Termontography: Ontology Building and the Sociocognitive Approach to Terminology Description

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Abstract

We start from a brief discussion of three shifts which have affected the discipline of terminology over the last decade: the shift towards computational terminology management, the linguistic shift in the theory of terminology and more recently the ontology shift. We briefly introduce the method of *termontography*, one of the results of the collaboration between terminologists from CVC Brussels and ontology engineers within the framework of the European project FF POIROT (IST 2001-38248).
The discipline of terminology is widening its scope towards knowledge representation and knowledge management. On the one hand reflection is needed on how the discipline of terminology can contribute to new challenges like the(multilingual) semantic web. On the other hand we need to ask how terminology management can benefit from new developments in IT and NL processing, and more specifically how terminology management can use ontologies.

0 Introduction

After having given a brief overview of three shifts in perspective which had an impact on the discipline of terminology (1), we discuss the newly developed method of termontography in its capacity to give support to multilingual ontology engineering(2). We finally formulate some reflections on the future of the discipline of terminology (3).

1 Shifts within the discipline of terminology

Over the last decade the theory of terminology and the practice of terminography have been subjected to a number of changes. In the first place the electronic revolution has affected terminology management and the working methods of terminographers (Bouringault, D & C. Jacquemin & M-C. L'Homme 2001). In the second place the principles of what is now called 'traditional terminology' (Sager 1990, Cabré 1999 & 2000, Temmerman 2000) have been seriously questioned. Terminology has benefited from insights in cognitive and computational linguistics. This resulted in a number of principles and methodologies which allow for flexibility and a diversification in approach depending on the user's requirements for each specific terminology project. The third shift relates to the parallel working methods and mutual interests of ontology engineers and terminologists

1.1 Shift 1 computational terminology management

Electronic corpora have strongly affected the working methods of terminologists (1.1.1), whereas terminology management software (1.1.2) has brought more rigour and uniformity in both terminological record structures and contents.

1.1.1 Electronic corpora

Much research has been devoted to automatic and semi-automatic retrieval of information from text corpora and from the semantic web (Pearson, J. 1998; Bouringault, D & C. Jacquemin & M-C. L'Homme 2001). Software has been developed for extracting terms needed for information retrieval, for extracting terms from bilingual (multilingual) corpora for translation and other applications, for enriching term extraction (building categorial hierarchies or networks, looking for semantic and categorial information), for studying textual and lexical context and for extracting relationships and definitions.

1.1.2 Software for terminological data management

Whereas earlier on, file cards and terminology lists were created manually or with the help of a type writer, today a wide range of software tools for terminological data management are available (Schmitz 2001).

1.2 Shift 2: the linguistic shift

The discipline of terminology has seen a shift from what is now referred to as traditional terminology (standardisation-oriented and concept-centred) to a communication-oriented and discourse-centred approach (Cabré 1999 & 2000, Temmerman 2000) referred to as sociocognitive terminology in e.g. Temmerman (2000).
For many subjects the traditional approach was not feasible nor desirable, e.g. the life sciences (Temmerman 2000); and e.g. VAT legislation (Temmerman et al. forthcoming).
Insights of cognitive semantics (e.g. prototype structure theory of meaning and the role of metaphorical thinking in categorisation and understanding) as well as computational semantics have had their impact on the theory of terminology and special language studies. Instead of clearly delineated concepts (Temmerman 2000: 4-8), terms (linguistic expressions) in texts became the starting point in terminological analysis. The switch from concepts to units of understanding and categories[1] (which may have prototype structure) put the earlier belief in the need to study language-independent conceptualisation in perspective.
Whereas in the traditional approach the emphasis was on intercategorial relationships of a concept within a logical or partitive concept structure, in the sociocognitive approach categories are structured in an intra- and intercategorial way relative to a cognitive model or categorial framework
The traditional way of defining each concept intensionally (hyperonym and differentiating characteristics) and/or extensionally is given less prominence as from studying definitions in text corpora terminologists learn that content and form of a definition may vary in accordance with a number of parameters e.g. the type of category being defined (entity, activity, characteristic, etc.), the level of specialisation of the sender and the receiver of the message and the profile of the user of the terminological database. In a semantic web application the 'user' may be a non-human agent.
Also the univocity principle (only one term should be assigned to a concept and vice versa) has been questioned and relativised. It has been shown that understanding is a never-ending process in which synonymy and polysemy play a role.
Attention has been given to how cognitive models (e.g. metaphorical models) play a role in the development of new ideas. It therefore makes sense to study concepts and terms diachronically. There are many examples of the fact that the relationship between concept and

[1] We distinguish between *category* and *concept* as two kinds of *units of understanding* (Temmerman 2001). Only few units of understanding appear **not** to have prototype structure and could therefore be named concepts. The ones which have prototype structure we refer to as categories

term is not arbitrary. In that sense terms are often motivated. Moreover categories are constantly evolving. Sometimes their history is essential for their understanding

1.3 Shift 3: the ontology shift

In recent years a shift has been seen from terminological databases to terminological knowledge bases (TKB), a term first introduced by Meyer et al. (1992). The creation of a terminological knowledge base involves studying terms as they are used in texts and discovering the semantic relations that exist between them (Barrière, 2001). More recently and more frequently these TKBs are now referred to as ontologies.
In this section we first explain what we mean by ontologies (1.3.1). We mention the research interests in ontologies (1.3.2) and discuss the ongoing cross-fertilisation between the disciplines of ontology engineering and terminology (1.3.3).

1.3.1 What is an ontology?

We define an ontology as a knowledge repository in which categories (terms) are defined as well as relationships between these categories. Implicit knowledge (for humans) needs to be made explicit for computers.The IEEE Standard Upper Ontology Working Group defines an ontology as being "similar to a dictionary or glossary, but with greater detail and structure that enables computers to process its content. An ontology consists of a set of concepts, axioms, and relationships that describe a domain of interest." (http://ontology.teknowledge.com). Ontologies can be represented in (one or more) natural languages (linguistic ontologies) and in formal languages (Jarrar & Meersman, 2002).

1.3.2 Ontologies and the knowledge challenge

The European IST Research Projects under the 6th Framework call for «Technologies to support the process of acquiring and modelling, navigating and retrieving, representing and visualising, interpreting and sharing knowledge ». (…)«These functions will be integrated in new semantic-based and context-aware systems including cognitive and agent-based tools. Work will address extensible knowledge resources and **ontologies** so as to facilitate service interoperability and enable next-generation semantic-web applications.» (http://europa.eu.int/information_society/index_en.htm)The growing body of information in electronic format (e.g. the World Wide Web) needs to be modelled in order to help computers handle complex and disparate information and to facilitate knowledge sharing. Ontologies are ultimately used to help answer queries about a body of information.

1.3.3 Ontology and terminology: cross-fertilisation

It is important to realise that terminological analysis can help ontology engineers but that terminographers could be helped in turn by having access to existing ontologies when they are compiling new terminological databases and knowledge repositories. Of course, ontologically underbuilt terminography and lexicography are not completely new (Temmerman 2003 forthcoming). An example of an ontologically underbuilt bilingual special language dictionary is Dancette, J. & C. Rhétoré (2000) *Dictionnaire Analytique de la Distribution. Analytical Dictionary of Retailing.* This dictionary is compiled for a users' group of translators from English into French on the subject of retailing. The authors believe that a translator with French as his native language will benefit from being subdued in a wealth of ontological information, i.e. information on how the term or phrase which has to be translated is related to other terms in the same lexical field or semantic network of related terms. All this information is given in the target language (French) to stimulate the *discursive autonomy* of the translator in phrasing the target language text (Dancette 2000; Temmerman 2003 forthcoming). The

making explicit of the structure of semantic relationships (*"relations internotionelles"*) gives way to intensional and extentional definitions which are complemented with extra semantic information, intercategorial information, linguistic information and meaningful contexts. In the dictionary the intercategorial relationships are made explicit via cross referencing and descriptions.
The terminological methods and the expertise gathered in projects like Dancette's can be used to preprocess information in NL (texts) for ontology builders. CVC Brussels (http://cvc.ehb.be) developed the **termontography** method within the framework of the FFPOIROT-project[2]. (section 2).
Not only can terminology support ontology engineering, ontologies can in turn underpin the work of terminographers and lexicographers in different phases of their work, e.g. in websearches during corpus compilation; in corpus analysis and data mining. Tools at the service of terminographers and lexicographers need ontological underpinning.

2 Termontography[3]

Termontography is a multidisciplinary approach in which theories and methods for multilingual terminological analysis of the sociocognitive approach (Temmerman 2000) are combined with methods and guidelines for ontological analysis (Góméz-Pérez et al. 1996; Fernandez et al. 1997; Sure & Studer 2003). The motivation for combining these two research fields derives from our view that existing methodologies in terminology compilation (Sager 1990; Temmerman et al. 1990; Cabré 1999) and ontology development have significant commonalities. For instance, when building an ontology or compiling a terminological database, both ontologists and terminographers will start from the identification of their purposes, the restriction in the scope of the domain, the specification of the user requirements as well as the acquisition of domain knowledge needed for the extraction and understanding of categories and terms.
Termontography is a methodology for knowledge management and representation for specific domains of experience, combining domain expertise with information provided in natural language. Multilinguality problems are part and parcel of the analysis.
The termontography method works **middle-out**. It combines top-down and bottom-up approaches in order to ideally capture and represent knowledge acquired from texts. First of all, in close collaboration with field specialists of the domain which is subjected to ontological analysis, an initial framework of categories and inter-categorial relationships is being developed top-down. Initially, this categorisation framework serves as a template for the manual and semi-automatic extraction of knowledge from a corpus. However, it will gradually evolve in an enriched and more fine-grained network of semantic relations, reflecting culture-specific categorisations, as the knowledge elicited via textual material is then confronted with the categorical frame (a bottom-up analysis). The results of this analysis are reflected in a termontological database, which can for instance be used as supportive resource for formal knowledge engineering (Temmerman et al. forthcoming).
We will first describe the phases in the termontography workflow (2.1) and then show an example of a categorisation framework (2.2).

2.1 The termontography workflow

The termontography workflow is as follows (figure 1): first comes the preparatory work in the analysis and information gathering phases; then the actual database compilation consisting of

[2] The FFPOIROT project (IST 2001-38248) is supported by the European Commission under the fifth framework programme. Its primary aim is to build an ontology for the detection and prevention of fraud in VAT processes, securities exchange as well as investment, banking and insurance services. (http://www.starlab.vub.ac.be/research/projects/poirot/index.htm)
[3] Term coined by Koen Kerremans, research assistent at CVC Brussels.

the search, refinement, verification and validation phases; and finally the export of the knowledge from the mono- or multilingual termontological database, to an ontology and terminological dictionary. We will briefly describe each phase. We applied this methodology in trying to represent value added tax (VAT) regulations in different member states of the European Union.

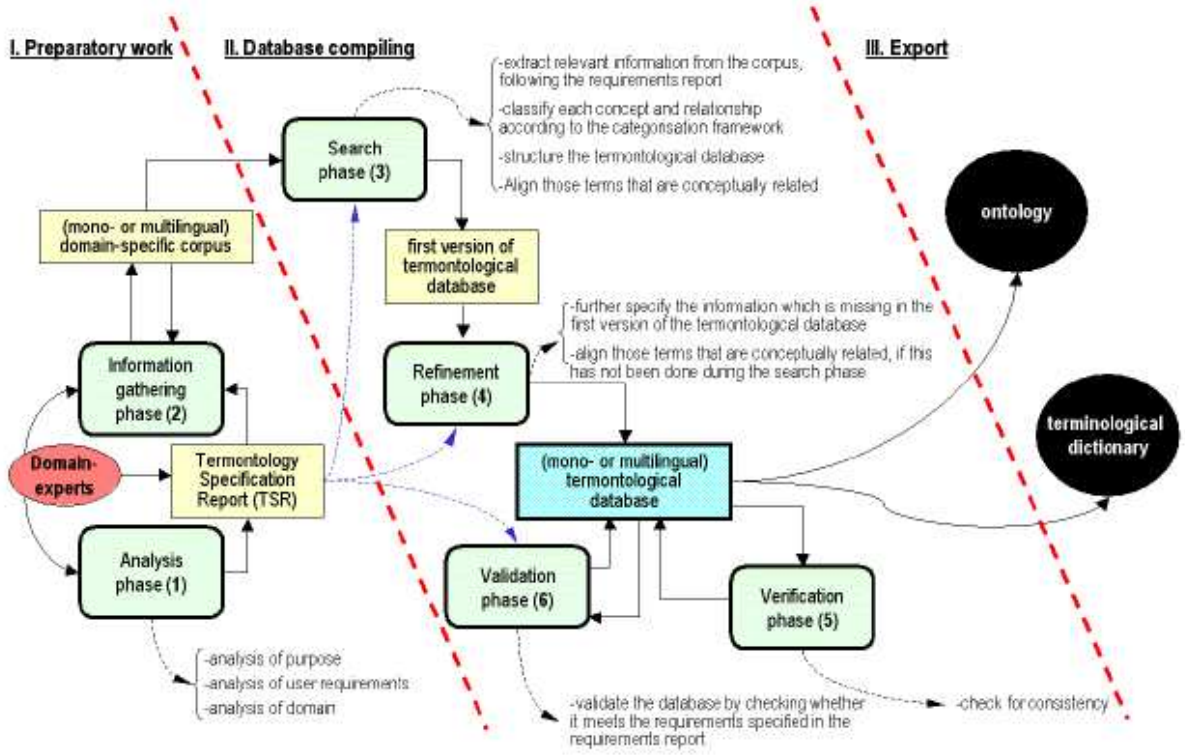

Figure 1 The termontography workflow

2.1.1 Analysis phase

In this phase the termontographer tries to gain insight in the purpose of the project, the scope of the domain as well as the user requirements. The result of the different analyses is stated in a Termontology Specification Report (TSR) which will inform the termontographer on the content and format of the termontological database which needs to be compiled. In the VAT-case, the purpose of the database is roughly to capture and present multilingual information about categories taken from VAT legislations of European member states. The scope of the domain depends on the purpose of the database and is restricted to the categories that occur in the categorisation framework. One group of potential users are ORM modellers (Halpin 2001) who follow the DOGMA modelling approach (Jarrar and Meersman 2002).

2.1.2 Information gathering phase

The categorisation framework as well as the TSR – both developed in the previous phase – will assist the termontographer in his search for relevant textual material with the purpose of compiling and managing a domain-specific corpus. Obviously, domain-experts play an essential role in this phase. They can e.g. section the termontographer to relevant domain-specific textual material or can recommend particular websites from which to retrieve texts.

2.1.3 Search phase

From the corpus the termontographer will extract (in case of a multilingual project: for each language separately) the terms and categories and direct them to their respective destinations in the categorisation framework. Verbal patterns indicating intercategorial relationships will be mapped to the framework as well. Depending on the level of detail required, the framework may be further specified. The mapping of both terms and verbal patterns will result in a first version of a termontological database.

2.1.4 Refinement phase

The purpose of the refinement phase is to further complete the termontological database by for instance aligning those terms that are equivalent (if this has not yet been done during the search phase), further specifying particular information about a term which could not be extracted from the corpus, specifying the co-texts or concordances in which terms occur as well as the reference to the source from which each co-text was extracted.

2.1.5 Verification phase

Verification refers to the process in which the termontographer checks the consistency and correctness of the termontological database. One could for instance check whether all terms have been assigned the right categorial label.

2.1.6 Validation phase

Although to some extent a redundant process, as the TSR is constantly consulted and upgraded in practically all the methodological steps in the workflow (figure1), the termontographer needs to check whether the content of the termontological database really meets the requirements as they were specified in the TSR.

2.2 Categorisation framework

We will now focus on one step in the termontography method which is to guarantee the multilingual and/or culture-specific input in the ontology of the domain of interest: i.e. the development of a domain-specific framework consisting of categories and intercategorial relationships

We will look at the particular features of the termontography categorisation framework starting from the example of ‘transaction for which no VAT is required’ in order to show how to overcome the difficulties with regard to the multilingual representation of categories. Despite their alleged ‘conceptual’ grounding, domain ontologies based on lexicalisations found in textual information do not map easily across languages (Hovy et al., 1999). It is usually necessary to ask domain specialists to provide language-independent frameworks of categories. What is then searched for in the text corpora is how the different categories in the framework are lexicalised in the different natural languages and in different legal systems. By discussing the category, paraphrased in English as, ‘transaction for which no VAT is required’, we will show the difficulties that arise when trying to align and represent multilingual and/or culture-specific knowledge from VAT legislations of different member states in a VAT regulatory ontology. These difficulties are due to differences in language, culture and conceptualisation.

The concept ‘transaction for which no VAT is required’ is a non-culture-specific category as it appears in the legislation of each European member state. Further specifying this category top-down – i.e. fully relying on the expertise of the field specialist without consulting any textual material – reveals four non-culture-specific and non-language specific subcategories.

According to the domain specialist, these subcategories can be paraphrased in English as follows:
subcategory 1: transactions in which the supplier does not have the right to deduct VAT
subcategory 2: transactions in which the supplier has the right to deduct VAT
subcategory 3: transactions that occur outside the territory of the VAT legislation at stake
subcategory 4: transactions that are outside the scope of VAT (e.g. a claim for compensation)
A bottom-up approach in which one were to extract (either manually or automatically) terms from national VAT legislations in order to see, in a second phase, how these terms could be aligned and generalised to the structure which is shown above, would be seriously hampered by the differences that occur in language (2.2.1), culture (2.2.2) and conceptualisation 2.2.3)

2.2.1 Differences in language

National VAT legislations are worded in different languages. The multilingual diversity is one of the most fundamental stumbling blocks for the alignment of the VAT legislations of different member states. The problem of alignment cannot simply be solved by looking for the translation equivalents of each concept lexicalised in a source language (e.g. English) as some words in the legislation are polysemous. For instance, the term 'vrijstelling' in the Belgian legislation is used to denote the first three subcategories of the category 'transactions for which no VAT is required'(figure 2). This will cause problems if one wants to know the UK translation of the Dutch term. For, if used to denote the first category, the term 'vrijstelling' is translated as 'exemption'. If used for the second category, the English term 'zero-rated' would be the only proper translation whereas for the third category, the complex term 'outside the scope of VAT' would be the only suitable translation candidate.
As these terms are official denotations in the different VAT legislations, one cannot discard of them by for instance using for each meaning of a polysemous word a disambiguated near-synonym, taken from general language.

	Dutch (Belgium)	French (Belgium)	English (UK)	English (Ireland)
subcategory 1	**-vrijstelling -tarief van nihil**	**-exemption**	**-exemption**	(to be specified)
subcategory 2	**-vrijstelling -tarief van nihil**	**-exemption**	**-zero-rated**	(to be specified)
subcategory 3	**-vrijstelling -niet onderworpen aan BTW**	(to be specified)	**-outside the scope of VAT**	**-exemption -zero-rated**
subcategory 4	**-niet onderworpen aan BTW**	(to be specified)	(to be specified)	(to be specified)

Figure 2. Language and culture-specific lexicalisations of subcategories of 'transaction for which no VAT is required' [4]

2.2.2 Differences in culture

Another complexity arises when the same language is spoken in different cultural settings. For instance, in the Irish VAT legislation, the English terms 'exemption' and 'zero-rated' are

4 We would like to thank Patrick Wille and Isabelle Desmeytere of VAT Applications NV (http://www.vatat.com/www/en/vatapp.htm) for providing us with examples from the VAT regulatory domain.

used to denote the third category. In the UK VAT legislation, however, ‘exemption’ is the lexicalisation of the first category, whereas zero-rated is used for the second.
This example clearly shows that language and culture may need a separate analysis.

2.2.3 Differences in categorisation

The third complexity relates to the fact that cultures may perceive seemingly equivalent categories differently. Although the Dutch term ‘vrijstelling’ and the English-UK term ‘zero-rated’ both refer to transactions in which a supplier has the right to deduct VAT, it does not follow that both terms cover exactly the same list of possible transactions.
Another clear example of difference in categorisation is the concept ‘taxable event’ which is defined in article 10 of the Sixth Directive 4 but implemented differently in the legislations of the different member states (see e.g. article 6 of the Italian VAT legislation, article 269 of the French VAT legislation or section 6(2) of the UK VAT legislation).

The problems described above could be overcome if one had (beforehand) an understanding of the categories according to which terms are classified. This suggests a middle-out approach in which one starts from a predefined framework of categories and relationships, derived at in collaboration with field specialists, to which terms and verbal constructions are mapped. This middle-out approach to multilingual knowledge representation, which is in line with the object-oriented approach proposed by Agnesund (1997), differs from attempts to create multilingual upper-level ontologies like in the MULECO-project (Bryan, 2002) or from attempts to establish correspondences between wordnets in different languages: EuroWordNet (Vossen, 1998) and MultiWordNet (Pianta et al., 2002) or from the mapping of “keywords” in several languages to the same concept in the domain ontology (Lauser et al, 2002).
The middle-out approach proposed by CVC Brussels permits one to examine which concepts are expressed in all languages, and which ones are lexicalised in only a subset of the languages. Moreover, it reveals lexical gaps in individual languages, as well as concepts that are particular to one language only.

3 Challenges for the discipline of terminology

In section 1 we indicated how the terminology community as been confronted with and influenced by recent developments in other disciplines like information technology, cognitive and computational linguistics and ontology engineering. In section two we introduced the termontography method and its approach towards multilingual and multicultural categorisation.
We believe that in the near future terminology can play a mayor part in the ongoing multidisciplinary discussion on the challenges of knowledge representation and management and in the development of the so-called semantic web, “an extension of the current web in which information is given well-defined meaning, better enabling computers and people to work in cooperation” (Tim Berners-Lee et al. 2001).
Terminology theorists could have a double mission to fulfil. Not only do we need to reflect on how the discipline of terminology can contribute to new challenges like the semantic web. Terminographers in turn will be eager to benefit from semantically enriched IT solutions and their impact on (multilingual) human language processing. More tools and more sophisticated workbenches for terminology project management are waiting for development.

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