Ontologies, Semantic Maps and Cognitive Scheme

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What are specific relations between Web-semantic and ontology (Uschold, 2005)? What is an ontology of a domain? What are the relations between texts relative to a domain and an ontology of this domain? How to build an ontology from texts (Aussenac-Gilles et al., 2005)? [·]

In our approach of these questions, we consider that there are different levels of ontologies: (i) ontology of a domain; (ii) ontology of relations that leads to a "semantic map" for structuring the ontology of a domain; (iii) general ontology, or "upper ontology", that gives formal semantic representations of concepts, definitions by combining semantic primitives and inference rules. The aim of this paper is to introduce, for further discussions, clear and formal distinctions between three levels of "ontology": the ontology specific to a domain with first-level-concepts and classes of instances; second- level-concepts of a semantic map relative to a "notion" (as cause, action, localization of events in space or in time, meeting between different peoples …); third-level-concepts of a general ontology where are interpreted the second and first levels concepts by means of schemes (l-expressions with types) and different (functional) types of objects. We plane also to explain how these levels are articulated between them.

We start with the notion of Frege's concept, viewed as an application operation (in an applicative language) of an operator (a mathematical function) from a domain of operands into {true, false}, concepts being opposite to objects or absolute operands. We introduce the notions of "typical" and "atypical" instances of a firth-level-concept by the way developed in the framework of the Logics of Determination of Objects (LDO) in considering "intension " and "extension" of a concept (Desclés, 2002; Pascu, 2006). We introduce a "typical object" associated to each concept, this typical object is interpreted as an abstract representation (and mental) of the concept, viewed as object. We introduce also determinative operations acting on objects and generating instances from the typical object. This logical framework gives a better flexibility for building an ontology of a domain where many typical objects inherit all properties of a concept but there are also atypical objects that cannot inherit all properties of a concept. A semantic map, defined for a specific notion – "cause", "action" and so on …- , is a structured set of second-level-concepts where to each concept 'f' of the semantic map is associated a class of linguistic markers or linguistic expressions of the concept 'f' with specific exploration context rules for determinate the semantic value of an occurrence of the marker in taking in account the context. When a semantic map relative to a notion has been defined, we obtain the possibility to analyse texts and, with the help of the engine EXCOM (developed by LaLIC laboratory of Paris-Sorbonne), we can give automatic semantic annotations of textual segments; in a second step, these annotations leads to pertinent information which is used for building and populating a specific ontology of a domain, that is different to precise first-level-concepts and associated classes of instances. However, the second-level-concepts of a semantic map are only labels which must be represented to obtain a full comprehensive interpretation of the built ontology. For instance, if a second-level-concept contains spatial and temporal relations then we must use, for describing it, more general concepts (third-level-concepts) as, in time domain: "event", "state", "process", "resulting state", "consequence state", "uttering process" , "concomitance", "non concomitance", "temporal reference frame" …(Desclés, 1990, 2005; Descles & Guentcheva, 1995) ; or, in space domain: "place", "interior of a place", "exterior of a place", "boundary of a place", "closure of a place", "movement in space", "oriented movement", "movement with teleonomy", "intermediate place in a movement" …Other general concepts must be also defined with precision, for instance: "agent who controls a movement", "patient", "instrument", "localizer", "source and target" … For this purpose, we use the formal representations by means of schemes of the field of "Cognitive Linguistics" (R. Jackendoff, L. Talmy, R. Langacker .. in USA; B. Pottier and A. Culioli in France) and, more specially, the general framework of the polystratal representations "Cognitive and Applicative Grammar"- GAC - (Desclés, 1990, 2003, 2005). This linguistic and formal model gives cognitive representations by means of "cognitive and semantic schemes" in using on one hand, the tools of Curry's Combinatory Logic, Church's l-calculus with functional types and in other hand, mathematical concepts of topology (with the theory of "abstract places") and localization relations (in French : "relations de repérage") (with identification, differentiation and breaking operations).

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