ON THE TERMINOLOGY USED IN THE EXACT SCIENCES. REFERENCES TO THE AREA OF ELECTROTECHNICS*

Acad. GLEB DRĂGAN[1]

Abstract: The paper is a sketch of a quite old preoccupation of the author related to the formation and significance of scientific terms and terminology. Terminology is especially related to the ontology of a field. It is exemplified with some terms in electrotechnics.

Keywords: scientific terminology, language, exact science, electrotechnics.

Today the amazing expansion of science and technology has created the necessity of a study concerning terminology in all its complexity, the focus being placed on the conveyance of the dynamic elements of language and knowledge.

In the case of the exact sciences, the insertion of the prescriptive elements into a special language is circumscribed by the numerous functions that terminology has to deal with.

Particularly at the semantic level, a conflict arises that is brought about by the relative uselessness of the prescriptive elements when they come to give an image of the object, and convey into knowledge. We can illustrate this dilemma by mentioning the cognitive process and the process of the applications.

The study of terminology, as a special discipline, is not only based upon linguistic principles, but imposes itself first of all by its typical feature of interdisciplinarity.

Terminology is compelled to resort to various other sciences, such as linguistics (semantics, lexicology, languages for concrete domains), computer science, exact sciences, and presupposes documentation, classification, denomination.

Multidisciplinarity refers to the origins of various terms, to the fundamental study of concepts, to the way of organizing and conveying knowledge, to the shaping of scientific information and, finally, to the storage of this knowledge.

The theoretical aspect of terminology concerns the development and the arrangement of scientific terms into a terminological *system*, meant to correlate with systems of related concepts.

This modality of analysis is based upon the coordination between our knowledge and experience, which interaction generates abstract entities. Concepts

* This text was included in the antologic volum "Terminologie cognitivă" by Gleb Drăgan, in print, AGIR Publishing House.

[1] Academician, President of the Technical Sciences Dept., Romanian Academy; President of Science History Dept. of the Romanian Committe for the History amd Philosophy of Science and Technics.

designate that segment of our knowledge that is based upon abstraction and experience; they build together a defined system that predetermines the semantic character of the terms they express.

In order to code and store the results of our preoccupations within one single field and in order to thereby move further into our research, we need a clear definition of the values, quantities and relationships that support, consist in and arise of our knowledge.

This necessity of assessing knowledge leads us to a referential presentation or, to put it in other words, we resort to a language of terms that consists in a conceptual structure embodying pre-established relationships among the concepts, a structure that is by definition linked to a system of terms. Terminology arises from definitions, as a result of their status as connectors among concepts and terms: in order to disclose those relationships.

There is a permanent emerging necessity to define new terms, as knowledge continuously evolves.

Terminology facilitates the evolution and the control of language in parallel with the development of knowledge.

The knowledge transfer, by a deliberate linguistic activity, represents that function of language that strongly challenges our reasoning, since the preservation and development of scientific knowledge depends upon this conveying modality.

A term represents the connecting link between the empirical observation and the scientific cognition; the latter depends upon and defines, amongst the multitude of the objects and phenomena, their general, special and distinguishing meaning.

In fact, a term is the conveyance of a set of objects or phenomena under their generality aspect, but beyond their truthfulness or falsity; it is only the reasoning, often relying on experience, that confers the truth-value.

From a theoretical point of view, the most important criterion for the identification of terms is the notion of concept, through which a special domain is designated, but that becomes more and more complex when the general and specialized knowledge, as well as the general (natural) language and the special ones coexist.

The formal (specialized) language is constructed in parallel with the natural language, by resorting to symbols (terms). The value of a language, and consequently of its associated structure, is given by its interpretation, by its capacity of accurately describe and represent the considered object or phenomenon.

Since our knowledge within one field evolves, each and every stage of cognition requires the adjustment of language in accordance to this evolution. The representative function of one term is given by the phase of cognition and not by the final phase.

The progress of terminology in various fields of knowledge is to a large extent due to the use of computers, that allows the application of ontology.

The term “ontology” derives from the field of philosophy and signifies, in a general meaning, the systematic explanation of existence.

In the sphere of artificial intelligence, R. Neches and his colleagues were the first to provide a definition of ontology, with a reference to terminology:

"An ontology defines the terms and basic relationships of the vocabulary of a field, as well as the rules which indicate in what way terms and rules combine so that the vocabulary be understood".

It is worth mentioning that, in the framework of this definition, ontology includes not only the terms explicitly defined, but also the terms that can be created by means of deduction. T. Gruber (1993) advances the following definition: "ontology is an explicit specification of a conceptualization".

Other definitions were presented by N. Guerrini and P. Giaretta in 1995 and by B. Swartout and colleagues in 1997.

A society of information cannot exist without communication, which implies the use of a language that is comprehensible to everyone.

In this framework, ontology allows the use of common vocabularies (namely, the natural and the artificial language), as far as the terms and their significance are concerned.

In this way ontology constitutes a primordial field of research. It is worth mentioning that ontology does not actually represent a terminology, but rather a particular structure of conceptual knowledge.

There have been elaborated several ontologies, focused on various fields of research: framework-ontologies, ontologies with applicative purposes etc.

In accordance to these ontologies, there have been conceived models such as the *OK* model, based on epistemological principles which, even if it does not allow the approach of all the problems of lexical semantics, gives the possibility to obtain coherent definitions in the case of the technical field; or the *Ontology Design Environment model (ODE)*, which refers to the environmental terminology.

In connection with the importance of terminology in conveying knowledge, I shall present a series of insufficiently correct expressions of scientific terminology with some references to electrotechnics.

Let us consider the term "*quantity*", which can, in some cases, point to two different concepts, namely quantity in the *special* sense and quantity in the *general* sense.

A quantity in the *special* sense can be defined as follows: the expression of the property of an object or of a phenomenon, that can be measured or calculated, or the property used for the quantitative description regarding a particular phenomenon, a body or a substance.

The quantities in the special sense, which are mutually comparable, can be grouped together in categories of quantities.

Distances, diameters, wavelength, etc. make up such a category. The quantities that are mutually comparable are called quantities of the same type. Each category of quantities of the same type is a part of all considered quantities in the special sense.

In this way a part is a quantity in the *general* sense, such as, for instance, length, time, mass or energy.

A category of quantities is only *qualitatively* determined; it cannot be quantitatively expressed because it represents only a part of the quantities, while each element of this category can be qualitatively expressed.

A clarifying example from this perspective is the concept of *electric field*, which represents a quantity in general sense, and can be expressed only qualitatively.

Consequently, the expression of the unit of measure *V*/*m* (volts per meter) of this measure, as established in the STAS, according to the CEI, is not satisfactory. The *intensity of the electric field*, quantity in the special sense, can be expressed by *V*/*m*.

If a particular element of a category of quantities is chosen as n reference quantity, called unit, any other element of that category can generally be expressed in unit terms, as being the product between the chosen unit and a number called numerical salvation.

According to ISO 31: 1992, a quantity in the specific sense is called *quantity* and a quantity in the general sense is called *category of quantities* (in French, *grandeur, catégorie des grandeurs*).

Another difficult problem is that related to the term *energy*. According to the first law of thermodynamics, the quantity of energy cannot be produced or consumed; the sum of all energies in a closed system is constant.

TSO, through its technical committee, in the case of a technical system, refers to energy production and consumption.

But this energy is not the same with the energy in a physical sense, which is defined on the basis of the first law of thermodynamics.

The overlapping between the significance of the concept of energy in the physical sense and the one in the technical-economic sense generates confusions, which points to the difficulties engendered by a terminology that is not sufficiently well prescribed.

The technical committee, whose activity refers to systems of energy in a technical sense, accepted the term energy mentioned in ISO 31: 1992. It signifies quantities and units with regard to the technical meaning of this measure.

Within the Committee's workshop there has also been adopted the term *energyware* (French *produit d'energie*) for the energy in a technical economic sense.

Another example is the one set forth by the term *force*, which appears in Newton, in the law of movement. This term is not seldom used with the meaning of energy or power. Thus instead of electro-motive force or magneto-motive force, we come across electro-motive power, magneto-motive-power, respectively.

In our country, there often appear confusions related to *corona discharge*. First of all, the term corona effect is still used, which is in contradiction with the physical significance of this phenomenon.

On the other hand, no clear distinction is operated between the terms *initial intensity* and *critical intensity* of the electric field of corona discharge (initial tension and critical tension of corona discharge, respectively).

The initial intensity of the electric field of corona discharge intervenes in the case of unipolar corona discharge, while the critical intensity of the electric field applies to the case of bipolar corona discharge.

The corona discharge of alternative tension is bipolar, whereas the corona impulse discharge is unipolar. In the case of continuous tension, the corona discharge is usually unipolar; only for two relatively close conductors, of opposite polarity, can the bipolar corona discharge appear.

Obviously, the present paper refers only to some aspects of terminology in general, and, respectively, of terminology in electrotechnics. However, with the extraordinary evolution of science and technology, the role of terminology in assimilating and correctly transmitting knowledge becomes decisive.

REFERENCES

1. Gruber, T. (1993), Gruber, T. (1993). *A Translation Approach to Portable Ontologies*, Knowledge Acquisition, 5(2): 199–220, 1993.
2. Guerrini, N. and Giaretta, P. (1995), *Ontologies and knowledge bases: Towards a terminological clarification*. In N.J.I. Mars, editor, *Towards Very Large Knowledge Bases*. IOS Press, 1995.
3. Neches, R. *et al.* (1991). Neches, R., Fikes, R., Finin, T., Gruber, T., Senator, T., & Swartout, W. (1991). *Enabling technology for knowledge sharing*. *AI Magazine*, 12(3): 36–56.
4. Swartout, B. et al. (1997), Swartout, B., Patil, R., Knight, K. & Russ, T. (1997). *Towards Distributed Use of Large Scale Ontologie*s, Symposium on Ontological Engineering of AAAI. Stanford, California, 1997.