Applied Ontology 19 (2024) 1–5
DOI 10.3233/AO-240012
IOS Press

Concept systems and frames in terminology

Pius ten Hacken and Rossella Resi
Department of Translation Studies, Leopold-Franzens-Universität Innsbruck, Austria
E-mails: pius.ten-hacken@uibk.ac.at, rossella.resi@uibk.ac.at

Terminology is often seen as the domain-specific vocabulary of a particular field of specialization. In this perception, the terminology of a domain can be represented adequately by means of a glossary, i.e. a list of expressions with information about their meaning. However, for domain specialists, a terminology in which the set of terms does not have any kind of inner logic is not satisfactory. To specialists, terms listed in a glossary are connected with each other in different ways. These ways often remain implicit, because specialists agree on them without needing to specify them. In any case, a glossary can only be a partial representation of the terminology of a particular domain.

In several fields, the need to make the system behind the terms in the glossary explicit has arisen at some point in their history. Two well-known examples are the taxonomy proposed by Carl Linnaeus (1707–1778) and the nomenclature proposed by Antoine de Lavoisier (1743–1794). It is worth considering how and to what extent these examples reflect more general properties of terminology.

Linnaeus developed his taxonomy to classify plants and animals. Here, we will only focus on the latter. By his systematic use of the binomial nomenclature on the basis of his taxonomy, Linnaeus made it possible to designate each species in a way that reflects its position in the taxonomy systematically. Taxonomies represent the most basic ontological system. A taxonomy is based on a partitioning at each level, which makes it rigorously systematic. As names of species and taxa are terms in zoology, Linnaeus contributed to the terminology of zoology. Since the emergence of the theory of evolution, genetic relations have been invoked to motivate the individual partitionings. However, a taxonomy is not a full ontology. A taxonomy of zoology does not include all terms of the field. It includes names of species and of higher taxonomic ranks, but not, for instance, the terms that describe the organs of animals.

Lavoisier's nomenclature, originally published in 1787 in collaboration with three colleagues, constituted a significant step in the development of chemistry as a scientific field out of alchemy. Whereas in traditional alchemy, the alchemist would gain insights and pass them on to apprentices, chemistry is based on a much more public mode of communication. An alchemist would write down notes for his own recollection, not as an account intended to be read by others. The nomenclature was necessary in order to make experiments reproducible. Currently, the nomenclature is managed by the International Union of Pure and Applied Chemistry (IUPAC). It is based on a system that relates the composition of a chemical substance to its name, leading to such systematic oppositions as *sulfite*, *sulfate*, *nitrite* and *nitrate*. This system, described for anorganic chemistry by Connelly & Damhus (2005), covers a much larger portion of the ontology of chemistry than the taxonomy does of zoology, but it is dependent on properties of chemistry not found in other fields, so that it cannot be generalized.

The first general theory of terminology was developed by Eugen Wüster (1898–1977). Wüster's (1931) PhD is a study of the terminology of electrical engineering, but he used the field only as an example, not using its particular properties in the solutions he proposed. In subsequent years, Wüster was active in the

preparation of terminological standards for ISA and ISO. In his posthumously published introduction, based on lecture notes for his course at the University of Vienna, Wüster (1979) outlines a general theory of terminology (ATL, German *Allgemeine Terminologielehre*). A central assumption of ATL is that terminology work is onomasiological, i.e. starting from the concept and working towards the name. Wüster (1979: [1] 8–23) assigns a prominent position to the specification of relations between concepts and their representation in concept systems (German *Begriffssysteme*).

One reason for Wüster to discuss the representation of concept systems in ATL in some detail is that they can easily become quite complex. An example can be derived from the field of zoology. When dealing with the Asian elephant, in Linnaeus's system it is designated by a binomial name, *Elephas maximus*. This indicates its position in the taxonomy, but there are many further relevant terms that need to be related to it. One type of relation that should be recorded is meronymy. Examples are *trunk*, *tusk*, *tail*, *leg*.

Meronymy is less systematic than taxonomy and interacts with it in complex ways. Whereas taxonomy is based on a partitioning, meronymy highlights only the prominent parts, leaving behind a remainder that is not itself perceived as a concept. Moreover, a meronym can be realized more than once. A healthy elephant has two tusks and four legs.

One source of the complexity of the interaction between meronyms and a taxonomy is that in a taxonomy specific properties are selected for the partitioning, but meronymy may refer to other, independent properties. Thus, tusks are found in elephants, walruses and hippopotamuses, but they are not used to classify these species in the taxonomy. The three species are all mammals, but they belong to three different orders and each of these orders also includes animals without tusks. Therefore, it is not possible to identify a single node in the taxonomy that includes all animals with tusks. A further complication in the attempt to include meronomy in the concept system consists in the number of realizations of a meronym. The number of instances of a body part in an animal may vary characteristically. Thus, birds have two legs, elephants four, flies six and spiders eight. In some cases, the number correlates with properties that underlie the taxonomy, but in other cases not.

Wüster (1979: [2] 66) gives a general overview of the relations between concepts he envisages. After relations based on hyponymy and meronymy, he lists relations based on substance and object made of it (*Stoff-Gebilde*), chronological relations, and *Wirkbeziehungen*, relations based on causality, use of instruments and descendance. Keeping to the domain of zoology, the problem with such systems can be illustrated with the definition of *pulmonary vein* in (1).

(1) The pulmonary veins are the veins that transfer oxygenated blood from the lungs to the heart.

The definition in (1) starts with a hyperonym, *vein*, and mentions three other terms, *oxygenated blood*, *lung* and *heart*. However, the nature of the relationship with these three terms is hard to capture by means of a scheme such as Wüster's (1979: [2] 66). In order to see the nature of the problem, we can start from the characterizations in (2).

(2) a. pulmonary vein X contains Y oxygenated blood
b. pulmonary vein X starts in Y lung
c. pulmonary vein X ends in Y heart

In (2), the relation is expressed by a predicate with X and Y, where X is the term for which the relation is specified and Y the target of the relationship. In (2a), *contains* is much less specific than *transfer* in (1). In particular, *transfer* evokes an event, whereas *contains* only refers to a situation. This means that (2a) does not express all relevant information about the relation. At the same time, we have to keep in

mind that relationships are meant to be general, i.e. the attribute *X contains Y* is available for all terms. This produces a large amount of empty slots. Most terms will not specify what the concept they refer to contains. We might say that lungs contain air and the heart contains blood, but what does an elephant contain? In fact, specifying the attribute for each term invites terminologists to think of what value might be inserted, which easily provokes extended uses of the nature of the relation. Thus, it would be tempting to say that an elephant contains a heart, whereas it is more appropriate to capture this relation as meronymy.

A solution to the problem of specifying relations such as the ones in (1) is to treat the nature of the relation not as an attribute but as a value. An example of a basic implementation of this idea is the specification in (3).

(3) a. pulmonary vein
b. nature of relation 1 X transports Y
c. target of relation 1 oxygenated blood

In (3), the term entry is specified in (3a) and (3b-c) give two attribute-value pairs for this term. In (3b), the nature of the relation is described by a value. This allows for a precise specification without requiring a new attribute that would be available (in most cases vacuously) for all terms. Instead of the statement (2a), there are now two statements (3b-c) that are connected. In this case, we used "1" as a simple index to connect them.

A refinement of this approach can be achieved by means of a classification of relations. In (2), two types of relations are specified. Whereas (2b-c) are locational, (2a) refers to the function of the pulmonary vein. This information can be used to classify the relations, producing a richer structure than the numbered relations exemplified in (3b-c). The question is in which case and to what extent such a reduction of the generality yields advantages. Here we enter into the area covered by Frame-Based Terminology (FBT).

In comparing ATL and FBT, there is an immediate problem arising from a difference in outlook. Wüster's (1979) ATL developed out of a study of the domain of electrical engineering, but from the outset it is clear that Wüster was interested in a general theory of terminology. FBT was developed by Pamela Faber and her team in Granada. Faber (2015) gives a concise presentation of this approach. It emerged out of a detailed study of the domain of ecology. In this domain, events play a central role. For a full understanding of the domain of ecology, it is arguably more helpful to focus on events rather than taxonomic hierarchies. As presentations of FBT generally take this domain as their starting point, it is not always clear how to distinguish design decisions that are domain-specific from the ones that are meant to be general for terminology in all domains.

In this special issue, we offer five articles that relate to the questions outlined above. The first two can be seen as presentations of the two approaches to ontologies implied in ATL and in FBT. The other three elaborate and compare these approaches in some specific contexts.

In the first contribution, Laura Giacomini delves into the concept of domain ontology, highlighting differences, ambiguities, and challenges that emerge from the interdisciplinary interaction between Ontology Engineering and Terminology. She considers factors such as the purpose, scope, and acquisition of ontological data, selection of suitable formats, and models for representing ontologies. Her discussion concludes by envisioning an integration of complex concept systems, like ontologies, into future terminology work. She emphasizes the need to develop models that satisfy the specific requirements of terminology itself and typical users, in order to ensure effective utilization and implementation.

In the second article, Pamela Faber and Pilar León-Araúz reverse the perspective. Whereas Giacomini takes the ontology of a field as the starting point and considers its use in terminology work, Faber and León-Araúz focus on the conversion of terminological resources into ontologies. They present FBT as it is implemented in the EcoLexicon as an example of the use of an existing terminology for constructing an ontology with a hierarchical structure of conceptual categories. Concepts extracted from definitions and specialized environmental texts are assigned to specific classes within a conceptual hierarchy. This hierarchy outlines the relationships between different concepts, ultimately contributing to a more comprehensive and organized ontology. In this way, the EcoLexicon as a terminological resource is reshaped, introducing a more formal and structured approach.

These two contributions offer complementary perspectives on the process of conceptual modelling, which, as indicated above, has been a central objective of terminology management since Eugen Wüster's work. Whereas Giacomini looks at the use of ontologies as a basis for terminology work, Faber and León-Araúz take the terminology as the starting point and consider how ontologies can be derived from it and support the improvement of the terminological representation.

The second part of the special issue consists of three case studies. In each of these, a particular domain is considered from contrasting perspectives in order to assess the advantages of concept systems modelled as ontologies as in ATL and of frames as used in FBT.

In the first of these, Rossella Resi takes building engineering as her domain and analyses the use of ontologies and frames in the context of translation. In translation, a central problem is the identification and management of terminological gaps, i.e. cases where a concept in one language does not have a matching designation in another language. The use of ontological representations can help in detecting discrepancies between languages at a conceptual level, but in the application to practical translation, their usefulness is limited. A frame-based approach is shown to provide a more solid basis for detecting and resolving terminological gaps at both conceptual and linguistic levels, ensuring a better transfer from a source to a target language. An analysis from an FBT perspective emphasizes the importance of analysing larger text units, such as segments or paragraphs, rather than focusing solely on individual terms. In this way, it reveals similarities and differences in designations across languages and highlights the importance of context-oriented methods for the treatment of terminology in translations.

The second case study, by Waldemar Nazarov, is devoted to terminology in legal domains. Legal terminology is special in the sense that the validity of definitions of and relations between terms is restricted by the authority of the legislators. Terms in one country are not necessarily valid in another. Moreover, legal texts exploit the tension between precision and vagueness in the definition of legal concepts. Nazarov shows that a frame-based approach can be helpful in legal domains in order to accommodate the contextual nature of legal terms. He emphasizes the culture-bound nature of the legal sphere and its abstractness, relying as it does on language for observation, expression, application, and even creation of concepts. The dynamic nature of case law and changes in legislation further complicate the analysis of legal language. Nazarov suggests that these problems can be addressed by integrating elements from frame semantics and comparative law in the procedure for the construction of an ontology of legal concepts. This is particularly relevant in legal translation, where the translator needs to understand the intricacies of terminological differences between legal systems.

The final case study by Irene Jiménez Alonso and Pius ten Hacken analyses the domain of seafood from a gastronomic and commercial perspective. As their point of departure they take the conceptual differences between Spain and Germany in this domain. As ATL assumes that concept systems are generally language-independent, they supplement it with insights from Cabré's (1999) Communicative Theory of Terminology (CTT). CTT advocates the separate, independent coverage of a domain in each

language. Subsequently, correspondence records specify crosslinguistic relations. Language-internally, CTT matches the approach to concept systems adopted in ATL quite closely. A challenge for the application of FBT in this domain is the prominence of taxonomic relations. It is shown, however, that also in this domain events can be identified that can be modelled as frames which supplement the taxonomic information in the ontology.

The three case studies all study terminology contrastively on two counts. On one hand, they look at concept systems as representations of a domain ontology as adopted in ATL in contrast to frames used in FBT. On the other hand, they consider differences between two languages as they come up in translation. The latter perspective is not accidental, as terminology has always been one of the central issues in technical and legal translation, so that contrastive work in terminology has often been performed by translation specialists. By offering these case studies and the two approaches to ontologies that are current in terminology, we hope to attract the attention of ontologists to this field of application and invite them to engage with it.

References

Cabré, M.T. (1999). *Terminology: Theory, Methods and Applications [DeCesaris, Janet Ann, transl.; Sager, Juan C., ed.]*. Amsterdam: Benjamins.

Connelly, N.G. & Damhus, T. (Eds.) (2005). *Nomenclature of Inorganic Chemistry: IUPAC Recommendations 2005*. London: Royal Society of Chemistry.

Faber, P. (2015). Frames as a framework for terminology. In H. Kockaert and F. Steurs (Eds.), *Handbook of Terminology* (Vol. 1, pp. 14–33). Amsterdam: Benjamins. doi:10.1075/hot.1.02fra1.

Wüster, E. (1931). *Internationale Sprachnormung in der Technik*. Berlin: VDI.

Wüster, E. (1979). *Einführung in die Allgemeine Terminologielehre und Terminologische Lexikographie, Teil 1: Textteil, Teil 2: Bildteil*. L. Bauer (Ed.). Wien: Springer.