final ontological model to build on.

From an information technology perspective, the different meanings of the term ontology may be grouped under two headings, which are named as follows by Daconta et al. in their textbook on the Semantic Web (2003: 186):

1) **BIG O**: A branch of philosophy (of science)

2) **Little o**:
a) an engineering discipline, also called ontological engineering
b)engineering applications, i.e. conceptualizations establishing joint terminologies between the members of specific communities of interest

As will become clear from the section below, I should like to add one more meaning to the list, viz. **meta-ontology**.

Engineering applications, corresponding to meaning 2 b) above, are arranged by Daconta et al. (2003: 157) in an **ontology** spectrum ranging from the semantically weak to the semantically strong applications:

- **Taxonomies** represent knowledge with minimal hierarchic or parent/child structure, if any
- **Thesauri** comprise relations among words and synonyms
- **Conceptual models** comprise more complex knowledge
- **Logical theory** represents knowledge in a rich, complex, consistent, and meaningful way

Thus the generic term ontology is used to cover all the conceptualisations and corresponding applications above; however, the term ontology is also often used about a particular subtype of ontology represented in a so-called web ontology language; in the ontology spectrum, this subtype can be found at the semantically rich end (Daconta et al. 2003: 181).

THE NEED FOR A COMMON META-ONTOLOGY

As mentioned above, one meaning of the term ontology needs to be added to the list in between Big O and little o ontology, viz. meta-ontology. There is probably no agreement whatever as to the meaning of that term, but at least a useful information technology definition can be found in Cappelli et al. (2004: 86):

> A methodology (of ontology design) based on formal philosophical notions general enough to be used independently of a particular domain

I prefer the definition below, which explicitly mentions the purely theoretical aspect:

> The theory behind and the methodology of ontology design

At a high level of abstraction, it must be possible to create a common meta-ontology for terminology and information technology. And instead of re-inventing the wheel, why not exploit existing approaches, one of them described nearly 10 years ago by Gerhard Budin?

In 1996, Gerhard Budin introduced his theoretical WIKO meta-model to describe the dynamics and complexity of scientific information and communication processes, based on the hypothesis that the domains of information science, LSP, applied linguistics, and the discipline of terminology call for a common meta-theoretical approach.

He used the concept of **organisation** as a complex, dynamic basic principle capable of integrating knowledge, information, communication, and terminology and showed that integration could take place not only at a metascientific level, but also at the concrete modelling level.

The concept of **ontological organisation** on which Budin based his model originates from Alwin Diemer’s general ontology, described below.

ALWIN DIEMER’S GENERAL ONTOLOGY

Diemer’s general ontology consists in a typology of objects. An English version of Budin’s table showing this typology can be found in table 1 (Budin 1996: 28). I agree with Budin that it is an astonishingly flexible and generally applicable instrument for differentiating ontical phenomena.

Table 1

ALWIN DIEMER'S OBJECT TYPOLOGY	ELEMENTARY ENTITIES				INTENTIONAL ENTITIES			
	SIMPLEX		COMPLEX		SIMPLEX		COMPLEX	
ELEMENTALS	ELEMENT	STATIC: thing, property	WHOLE / MOLECULAR (STATIC/DYNAMIC): set, aggregate, collective, system, organism		INTENTIONAL ELEMENT	STATIC: sign, symbol	INTENTIONAL WHOLE	STATIC: product of art, science, etc.
		DYNAMIC: event				DYNAMIC: planned act or event		DYNAMIC: meaning system, e.g. society
INTERALS	INTERAL	STATIC: relation, function	RELATIONSHIP	STATIC: structure organisation	INTENTIONAL RELATION	STATIC: meaning, reference	INTENTIONAL COMPLEX RELATION	STATIC: meaning complex, context
		DYNAMIC: process		DYNAMIC: coupling		DYNAMIC: action		DYNAMIC: communication, interaction
TOTALS	TOTAL (field)		ENVIRONMENT		WORLD			

It is especially useful in a systemic approach to modelling since it is based on the principle of the common source of the three basic phenomena: element, **relation**, and **totality** (Diemer 1959: 72). No doubt Budin is right that this **triadic** principle allows the integration of three normally incompatible ontological/epistemological positions: Atomism, Relationism, and Holism (Budin 1996: 27).

Diemer's triadic approach is only one among several similar **trichotomies** described by Sowa (2000: 58 – 67), i.e. those of Kant, Hegel, Peirce, Husserl, Whitehead, and Heidegger. Charles S. Peirce defines three modes of being: firstness (unstructured or monadic being), secondness (binary, relational being), and thirdness (complex, structured being) (Peirce 1903: 1.23-6). According to Sowa, it is by far the most appealing and useful among the triadic approaches; although strongly grounded in logic, it avoided the split which later developed between logic-based analytic philosophy on the one hand and phenomenology and existentialism on the other (Sowa 2000: 66).

Whatever approach is chosen, what is important to terminologists and others is to agree on truly basic principles of ontological organisation before turning to methodological questions. In my opinion, Budin's interpretation of Diemer's general ontology enables us to do just that.

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