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'Ontology' and Terminological Frameworks: an Overview of Issues and Term(s)[1]

Abstract

This paper addresses the question of the protean nature of 'ontology', with special attention paid to its use within the domain of terminology theories and applications. This term is widely used nowadays within various disciplines for designating different types of organising relational frameworks. Yet, its designations remain unvaried and, in this way, it causes ambiguity. The multifaceted nature of the so-called 'ontology' hinders the possibility of providing an unambiguous definition. This is mainly due to the multi- and interdisciplinary dimension of this notion, which is outlined here through an overview of its application within philosophy, information science, and linguistic disciplines.

The reference model of ontology that is applied nowadays in various disciplines corresponds to an object, or more precisely, to various types of objects which are all based on a relational framework, and are used for organising different types of knowledge units. This view differs from the original value of ontology that was shaped within philosophy as a purely theoretical model, a global and universally-valid abstract classification of reality. Therefore, it seems appropriate that this term should acquire greater precision especially when it is used within the domain of terminology.

1. Introduction

The issue at stake in this paper is 'ontology' intended as a framework that can enhance the definition of conceptual, linguistic, and referential units by outlining their hierarchical relations. Its ultimate goal is that of facilitating the representation and transmission of knowledge. The nature of the units organised in an ontology can vary, depending on both the background theory and the specific tasks it is used to undertake in terminology studies (see below § 3.2., § 4.3.). Generally speaking, such units can be identified with the coalescence of conceptual, linguistic, and referential knowledge into terms. The working definition of 'ontology' sketched above aims at providing the reader with a specific focus of attention throughout the following analysis of the different interpretations of this concept given in the more relevant disciplines among those which interact with terminology.

In fact, ontology is an increasingly important issue in contemporary terminology theory and applications, where it has gained a key role in the elaboration of terminological repositories. Yet, from the perspective of terminology studies the nature of ontology is not always unambiguous. This can be partly attributed to the interdisciplinarity that characterises both terminology and ontology. As regards the former, its 'endogenous' interrelation with other disciplines is clearly stated starting from the works of its founder, Eugen Wüster (1974, 1991; see also Cabré 1999: 25-55). Ontology is also applied within diverse knowledge fields and can acquire different values according to the discipline and the specific reference theory adopted to define and outline it. In its turn, the background theory in the various domains may also depend on the end purpose for which the ontology is shaped. As a result, the protean nature of this concept often hinders the possibility of providing an unambiguous definition, even within one single discipline.

1 This article is a development of a paper presented at the *XVII European Symposium on Languages for Specific Purposes* that took place at the Aarhus School of Business, Aarhus University, 17-21 August 2009.

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This analysis attempts to identify the reasons for the terminological and conceptual ambiguity that characterises the notion of ontology as it is used in contemporary terminology theory and applications. Special attention will be devoted here to the nature of ontology within the field of information science, as the interrelation of this discipline with terminology has played a significant role especially in the last decades.

A significant shift has characterised the notion of ontology, from its origin in the domain of philosophy to the contemporary (ab)use within a great number of fields ranging from linguistics to different areas of information science. The multidisciplinary dimension of ontology is outlined here starting from the notion of ontology within philosophy and information science (see § 2.). This introduces its applicative facet, namely, ontology as a relational framework used for organising and representing knowledge units. The close link that ontology has with language (§ 3.1.) together with its defining and regulating function explains its importance within terminology (§ 3.2.). The recent changes in the theoretical framework of terminology have required that the traditional reference model of ontology be adjusted, with an ensuing modification of its substance, while its designation remains unaltered (§ 4.1.; § 4.2.), and is often used for indicating any type of structured repository (§ 4.3.).

2. From philosophical 'Ontology' to 'ontologies' in information science[2]

The term 'Ontology' was originally applied within the domain of philosophy to designate the study of the nature of being and existence, as distinct from epistemology (i.e. the theory of human knowledge), and is outlined as a language- and domain-independent system of categories that can account for the structure of the world (Guarino 1998: 2). Ontology as a philosophical discipline cannot be considered a monolithic entity. Indeed, within the history of philosphical thought the notion of Ontology has been given different interpretations. A thorough outline goes beyond the scope of this paper, but a valuable synthesis can be found in Øhrstrøm et al. (2005) and Smith (s.d.). Nevertheless, a basic continuity in the outline of Ontology can be identified: from Aristotle's *Metaphysics* (1997) up to contemporary theories it emerges as the branch of the science of thought focused on questions related to the nature and existence of objects, and how these can be classified in a reality representation model.

Nowadays the philosophical notion of Ontology is matched and, in some cases, even blurs into the concept of ontology shaped within information science and artificial intelligence. In fact, the multidisciplinary and multifaceted nature of ontology is a result of the role it has gained beyond the boundaries of philosophy within different fields related to the study of knowledge. In the last decades ontology has acquired a significant role particularly in computing and artificial intelligence, where it is associated with research relating to knowledge representation, data- and knowledge base theory, natural language processing, and machine translation (Poli 2003: 5; see also Guarino 1998: 1).

The term 'ontology' was introduced in the area of information science in the 1980's (Øhrstrøm et al. 2005: 434). It is currently used both for indicating a background (logical) theory and, in most cases, an object, that is to say a formal semantic structure that accounts for a "conceptualisation" (Guarino/Giaretta 1995: 1-3). More precisely, Guarino (1998: 2) defines ontology as "an engineering artifact, constituted by a specific vocabulary used to describe a certain reality, plus a set of explicit assumptions regarding the intended meaning of the vocabulary words". Indeed, numerous definitions are available in the literature of information science, as a consequence of the lively debate on the nature of ontology in this field. Gruber's (1993: 199) is among the most quoted, and was modified with a significant addition by Studer et al. (1998: 184): "An ontology is a formal, explicit specification of a **shared** conceptualization" [emphasis added].

2 Following Guarino/Giaretta (1995: 2-3) two notions of ontology are distinguished here through the use of upper and lower case initial letter respectively: the former indicates a branch of philosophy and the latter an object in information science (cfr. also Guarino et al. 2009: 1-2).

Hence, while philosophical Ontology has the all-encompassing aim of identifying the very nature and organisation of things, is unique and domain independent, ontology in the experimental sciences is characterised by a pragmatic orientation which can determine its specific outline, and is generally centred on a restricted domain (Guarino et al. 2009: 1-2). Øhrstrøm et al. (2005: 436) clearly state that:

> In pure form, the Ontology as philosophical discipline is characterized by being singular, perspective- and domain-independent and oriented towards making strong claims about the world. Similarly, ontology as an information practice is characterized by fragmented pieces of knowledge, it depends on the choice of domain and perspective, and as such, makes primarily local claims, and finally, it is intended as an information strategy in which ontologies are seen as artifacts.

Therefore, the underlying paradigm of ontology has been modified, while its designation remains basically unaltered throughout time and across disciplines (if we ignore the graphic distinction highlighted in n. 2). This can be mainly attributed to the shift from the concept of ontology as a pure theoretical model within philosophy to its establishment as an instrument of knowledge organisation within information systems applications (see Smith s.d.).

Nevertheless, the philosophical origins of ontology are to be found also in its subsequent theoretical and applicative developments within the various disciplines in which it has been adopted up to the present time. The link between philosophy and information science can be identified in the fact that both areas of investigation are concerned with the search for a classification system that can be a valid model for structuring an abstraction of reality through the organisation of relevant data. Both philosophy and information science aim at finding a model that makes it possible to integrate information in order to create tools for both interpreting and producing knowledge. Such information is distributed, according to the specific properties of data, in taxonomies or in knowledge bases. As Poli/Obrst (2010: 4) clearly point out: "Ontological engineering […] has issues comparable to that of philosophical ontology, but reflected technologically in the attempt to develop ontologies as software usable models".[3] Smith/Ceusters (2003: 3) highlight the parallel between ontology within philosophy and information science by pointing to the substantial coincidence of the problems encountered by both philosophers and information scientists in shaping an ontological model, i.e. the "problems relating to universals and particulars, properties and relations, events and processes". Øhrstrøm et al. (2005: 436-437) even posit that the theories and applications of ontology in philosophy and information science benefit from a mutual interchange of ideas, and that their relationship cannot be considered dichotomic but rather one in which the two different positions are part of a continuum.

An overview of the applicative side of ontology leads to its being broadly interpreted as a (formalised) framework for **organising** and **representing** knowledge, the latter can be conceptual and/or factual (Poli/Obrst 2010: 4). Indeed, in contemporary applications ontology is interpreted as being oriented either to concepts or to objects. Poli (1999: 3) highlights that this difference corresponds to distinct orientations in philosophy, and it could easily be settled by using distinct terms that avoid ambiguity, i.e. 'epistemology' and 'ontology' respectively. Ontology is not only a model for organising and representing knowledge. Indeed, if it is intended as a 'software usable model' it can be seen as a device that can support the **retrieval** and even the **production** of knowledge.

The reading given in the present study focuses on ontology as an object rather than a theory, while considering that whatever type of artefact one takes into account it is still the outcome of a specific (onto)logical theory. This interpretation of ontology is relevant for its consideration within the domain of contemporary terminology. Particular attention will be directed here to the taxonomy model, i.e. a hierarchic relational framework, which can be considered the "backbone" of

3 Ontology engineering models are produced to serve applications within different disciplinary fields. They can be used for example as a tool for "solving problems related to translation […], information retrieval […], knowledge management […] and other issues related to knowledge-based activities […]" (Gillam et al. 2007: 49).

ontology (Guarino et al. 2009: 2). This model is a constant feature in ontology studies within philosophy, information science (see e.g. Studer et al. 1998: 186, Smith s.d.: *passim*, Buitelaar et al. 2005: 5), and terminology alike (see below § 3.2., § 4.1.).

3. The role of ontology within other disciplines

Throughout history, the organization of knowledge has been represented in different ways, according to the tasks it was constructed to accomplish, ranging from Aristotelian categorisation, through Linnaean taxonomy, to the current formal ontologies. A constant feature of such representations is that they allow users to order in a schema the (conceptual) entities classified, their properties, and mutual relations. This is true both if the representation is focused on specific areas and if it is extended to the totality of knowledge, that is to say if it is shaped as a domain or general ontology respectively (see § 4.2.). While displaying a formal specificity, classificatory paradigms have presented substantial uniformity over the centuries. Indeed, these models are ultimately based on structural criteria that are essential for the organization of thought itself. Among these are the fundamental principles of categorisation,[4] related to generality/particularity, whole/part, together with time-space coordinates; such principles can also depend on the perspective of the subject in relation to the object of knowledge.

Various factors are at the basis of the ontological models proposed in the different disciplinary fields and, even more, in interdisciplinary areas. Among them are the purposes for which ontologies are planned and created within distinct disciplines and schools of thought, for example in philosophy, artificial intelligence, terminology, and linguistics (Smith s.d., Guarino/Giaretta 1995: 1-3, Nickels et al. 2007). Nickels et al. (2007) point out key criteria on which the outline of ontology within and across disciplines can be drawn. They are the variables of generality, objectivity, origin (author or evolutionary process), user, purpose, and quality of ontologies. These variables, according to the authors lead to an inventory of classificatory parameters which can outline a 'typology of ontologies' (see Nickels et al. 2007: 23-33).

3.1. Ontology and language: the linguistic disciplines

A relevant feature inherent in the different types of conceptual/objectual schemes – or 'ontological models' – mentioned above is the necessary link they establish with language. This is true within the contexts of information science and terminology, as in both areas the intersection of language with the organisation of knowledge data is essential. A (natural or formal) language that is used as a means of expression and description of knowledge units needs to be clear-cut. In this scenario, natural and formal languages represent the two extremes of a spectrum of regulation in the form of syntax and grammar. Hence, ontology plays a key role as it can provide a conceptual scheme shared by a community of users, is potentially independent of linguistic and cultural specificity (see e.g. Geentjens et al. 2006: 2, Guarino et al. 2009: 8), but it is also capable of being integrated with a taxonomic framework of linguistic data.

On the one hand, natural language can be normalised or, at least, regulated to allow less ambiguous communication in specialised fields, as happens in terminology. On the other hand, it can be used to facilitate the interaction between man and machine in information system applications oriented towards knowledge representation and retrieval. In both cases a combination of natural language with ontology is posited. The delineation of ontologies is based on languages that can be characterised by different levels of formality (Uschold/Jasper 1999: 4; see also Smith 2003: 6). Hence, they can range from simple conceptual hierarchies of subsumption relationships to the more articulate models in which "suitable axioms are added in order to express other relationships between concepts and to constrain their intended interpretation" (Guarino 1998: 2).

4 In cognitive neuropsychology studies the idea that concepts are organised in the brain into categories is at the basis of the analysis of the organisation of conceptual knowledge, the lexicon, and the storage of memories (see e.g. Martin/Caramazza 2003).

In ontology engineering, natural languages can complement the formal ones, e.g. for designating and also defining concepts. This is true especially if the ontology is oriented to human communication. As Temmerman/Kerremans (2003: 3) point out: "Ontologies can be represented in (one or more) natural languages (linguistic ontologies) and in formal languages". In information science a pragmatic view of ontology applications points to the interrelation of humans and computers. Hence, the systems of communication used by the two categories of 'agents' need to be integrated (Uschold/Jasper 1999: 4). Schwitter (2008) highlights the advantages of enriching formal ontologies with linguistic expressions in order to facilitate human interaction with the data organised in the object ontology (see also Guarino et al. 2009: 14). Another perspective of ontology applications is delineated against the background of natural language processing studies (see e.g. Nirenburg/Raskin 2004: 149-153).

In terminology, language is both the object of its categorisation and a categorising instrument; it is a meta-language used for defining the classified concepts which, in turn, are designated by linguistic units. Terms can be considered complex units where the linguistic, mental, and referential facets are correlated (Sager 1990: 22, 57; Cabré 1996: 19; Temmerman 2000: 224). Throughout its history terminology meets ontology or, more generally, the frameworks used to provide conceptual and/or objectual representations. These relational structures are directly linked with the linguistic units used as verbal expressions of concepts, and with their definitions provided in a natural language.

The organising and representation framework identified with the relational framework of ontology has also gained increasing importance within language studies. In the area of general linguistics the notion of **ontolinguistics** has been recently introduced (Schalley/Zaefferer 2007a). It parallels those of **ontoterminologie** (Roche 2007) and **Termontography** (Temmerman/Kerremans 2003) originated within the domain of languages for special purposes. These terms indicate research and applicative methodologies in which ontology is attributed a focal role in the study of (general or specialised) language. **Ontolinguistics** aims at promoting "an ontology-driven approach to linguistics" (Nickels et al. 2007: 41), focused "not only on the conceptual contents of linguistic signs, but also on their decompositional structures and on the network of interconceptual relations they are embedded in" (Schalley/Zaefferer 2007b: 11). **Ontoterminologie** is "cette approche qui place l'ontologie au centre de la terminologie. Une approche où l'ontologie joue un rôle fondamental à double titre: pour la construction du système notionnel et pour l'opérationnalisation de la terminologie" (Roche 2007: 14). **Termontography** "is a multidisciplinary approach in which theories and methods for multilingual terminological analysis of the sociocognitive approach […] are combined with methods and guidelines for ontological analysis […]" (Temmerman/Kerremans 2003: 4); via this method it is possible to "explicitly represent cognitive structures by means of categorisation frameworks and to make the ontological information more useful and accessible" (Geentjens et al. 2006: 21-22).

3.2. Ontology, conceptual frameworks, and language description in terminology

In terminology applications, the issues of clear-cut conceptual classification meet with those of linguistic description. The latter displays two competing needs that have to be satisfied, namely the regulating and the descriptive. These coexisting facets are inherent in the activity of term identification and description, and are mapped onto systems of concept definition. The interplay of linguistic, referential, and conceptual knowledge that characterises terminology studies has always been a focal point in the investigation of human knowledge, of the way in which it is organised and transmitted. The relational framework that is also called 'ontology' has taken root as the reference model that allows the organisation and representation of knowledge, and it is used to this aim in terminology as well as in other disciplines.

Since the origin of this discipline with Wüster's theory of terminology the concept-centred view and the normalising orientation are its dominant features. In his view variation in linguistic use hinders direct and unequivocal communication. As a consequence, specialised language needs to be based on a set of unambiguously defined concepts associated with fixed designations. The definition of concepts results from the identification of the logical and ontological relations between them. Hence, a knowledge domain can be represented in a relational conceptual framework in which definitions are outlined (Wüster 1974: 72-74). Although nowadays Wüster's "General Theory of Terminology" (Wüster 1991) still represents an important point of reference in terminological studies, it coexists with different interpretations of terminology. These have developed in the last decades in the direction of a stronger consideration of the communicative, social and cognitive dimensions of languages for special purposes. A part of contemporary terminological research and applications focuses on a descriptive approach to terms that starts from their textual and communicative dimension and then takes into account their conceptual side. The reference here is to the four different theoretical directions highlighted by L'Homme (2005: 1115-1116): socioterminology (Gaudin 2003), textual terminology (Bourigault/Slodzian 1999), the sociocognitive approach (Temmerman 2000), and the communicative theory of terminology (Cabré 2003).

In spite of the different theoretical approaches, conceptual representation in terminology practice displays a certain continuity with the traditional paradigm. In fact, concept representation in terminology is still based on a relational framework, even though its defining function can be integrated by complementary devices. Within the sociocognitive theory of terminology such devices are based on communicative and cognitive paradigms, and are capable of providing relevant information that cannot be managed by the more rigid conceptual frameworks. The reference here is to the integration of the ontological backbone with templates which can account for relevant terminological information that cannot be described via the traditional taxonomic model, such as the relations of those "units of understanding" that do not display categorical properties (Temmerman 2000). In her theory Temmerman (2000: 73-123, 226) introduces the notion of "template of understanding". It is delineated as a model that can contain the relevant units of information on a concept according to the different degree of relevance they display. Templates can also summarise event frames (Faber et al. 2005; Faber 2009), thereby highlighting the conceptual relations which are considered essential for the definition but are different from the properly logical and ontological relations. The shift of focus from the intensional properties to the prototype and contextual features of the classified entities is typical of the cognitive and the 'frame' theory. As a consequence, the classified 'items' are not necessarily seen as pure abstractions, but rather as linguistic or conceptual units, or again more generally as units in which conceptual, factual, and linguistic knowledge merge. Thus, the framework in which they are organised needs to be appropriate to gathering different types of entities, rather than being designed to give account of all things that exist, as an ontology does.

Nowadays, terminological applications need to take into consideration both conceptual univocity and lexical variations that are socially and culturally motivated (Kerremans/Temmerman 2008, Kerremans 2010). Hence, the necessity of identifying a valid model for delineating and delimiting concepts in a relational framework coexists with the need to present the *in vivo* dimension of their linguistic designations. To this scenario is also added the application of knowledge representation and management systems that come from the domain of information science. These systems are adopted for the production and use of terminologies and for the retrieval of linguistic and conceptual data from corpora of specialised materials (see Bourigault et al. 2001, Ibekwe-SanJuan et al. 2007).[5] Indeed, terminologies are delineated more and more often as proper knowledge bases for specialised domains (Meyer et al. 1992, Meyer et al. 1997), and can be directed both to human users and to artificial agents.

5 Textual terminology meets artificial intelligence for the elaboration of what are defined as "ressources terminologiques ou ontologiques (RTO)" (Bourigault et al. 2004: 88), based on texts. RTOs are the outcome of the *Terminologie et Intelligence Artificielle* (TIA) group that, since the early 1990's has conducted an interdisciplinary research activity where the methods and applications of linguistics, knowledge engineering, natural language processing, and information sciences meet in order to build RTOs.

A few decades ago Wüster underlined the connection between terminology and other disciplines, among which were mentioned informatics and ontology. The title of one of Wüster's articles (1974) remains emblematic for summarising the interdisciplinary connections of terminology: *Die allgemeine Terminologielehre. Ein Grenzgebiet zwischen Sprachwissenschaft, Logik, Ontologie, Informatik und den Sachwissenschaften*. Nowadays an even closer integration among these disciplines has taken place, as information science can no longer be considered ancillary to terminology as it was in Wüster's view (Wüster 1974: 98), because the two domains reveal an increasing mutual interchange (Temmerman/Kerremans 2003: 3-4; Kerremans et al. 2005; see Cabré 1999: 52-55, 160-193). On the one hand, terminology as a theory and as a product "must go beyond the needs of humans" (Smith 2008: 83), because it is often elaborated both for human users and for computer applications, which necessarily rely on rigid formalisations. Hence, it also needs to come to terms with the theories and procedures of information science. On the other hand, the principles and methods of terminology practice represent a resource for information science (Smith 2008: 83). Therefore, terminology nowadays can even serve other disciplines, and ontology engineering has a primary role among them (Kerremans/Temmerman 2004). The privileged connection between these disciplines was already highlighted by Galinski (1990: 87):

> Modern terminology work is closely linked with documentation and information science. High-quality terminology work results in reliable, multifunctional (mono- or multilingual) terminographical data (i.e. terminological data and associated data), which are primary elements of information and knowledge management systems.

The view of ontology within the field of terminology theories and applications has undergone major changes. This is a consequence of the interdisciplinary commitment of terminology studies, especially with information science. As suggested above, these modifications are part of a more complex background of evolutions in the theoretical stance of terminology itself. These originate from the different weight given to the communicative, cognitive and referential sides of term analysis and description by different strands of thought (see Faber 2009: 109-121). This situation is evident if against the background of ontology are considered, on the one hand, the principles of the relational conceptual scheme proposed by Wüster from the 1930's onwards and, on the other, contemporary terminological practice which increasingly often converges with information science and knowledge engineering.

It should be pointed out that ontology is only a part of Wüster's theory, where it is considered, together with logic, as a reference discipline that can provide the principles for establishing relational definitions of concepts. Wüster (1974: 85) underlines the importance of Ontology and logic in the identification of the characteristics of abstract concepts and factual individuals. Logic has a primary function in the identification of dependency conceptual relations (Wüster [1959] 2004: 286). Ontology provides further classificatory and defining parameters for the delineation of concept relations, i.e. coordination and chain relations, which are based on data deriving from the abstraction of factual relations between individuals (Wüster 1974: 92-95). For an effective identification of terms in a specialised dictionary that is onomasiologically oriented, Wüster recommends that a conceptual scheme be established (Wüster [1959] 2004: 299). Since the scheme results from the identification of logical and ontological conceptual relationships (i.e. inclusion and part-whole hierarchical relations), it can allow the representation of both concepts and their relational characteristics. The latter enable the terminographer to outline intensional and extensional definitions (Wüster [1959] 2004: 302-304; Wüster 1991: 34-35; see also Antia 2000: 101-116 and Nuopponen 1994).

In contemporary terminology, ontology has acquired a more central role, and the term itself has become an umbrella designation for different kinds of defining and representation frameworks. Among the numerous examples of such applications the following can be mentioned: Meyer et al. (1997) propose the integration of artificial intelligence and terminology principles for the creation of a terminological knowledge base in the project CODE (Conceptually Oriented Description Environment); Madsen et al. (2002) for the project CAOS (Computer Aided Ontology Structuring) plan a properly formal ontology for substituting the “informal concept system” (Madsen et al. 2002: 1); other projects are presented in Kerremans et al. (2004; 2005), Cabré et al. (2004), Smith/Ceusters (2003), Ceusters et al. (2003), Madsen (2008), and Smith (2008).

Hence, the panorama of ontology within terminology goes from the conceptual scheme proposed by Wüster (1991: 22-32) to the more ‘formalised’ ones which are functional for the creation of terminological knowledge bases (Meyer et al. 1997), and to proper ontologies, elaborated by knowledge engineers and information scientists in order to be integrated with terminological information (Smith/Ceusters 2003; Kerremans et al. 2004; Faber et al. 2009). While the traditional reference model is human-centred, knowledge bases and terminological ontologies are thought to be used and implemented by humans and computers alike.

4. Ontology or framework within terminology

The aim of Wüster’s work was directed at clarifying and standardising specialised concepts and their designations, especially in a multilingual dimension. While this point is still valid, in the majority of contemporary terminological projects further needs have also arisen, derived from communicative and cognitivistic approaches to term analysis and representation. The model that originates from philosophical Ontology is generally actualised nowadays into an object that could be called a ‘relational framework’ rather than an ontology. The term ‘framework’ has fewer connotative implications, and its apparent generality can be limited by using appropriate modifiers.

In fact, in terminology, a ‘framework’ can be considered as a backbone that is used to provide a structured organisation of knowledge units, the nature of which can be linguistic, cognitive, and referential. Terminological knowledge units can be seen as a combination of the three dimensions, as highlighted above (§ 3.1.), but emphasis can also be laid only on one of these components. Hence, the relational structure that results from the examination of knowledge units can have different outlines, depending on the theoretical approach adopted. Wüster’s perspective was focused on the referential-conceptual dimension of the units hierarchically structured according to the principles of logic and Ontology which allow us to define them, clarifying in this way also the linguistic (denotative) facet of terms (see § 3.2). In contemporary applications, the hierarchical framework is the core structure of terminology repositories, often organised as proper knowledge bases. These can be both directed to human users and planned for being adopted in knowledge-based computer applications (see § 4.2., § 4.3.). The latter are centred on the acquisition, formalisation, and representation of knowledge, are developed in an interdisciplinary dimension, and aim at providing resources useful to research and applications in various domains – that go e.g. from machine translation to artificial intelligence – relating to the retrieval, organisation, and management of knowledge.

As a consequence, a so-called ‘ontology’ is, indeed, the representation scheme of linguistic, referential, or conceptual units, and its structuring principles can vary, depending on the specific objects it is used to organise, and the goals for which it is planned. Furthermore, in ontology engineering there can also be a convergence of classificatory parameters that are difficult to formalise systematically and to match with the structuring principles of ontology. The reference is to the issues related to cultural, inter-linguistic, and folk components of knowledge. Hence, the term ‘relational framework’ rather than ‘ontology’ could be used as an ‘unmarked’ designation to refer to the classificatory and defining structures widely used nowadays in different scientific disciplines.

The ‘relational framework’ is, indeed, an effective model which allows researchers to integrate terminological and conceptual regulation with linguistic data that are cognitively oriented, namely those resulting from the methods of analysis deriving from prototype structure analysis, cognitive model analysis, and diachronic analysis (Geentjens et al. 2006: 10). In modern terminological research, an ontology represents the formalised conceptual point of reference that, in principle, is not radically divergent from Wüster’s taxonomic model. Indeed, it can be balanced, completed, and made even more ‘dynamic’ through complementary devices that also account for the cultural, social, and cognitive aspects, together with the contextual features of the items included in the defining framework (see e.g. above § 3.2.).

4.1. The outline of relational frameworks in terminology

The relational framework represents the backbone of terminology knowledge bases as well as of many applications in information science, and particularly in ontology engineering. Such schemes aim at representing types of knowledge that cannot always be easily and univocally formalised if the philosophical core rules of Ontology are respected (see § 2.). In the area of information science this point is made clear for example by Gruber (1995: 2) who underlines that, in the design of ontologies for knowledge sharing, the final 'artefact' depends on the aim it is built for rather than on proper ontological principles (Gruber 1995: 2). Nonetheless, even though these relational frameworks can have very different outlines, they are more and more often unified under the common designation of 'ontology'.

Thus, what is generally called an ontology is delineated in its applications as a scheme representing the organisation of the concepts, or abstractions, of a (specific domain of) reality, and its outline can depend on the task it is built to accomplish and the nature of the entities it contains. The fact that ontologies are elaborated to pursue a practical goal determines substantial variation in the nature of the 'conceptualised reality' they structure, as well as in the relevant criteria adopted for its organisation and representation. In addition, the term 'concept' itself can have different meanings in various disciplines, and these often coalesce in ontological applications and influence their final outline. Smith et al. (2005: 648; see also Smith 2003) synthesise as follows the different interpretations which coexist in most information science works focused on terminology:

> On the psychological view concepts are **mental entities**, analogous to ideas or beliefs; on the linguistic view concepts are the (somehow regimented) **meanings of general terms**; on the epistemological view concepts are **units of knowledge** (as this term is used in phrases such as 'knowledge representation'); and finally, on what some might call the 'ontological' view, concepts are **abstractions of kinds, attributes or properties** (i.e. of general invariant patterns on the side of entities in the world) [emphasis in original].

The above sketch traced by Smith et al. (2005) is a mere simplification of the complex reality which lies behind the construction of a 'conceptual representation'. But it can at least hint at the difficulties of producing and using an ontology, especially in the fuzzy area where terminology, knowledge representation, and information science cooperate increasingly often nowadays. In this interdisciplinary area, which is usually pragmatically oriented, the term 'ontology' acquires vague and hybrid meanings. This term is used to designate different objects only because they have in common similar characteristics, i.e. a basic hierarchic inheritance structure whose nodes can be (different types of) concepts, linguistic meanings, or both entities at the same time.

4.2. Different perspectives in ontology building

The terminological and conceptual ambiguity of the term 'ontology' can be ascribed to the fact that two contrasting requirements come to light in terminology and information science applications of ontology. On the one hand, following on from its philosophical origins, an ontology should be a unique (or even universal) organising model, which can encompass a more or less wide domain of knowledge, and be eventually valid for practical applications. On the other hand, an ontology, in terminology as well as in information science, is limited to a restricted knowledge domain, and its structure (and eventual constraints) depend on the perspective and the aim it is planned for. Hence, the so-called 'Tower of Babel' problem, relating to the plurality of codes and reference models, has gone beyond the domain of natural language, and invaded the area of artificial languages and ontology (Grenon 2008: 73; see also Smith/Ceusters 2003: 4).

Therefore, a basic distinction within the panorama of ontology can be made between a unique (or top-level) ontology and a partial (or domain) one. Guarino (1998: 7-8) delineates an even more complex picture of applied ontology by distinguishing top-level, domain, task, and application ontologies:

> **Top-level ontologies** describe very general concepts like space, time, matter, object, event, action, etc., which are independent of a particular problem or domain […]. **Domain ontologies** and **task ontologies** describe, respectively, the vocabulary related to a generic domain (like medicine, or automobiles) or a generic task or activity (like diagnosing or selling), by specializing the terms introduced in the top-level ontology. **Application ontologies** describe concepts depending both on a particular domain and task, which are often specializations of **both** the related ontologies [emphasis in original].

While a comprehensive reference ontology would be closer to the original intent of philosophical Ontology, the difficulties relating to its delineation are many, and show a substantial similarity throughout history and the various disciplines. These can be synthesised in the words of Smith/Ceusters (2003: 4) who pinpoint the problems inherent in the implementation of a top-level ontology in the fact that it "would have to be simple enough that it can be programmed into our computers, yet it would have to be comprehensive enough that it can allow the expression of terms derived from all competing systems of classification". Possible solutions are identified in overcoming the philosophical principles of ontology itself, that is to say in the implementation of partial ontologies devoted to sub-fields of knowledge rather than to an overall representation, "each resting on a different pragmatically motivated choice about the way an ontology should be built" (Smith/Ceusters 2003: 4; see also Buitelaar et al. 2005: 1).

Domain ontologies are the dominant model both in terminology and information science. Since they are constructed for practical applications, they often combine the traditional top-down approach (based on the representation of universal data) with bottom-up criteria, which prove easier to manage and, above all, are more suitable to the definition of particular and contextualised data (van der Vet/Mars 1998, Temmerman/Kerremans 2003: 4, Geentjens et al. 2006). In fact, terminography focuses on textual materials that are domain-specific and usually multilingual. Hence, in this practice it is fundamental to outline a relational (ontological) reference model that represents a unifying and bridging device for the linguistic and conceptual information recorded in each monolingual knowledge base (Kerremans et al. 2004: 2). These bridging devices are often called ontologies, as well as are single conceptual and terminological frameworks.

4.3. Ontology in terminology: a backbone with regulating functions

As introduced above (§ 3.2.), the more recent trends in terminology theory and applications are characterised by a descriptivist approach, and are also oriented at supporting translation practice. Hence, a growing importance has been attributed to the facets of linguistic and cultural variation in the context of specialised languages and to their representation in terminographic products, consisting mostly in terminological knowledge bases. As a consequence, in terminological applications a balance has been sought between the requirements of intra- and inter-linguistic regulation and the intention of also representing the *in vivo* characteristics of language as they appear in textual corpora, including the phenomena that cause linguistic irregularity. This aim is often accomplished by adopting a regulating (conceptual) 'ontology' that is combined with a bottom-up 'supplement' of descriptive data on terms and concepts that are drawn from specialised texts.

In this scenario the ontology has the function of bridging the various language-specific 'conceptual schemes'. In principle, the latter can be planned to be language-dependent or -independent, as is the case for example with Temmerman's Termontography method, where a 'neutral' "categorisation framework" is used to bridge language and culture specific terminologies; in addition, it is matched with a formal ontology (Geentjens et al. 2006: 13-15). Terminology frameworks, in their turn, present a description of units which is suited to the purpose for which the terminology is built (see e.g. Temmerman/Kerremans 2003). But, as outlined above, formal ontologies too are normally built to fit a specific domain: they also result from linguistic information and need to adjust their relational framework to the data arranged in them, so much so that they prove to be indeed language-dependent. As Geentjens et al. (2006: 13) point out: "Despite their alleged ‘conceptual’ grounding, domain ontologies based on lexicalisations found in textual information do not map easily across languages”. The problems related to matching multilingual and multimodal resources and ontology applications emerge also in another area of studies related both to language and information science, i.e. natural language processing (see e.g. Montiel-Ponsoda et al. 2008; Buitelaar et al. 2006). This is due to the fact that, ‘conceptual ontologies’ developed for information science and artificial intelligence applications “are built to support logic-based inference, and often include substantial amounts of world knowledge in addition to lexical knowledge” (Palmer 1999). Hence, the values of universality and objectivity of the ontology reference model cannot be preserved.

A domain ontology does not necessarily represent a general conceptual model, but just **a model** that is valid for a specific domain, a model that can possibly be integrated into a top-level ontology and that, in terminological practice, often matches linguistic and conceptual schemes. As a consequence, the common interpretation of ontology within terminology is far from the original and proper value of the ontological paradigm, because in addition to being pragmatically oriented, it is also guided by the specific needs of computational applications (Kerremans et al. 2004: 3).

Therefore, as pointed out above, the models elaborated in contemporary approaches to terminology join – in a mixed approach – the generalist and the particularist view of ontology. The former follows a top-down design, while in the latter the bottom-up perspective dominates (Temmerman/Kerremans 2003: 4). On the one hand, this integration of representation systems stresses the necessity of using a reference categorial model (i.e. an ontology proper). On the other hand, it highlights that this model is inadequate to produce a satisfactory scheme which can account for terminological complexities, particularly those due to linguistic and chronological variation, and also to the specific referential nature of the items designated by terms.

5. Conclusions

The link between terminology research and knowledge- and ontology engineering has determined a shift also in terminology theory, from its original delineation in the works by Wüster and the main terminology schools to its contemporary outline. Thus, the concept of ontology introduced in the initial phases of terminology studies can be traced back to the philosophical matrix, while the concept that can be outlined nowadays can be ascribed to the domain of information science; and these models are substantially different in nature.

Terminology, as well as ontology engineering and information science, has a practical stance on conceptual and linguistic representation. It is oriented towards the creation of a product which serves specific needs. Indeed, it aims at delineating a (terminological and concept) framework that effectively represents a knowledge domain. This approach influences both the theoretical underpinning and the final outcome of the research conducted in this area, because it is on the end product that the theoretical approach itself depends. Whereas in the domains of logic and philosophy – to which the ‘trademark’ of ontology belongs – the delineation of ontology (as a product) is an end in itself.

Ontology as a ‘logicist scheme’ is conceived as a structure subject to strict organisational rules. In this perspective the classificatory principles are preliminarily fixed (as generalisations) and the delineation of the ontology follows a top-down arrangement. The ‘computational’ approach aims at merging two different issues. These are, on the one hand, a regular classification based on aprioristic axioms and, on the other, the information resulting from human cognitive and communicative experience which, instead, can easily depend on contingent factors. Hence, the underlying aim of applied ontology is not the outlining of a global and universally-valid abstract classification of reality that may be of any philosophical import. It is rather that of elaborating a device that can support the creation of a repository of specialised information whose nature is conceptual, linguistic, and referential. It is an instrument that can be used to automatically retrieve or produce further knowledge for the specific purposes of both terminology and information science. Hence, the backbone of terminology knowledge bases, which is often designated as an ‘ontology’, should be more properly considered a relational framework.

Throughout history and its interdisciplinary applications the notion of ontology has gone through evident substantial changes, which are not reflected by its unique designation. The generalised use of a single term for different concepts should be reassessed, due to a consideration of two relevant issues: on the one hand, a consideration of the protean nature of ontology as it is applied within and across the various disciplines and, on the other, the central role that conceptual and terminological precision have in terminology.

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