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ANALYSIS OF THE DEFINITION THEORY ELEMENTS IN ISO704:2009. TERMINOLOGY WORK – PRINCIPLES AND METHODS

Обґрунтовано необхідність вдосконалення низки положень третього видання міжнародного стандарту ISO 704, які стосуються відношень між поняттями, природи дефініції, видів дефініцій, правил формулювання дефініцій та недосконалостей дефініцій.

Ключові слова: термінологія, стандарти ІСО, ІСО 704, типи відношень між поняттями, озшачення, природа означень.

The necessity of improving a number of statements in ISO 704 third edition concerning concept relations, nature of definitions, types of definitions, rules of formulating definitions and deficient definitions is justified.

Keywords: terminology, ISO standards, ISO 704, types of concept relations, definition, nature of definitions.

International standards are taken as the basis for developing national standards. So, any attempt to improve the quality of international standards is relevant. Obviously, these general considerations hold true for international standards on terminology work as well. Most of the aspects of formulating definitions (this activity belongs to the most important components of terminology work) are normalized by ISO 704. The subject of this publication is analysis of the definition theory elements presented in ISO 704 third edition [1].

ISO 704 standard is being constantly subjected to critical analysis by researchers, it being undoubtedly important for its further improvement. In particular, based on the proposals to use better examples in this standard that were put forward by Elen Wrigt, a trial version for ISO 704 revision was published in the Internet dated by June 2012 [2]. The standard is also being improved by way of its harmonizing with the adjacent standards [3], by trying to justify introduction of ontological components into the standard that is necessary for improving terminology work in information-processing computer-aided systems [4]. Logical aspects of terminology work also need improvement, in particular, the aspects associated with formulating definitions. So, the objective of this research is to identify those elements of the theory of definitions contained in ISO 704 that can be presented in a better way.

The methodology of research consisted in matching the theoretical knowledge on the theory of definitions and the results of empirical research of the definitions contained in explanatory dictionaries with the statements on definitions in the analyzed standard. As the result, in the analyzed standard there were discovered a number of definition theory elements that are to be revised.

For the practice of terminology work and, in particular, for the practice of formulating definitions it is important that recommendations on definition formulation covered all possible types of definitions. In this respect, recommendations presented in the analyzed standard are incomplete. In 5.5.1 of the standard it is stated that among the hierarchical relations to be used in terminology work in the process of constructing a system of concepts there must be at least generic and partitive relations. More types of hierarchical relations should be added, as the object of definition may be not only a whole object (Fig.1, b) or a part of the whole (Fig.1, a) but also a set of whole objects (Fig.1, c).

Relation of a set to an element is not the inverse one to relation of a part to the whole. Relation "*b is a whole relative to a*" is inverse to the relation "*a is a part of b*". Similarly, there are inverse relations in *a set – an element* system of relations. Consider the relation *a society is a set of people (persons)*. The inverse relation will be *a person is an element of society*.
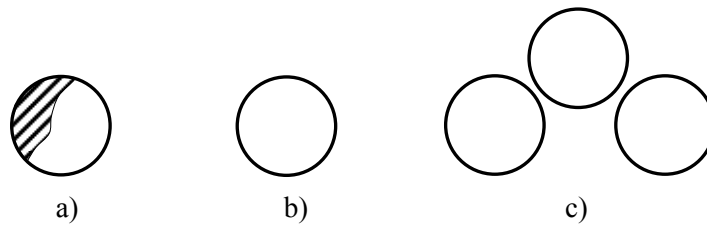

<center>a)   b)   c)</center>

Fig. 1. Types of objects to be defined:
a) a part of the whole object; b) the whole object; c) a set of whole objects.

Let us consider in more detail the difference between relations *a part – a whole* and *a set – an element*. Peculiarities of *a set – an element* relation are demonstrated in the following: *a term* as an element of a *terminology* set is used irrespective of whether this whole set is used, one *apparatus* is used irrespective of whether the whole set of objects defined by the term *equipment* is used; *a person* as an element of the *society* set acts irrespective of whether the whole set of *society* acts. It is quite different with the relation *a part – a whole*. Each of the parts acts or is used only together with other parts as the whole. A part of a term is not used independently, without its other parts, a part of an apparatus does not work without its other parts, a part of a human body does not live without its other parts. So, a set does not have such a characteristic as wholeness.

The performed empirical research of definitions in explanatory dictionaries has proved the existence of a large number of definitions constructed according to the following scheme:

<center>*s is a set of p.*</center>

To express this relation verbally different means are used, the most common of them being the following:

1. Designation of an object as a set is expressed as the plural form of the names of elements comprising this set. For example, infantry – "soldiers trained, armed, and equipped to fight on foot" [5, P. 585].

2. A set is designated analytically, i.e. using particular words:

    2.1. "Group of": brigade – "a group of people organized for a certain task" [5, P. 137].

    2.2. "Set of": apparatus – "a set of materials or equipment…" [5, P. 54].

    2.3. "Whole … of": atmosphere – "the whole mass of…" [5, P. 70].

    2.4. "Body of": class – "a body of student…" [5, P. 61].

    2.5. "Organisation of": association – "an organisation of persons…" [5, P. 67].

    2.6. "Collection of": assortment – "a collection of assorted things or persons" [5, P. 67].

But for these means of fixing a set of objects, many others are also used: "all of…", "series of…", "aggregation of…", "sum of…", "totality of…", "system of…", "formation of …" etc.

Explanatory dictionaries contain quite a large number of definitions based on *a set – an element* relation. One can easily check this having made a search by key words (as the key words there should be taken the words designating *a set – an element* relation) in electronic explanatory dictionaries. However, irrespective of the number (many or few) of the definitions based on *a set – an element* relation, the information on such relations should be included in ISO 704 standard: it is not important how often the need to formulate this or that type of definition arises – recommendations should be formulated for all types of cases that can turn up in the practice of defining.

Classification of relations recommended to be used in terminology work, and fixed in 5.5.1 of the standard being analyzed, also contains associative relations. Really, generic relations are relations between concepts, not between objects (these are relations between different appellations of the same object). For

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instance, both *a table* and *a piece of furniture* are appellations that can be applied to the same object, i.e. such an object as a table can be named using both the word *a table* and the word combination *a piece of furniture. A part – the whole* and *a set – an element* are not relations between different whole objects either: in one case this is the relation between the whole object and its part, and in another case it is the relation between a group of whole objects and one of these objects. Thus, as these two above named types of relations do not cover the relations between different objects, there appears the necessity to supplement the list of relations with another relation that in the standard is called an associative one.

The relations necessary for modeling a system of concepts that are analyzed in 5.5.1 of the standard can be classified in the following way:

1. Relations between objects:
    1.1. One-object relations.
        1.1.1. A part – the whole.
        1.1.2. An element – a set.
    1.2. Different-object relations.
2. Relations between appelations (generic).

In the above presented classification the terms are used in the following meaning:

One-object relations are the relations the members of which represent only one type of whole objects but the elements of these relations are different (in one case these are a whole object and its part, and in another case they are the whole object and a set of whole objects).

Different-object relations are the relations the members of which represent more than one type of whole objects. Among the presented relations only these relations (called associative relations in the analyzed standard) are not hierarchical.

Relations between designations (or concepts) are the relations that possess simultaneously the following characteristics: 1) they can be used to designate one and the same object; 2) their members are designations (or concepts) that comprise a certain set of features of the defined object and its subset (the above mentioned set of features corresponds to the concept being defined, and the subset corresponds to the generic one). For example, let us take designations (or concepts) *a piece of furniture* (generic) and *a table* (being defined) as members of the relation. A set of characteristics that constitute the intension of the concept *a piece of furniture* is a subset of characteristics of the concept *a table*.

It is important to note that even the presented above classification does not cover all widespread types of relations. Let us consider the relation between the names "Lviv" and Lviv in the Evening". This is not a generic relation because as it is fixed in 5.5.2.2.2 of ISO 704, "The *extension* with a single *object* cannot be divided further into a more *specific concept*." [1, P. 13]. In this case we have relation of a certain object to itself, i.e. the relation between different states of the same object. Such a relation should be referred to as a one-object relation but, contrary to other one-object relations, this relation is reflexive. (In case of partitive relations and relations *a set – an element,* members of relations are different but the whole object involved into the analysis is single; in case of a reflexive relation, even the members of the relation are one and the same object, and respectively, there is only one whole object).

In the third edition of ISO 704 standard the explanation of the intension of a definition can also be improved. Different directions of improvement are possible:

1. In 6.3.5 of the analyzed standard it is specified that "*an intensional definition* based on a *generic relation* shall represent the *concept* by stating the *generic concept* immediately above, …" [704, P. 25]. This demand is fixed in many editions in logics and reflects common practice of formulating definitions. But it narrows interpretation of the essence of a definition, limits researcher's thinking and instruments, narrows the search for the ways of computerizing formation and application of terminological systems in various subject fields. Really, classical generic definition should have only one generic feature. But the definition for which there is taken a super-ordinate concept being not immediately above, i.e. not being at the next higher level of hierarchy but the one being still above this higher level is not going to be incorrect. A super-ordinate concept can "jump" not only over one level of the concepts (system) classification but also over two, three… (in which case the definition should contain three, four … generic features). While

categorizing an object we can take as a super-ordinate concept the one that covers only one feature, i.e. we can take the most common concept (philosophic category). In such a case there is not going to be any more hierarchy of inherited features, the definition will not contain any abbreviation, any information compression because it will be named in definiens, with explicitly all features having been formulated. At the same time, such a definition meets the major requirement to definitions – it reveals the intension of the concept, i.e. it provides a list of characteristics that is accepted for differentiating the designated objects from others.

The requirement concerning formulation of generic intensional definition through indicating the nearest gender can be left to terminological standards, dictionaries, encyclopedias, educational publications. For other mentioned above cases it is expedient to allow to list all characteristics. The following should be added: it is common knowledge that different bases of division can be used in any sequence, so using one and the same set of division bases one can classify a certain type of objects in different ways. The number of possible classifications of a particular object (let this number be k) with the particular fixed number of division bases n, will be determined by the formula $k = n!$, and the number of possible generic concepts m will be $n - 1$. Thus, on the basis of the list of characteristics of the object being defined it is possible to form different (all possible) systems of concepts in which at every level of classification there will be defined a super-ordinate concept, i.e. being generic relative to the given one, and that can be used to formulate a classical generic definition. So, in formulations concerning the nature of definition in terminological standards it is necessary to at least leave a possibility for a bit more general look at intensional definition.

2. Another aspect of interpreting the nature of a definition in the analyzed standard that can be subjected to improvement concerns such a requirement to definitions (characteristics of definitions) as conciseness. In many educational and reference publications in logics and philosophy, in explanatory and encyclopedic dictionaries one can come across such an attribute of a definition as conciseness. This attribute of definitions (being at the same time a requirement to them) is also presented in 6.3.5 of ISO 704: "The *intensional definition* is a concise statement of what the *concept* is" [704, P. 25]. As far as this statement is concerned, the following should be added:

A. The concept *concise* is relative, i.e. there is no absolute measure to determine whether this requirement has been met in the definition. Besides, in scientific texts (for example, mathematical) it is easy to find very long definitions but this fact does not give any reasons to doubt their being definitions.

B. Being treated from the logical point of view, this requirement may mean that the definition should be formulated through the nearest gender and thus implicitly contain all the inherited characteristics and due to this fix large amount of information in a concise form. This conciseness is the consequence of formulating the definition as a generic one and so the additional formulation of conciseness is redundant.

C. This requirement can be interpreted in the stylistic aspect. Really, it is possible to formulate various synonymous variants of definitions in which to use more or less economical lexical and syntactical means. It is clear that the fewer words there are in a definians the better the definition is, as from the point of view of psychological perception, the statement containing fewer words is understood better than a too wordy one.

Apparently, it is correct to treat the requirement to a definition to be concise only in the stylistic sense. At the same time, formulating the requirement of conciseness using only one word *short(concise)* is ambiguous and does not allow to understand that stylistics is meant. Moreover, this requirement should be formulated as desired rather than necessary (as it has been noted, long wordy definitions still remain a type of definitions).

In the final part of 6.3.5 of ISO 704 [704, P. 27], the requirement of conciseness is formulated very correctly, contrary to the above cited fragment placed at the beginning of 6.3.5.

3. An important aspect of a definition also having rather desirable than necessary nature, though being more significant than conciseness, is essentiality of characteristics. When the word *essential* is used concerning definitions, in most cases the idea is to differentiate intensional definitions from extensional ones. Say, intensional definitions present information about essential features of the designated objects,

i.e. about their essence (nature), while extensional definitions present denominations (designations) of kinds or elements that being put together comprise the extension of a concept. However, more important is another aspect of essentiality that is missing in the standard. For instance, in 6.2 of the standard the characteristics of a definition are described in the following way: "The role of an *intensional definition* is to provide the minimum amount of information that forms the basis for abstraction and that allows one to recognize and differentiate the *concept* from other related *concepts*, especially *coordinate concepts*" [704, P. 22]. According to this description the following definition of a human being will be quite acceptable: "A human is a mammal with a soft ear lobe". This definition complies with all the requirements formulated in the citation presented above; really, availability of a soft ear lobe is a unique feature of a human being. At the same time, this feature is not essential in that sense that its availability does not foresee the availability of any other features. In case we distinguished in the definition the human ability for abstract thinking, for collective creative and transformational activity on the basis of this thinking, such features would be much more essential because they would allow to foresee many other human abilities different from other living beings. Taking into account the fact that at the initial stage of cognitive activity definitions will cover only external inessential features and with the evolution of cognition it will be possible to use more significant features in definitions, it is expedient to formulate the said requirement in the following way: the definition should contain the most essential features of the object being designated. The more essential features are used to formulate the definition, the more informative the definition is.

4. Some requirements to definitions formulated in 6.2 of the standard are incorrect. Let us consider, for example, the requirement to a definition to fix a unique extension of a concept: if we formulate definitions of concepts *equilateral triangle* and *equiangular triangle,* we'll see that the extensions of these concepts fixed by their definitions will be not merely non-unique, they will be identical, and this is not going to be a mistake. Unique to a concept and consequently to its definition there must be only the intension of this concept.

5. In 3.2 of ISO 704 some definitions from standard ISO 1087–1 are used. According to one of them, ostensive definition (demonstrative definition) is "definition which exhibits one or more representative object(s) in the extension of the concept" [1, P. 1]. This contradicts to the definition formulation from standard ISO 10241, according to which a definition is the verbal description of a concept.

A significant component of ISO 704 standard is formulation of the rules on defining and deficient definitions. For transparency, easiness of perception of the standard and for increasing its consistency it is important to correlate the rules for formulating definitions (they are contained in fragments in 6.1, 6.3.2, 6.3.5) and the rules of deficient definitions (formulated in 6.5), because it is obvious that it's possible to violate only something that is formulated in the form of a rule.

It is possible to formulate in general the major ideas of such a correlated presentation of rules and deficiencies. First of all, it is necessary to differentiate violations during defining concepts that are introduced into usage with this definition (primary defining) and during defining concepts already formed, for example, by the practice of word usage (secondary defining). It is clear that the rules of constructing definitions in every of these cases are going to be different.

In case of secondary defining the task is to reconstruct in the new definition the meaning in which the concept is being already used. So, the main rule is to ensure adequacy of the concept intension reconstructed in the definition to the concept intension having been formed by the practice of word usage (the principle of substitution presented in 6.3.4 of the analyzed standard concerns the adherence to this rule). Thus, the corresponding definition deficiency consists in violation of this rule. Discrepancy in intension of concept-definiens and concept-definiendum can be demonstrated in two ways.

The first of them is discrepancy between the extension of definiens (being the result of defining) and the extension of definiendum (created by the practice of concept usage). This rule can be found in every educational publication in philosophic logics as the rule of commensurability of extensions of a definiens and a definiendum.

At the same time, ensuring in the process of defining the equality of extensions does not guarantee identity of intension as the extension of the concept formed in the practice of its usage can be designated with the help of other features. For example, logics can be defined as the science taught by my neighbor (and this may correspond to the real situation), but the intension of the concept-definiens formed by the author of this definition does not correspond to the intension of the concept-definiendum formed by the practice of word usage. Thus, checking the correctness of the secondary definition should consist not in clarifying whether the extension of the concept-definiendum is identical to the extension of the concept-definiens but whether the intension of the concept-definiendum is identical to that of concept-definiens.

Requirements to the primary formulation of a definition should depend upon the features of the definition. Thus, to ensure that a definition possesses such a feature that allows to differentiate the designated object from others, the following conditions should be complied with: 1) not to use relative, i.e. ambiguous concepts, such as, for example, *young, a great deal of*; 2) not to allow circular definitions; 3) not to use the words with unidentified meaning… Formed in such a way (depending on the features of a definition) a list of attributive requirements to a definition should be supplemented with a list of desired features (for example, the most concise presentation, the most essential specific features).

In the result of the research done, besides the issues having been analyzed in this article, there have been discovered a number of other disputable issues that are significant for terminology work but need further discussion and presentation. To perfect ISO 704 and other associated terminological standards the coordinated efforts of specialists in different subject fields (logicians, philologists, philosophers, IT specialists) are needed.

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