Principles of terminological ontologies

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http://dantermbank.cbs.dk/dtb_uk/about_the_project/knowledge_validation

The principles of terminological ontologies are based on the formalization of concept characteristics according to typed feature theory, c.f. Carpenter (1992) and imply a number of specific constraints which aim at ensuring consistent ontologies and thus a consistent representation of a given domain of knowledge. The core principles have been developed by a group of researchers at CBS in the CAOS project (1998-2007) which aimed at semi-automatic development and validation of ontologies (Madsen, Thomsen & Vikner (2004), Madsen & Thomsen (2006)). The environment at the Department, in which the project group is embedded, is internationally recognized for its research in this field.

Figure 1 presents an overview of different types of ontologies, which is based on Madsen & Thomsen (2008), Gómez-Pérez et al. (2004), Mizoguchi et al. (1995), van Heijst et al. (1997), Guarino (1998) and Lassila & McGuiness (2001). Not all possible types of ontologies are included in the figure.

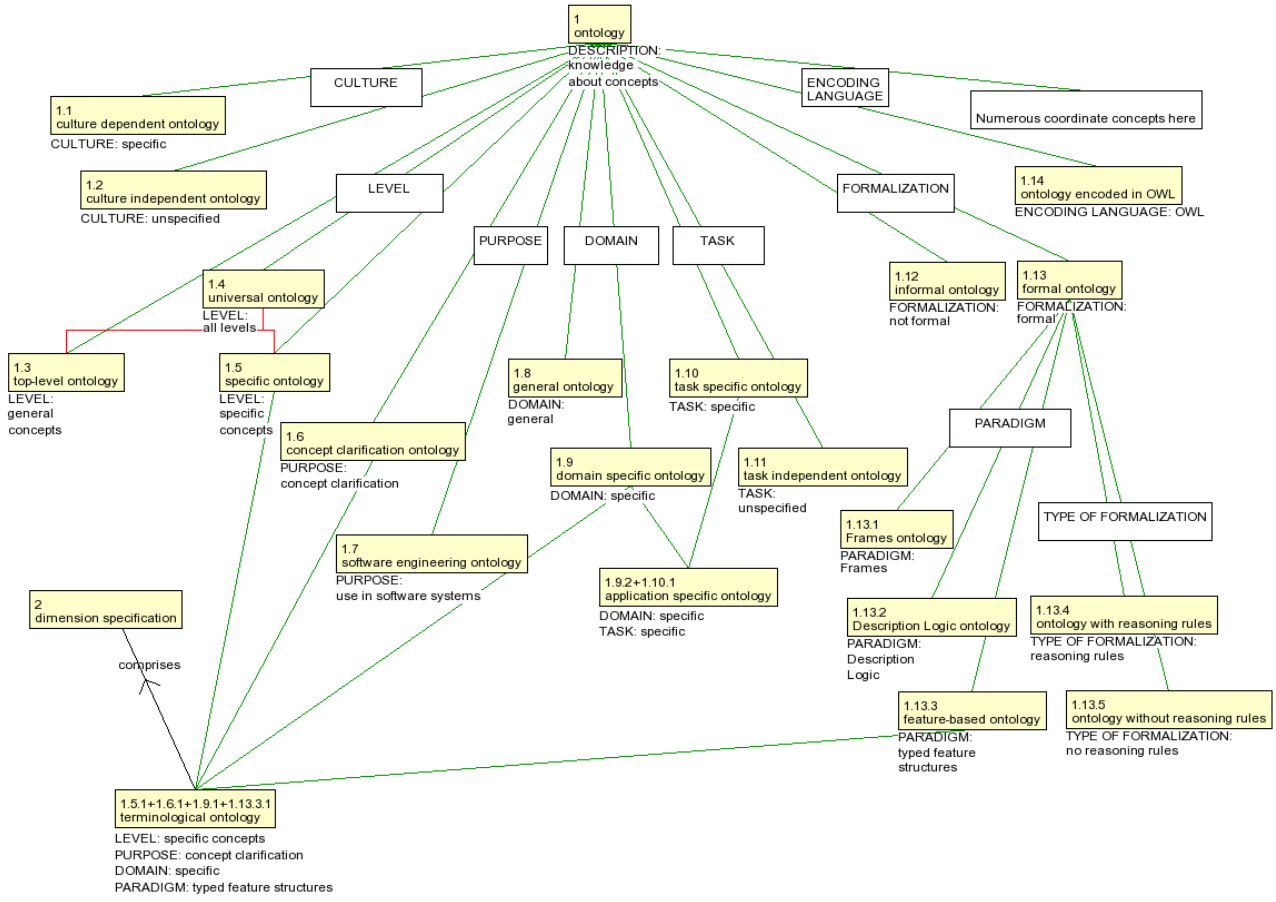

Figure 1: Simplified ontology of ontologies

The basic characteristics of terminological ontologies are illustrated in this figure. The green lines represent *type relations* (ISA relations), the red lines represent *part-whole relations* and the black lines with names represent other relations. The yellow boxes represent concepts with information on characteristics in the form of *feature specifications*[1] below the boxes (attribute-value pairs), e.g. *CULTURE: specific* (on *culture dependent ontology*).

The use of feature specifications is subject to a number of principles and constraints. Some of these are taken over from works on formal feature structures because they reflect terminological principles (e.g. Copestake 1992), or they formalize other principles from traditional terminology work (e.g. ISO 704:2009). Two principles, developed within the CAOS-project, specify that dimension specifications[2] are unique and reflect primary feature specifications (Madsen, Thomsen & Vikner (2004)). In the version of the ontology in Figure 1, dimension specifications are not shown on the concepts. An example of a dimension specification on the concept *formal ontology* is: [PARADIGM: Frames | Description Logic | typed feature structures].

One of the most important constraints in terminological ontologies is that co-ordinate concepts should be differentiated by means of one characteristic, and this is enforced at the end of the validation process in the DanTermBank project. In the ontology in Figure 1, we have introduced characteristics and subdivision criteria (in white boxes) that clearly distinguish the types of ontologies, e.g. *CULTURE*, *LEVEL*, *PURPOSE, DOMAIN* and *TASK*. Supplementary characteristics may be relevant as extra information on the concepts.

Terminological ontology allows multiple inheritance (polyhierarchy). Therefore, as illustrated in Figure 1, our terminological ontologies may be described as *specific*, *domain specific*, *feature-based* ontologies developed *for concept clarification purposes*. A given terminological ontology may be *culture dependent* or *culture independent*. For example, the two ontologies on the front page are culture dependent, whereas the ontology in Figure 1 is (presumably) culture independent. Terminological ontologies are not encoded in any specific formal encoding language; they may be encoded in various formal languages. Based on the above mentioned principles related to inheritance of characteristics, terminological ontologies can be validated to ensure consistency.

References

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[1] A feature specification is a formal specification of a characteristic of a concept by means of an attribute-value pair (http://www.isocat.org/rest/dc/228).

[2] A dimension is an attribute whose possible values allow a distinction between some of the subconcepts of the concept in question (http://www.isocat.org/datcat/DC-190), and a dimension specification is the association of a dimension with its possible values (http://www.isocat.org/datcat/DC-191).

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