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STUDY OF STRUCTURAL-SEMANTIC MODEL OF SCIENTIFIC AND TECHNICAL TERMINOLOGY (based on the material of highly specialized terms)

This article highlights the problems of special vocabulary of a certain sublanguage, approaches that allow identifying the inventory of linguistic signs. This article highlights the problems of special vocabulary of a certain sublanguage, approaches that allow identifying the inventory of linguistic signs. The authors examine the structural and semantic model of scientific and technical terminology (based on the terms of the electric power industry), which is a simple exponent of a structure, for example, the construction "a noun formed from a transitive verb, or the case of the implementation of a certain structural and semantic model, in which the meanings of the components, due to the nature of the model itself. The article also offers a synchro-semiotic analysis of language signs as a step in the diachronic process of sign formation of scientific and technical terminology. In terms of language synchrony, the associative relationship between the intrinsic and special meaning of a complex sign, in principle, has the same conditional, arbitrary character as the relationship between the meanings of individual components of the intangible form of the sign. The result of the proposed analysis of complex formations represents the form of analytical expression of concepts and functioning in scientific and technical speech in parallel with the terms. It is argued that an understanding of semiotically complex formations and the motivation of terms helps the correct use of the concept in speech.

Key words: electric power industry, vocabulary, term, scientific and technical terminology, structural and semantic model, electrical quantity, static-synchronous analysis.

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Ғылыми-техникалық терминологияның құрылымдық-семантикалық моделін зерттеу (тарсалалық терминдер материалында)

Аталмыш мақалада кәсіби тілдің ішкі болмысы мен кәсіби лексиканың мәселелері, тілдік белгілерді анықтайтын тәсілдер қарастырылған. Авторлар электр энергетикасы терминдерінің материалы негізінде ғылыми-техникалық терминологияның құрылымдық-семантикалық моделін жүйелі түрде зерттейді. Ол құрылымның қарапайым экспоненті болып табылады, атап айтқанда, «сабақты етістіктен зат есім жасайтын» қарапайым сөзжасам көрсеткішін жүзеге асыру жағдайлары егжей-тегжейлі қарастырылады. Сондай-ақ, зерттеуде тілдік бірліктер жүйесінің өтпелі элементтерін қамтитын тілдік жүйелер мен ішкі жүйелер атап өтілді. Адамның кез келген арнайы іс-әрекетінде зерттеудің практикалық және теориялық тәсілдерін ажыратып көрсетуге болады. Авторлар ғылыми-техникалық терминологияны белгілеудің диахрондық процесінің сатысы ретінде тіл белгілерін синхронды-семиотикалық талдауды ұсынды. Тілдік синхрондылық тұрғысында күрделі белгінің ішкі және арнайы мағынасы арасындағы ассоциативті қатынасы, негізінен, сөз-белгінің материалдық емес түрінің жеке компоненттерінің мағыналары арасындағы қатынас сияқты шартты және ерікті сипаты бар. Осылайша, ұсынылып отырған күрделі түзілімдерді талдаудың нәтижесі – терминдермен қатар ғылыми-техникалық сөйлеуде ұғымдардың аналитикалық көрінісі және жұмыс жасау формасы болып табылады. Қорыта келе, авторлар ғылыми-техникалық терминологияның құрылымдық-семантикалық моделін (электр энергетика терминдерінің материалында) үлгіні түсіну сөйлеу барысында ұғымды дұрыс қолдануға көмектеседі деген тұжырымға келеді.

Түйін сөздер: электр энергетикасы, лексика, термин, ғылыми-техникалық терминология, құрылымдық-семантикалық үлгі, электрлік шама, статикалық-синхрондық талдау.

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Изучение структурно-семантической модели научно-технической терминологии (на материале узкоспециальных терминов)

В данной статье освещаются проблемы специальной лексики определенного подъязыка, подходы, позволяющие выявить инвентарь языковых знаков. Авторы на материале терминов электроэнергетики рассматривают структурно-семантическую модель научно-технической терминологии, которая представляет собой простой экспонент конструкции, например, конструкции «существительное, образованное от переходного глагола», или же случай реализации определенной структурно-семантической модели, в которой значения компонентов обусловлены характером самой модели. Также отмечаются языковые системы и подсистемы, которые охватывают переходные элементы системы языковых единиц. В любой специальной деятельности человека можно различать практический и теоретический подходы исследования. Авторы предложили синхроническо-семиотический анализ языковых знаков как ступень диахронического процесса знакообразования научно-технической терминологии. В плане синхронии языка ассоциативная связь между собственным и специальным значением сложного знака, в принципе, имеет такой же условный, произвольный характер, как и связь между значениями отдельных компонентов нематериальной формы знака. Таким образом, результат предложенного анализа сложных образований представляет форму аналитического выражения понятий и функционирование в научно-технической речи параллельно с терминами. Утверждается, что понимание структурно-семантической модели научно-технической терминологии на материале терминов электроэнергетики помогает правильно употреблять данные понятия в речи.

Ключевые слова: электроэнергетика, лексика, термин, научно-техническая терминология, структурно-семантическая модель, электрическая величина, статико-синхронический анализ.

Introduction

Theoretical problems connected with terminology attract the attention of many researchers, both specialists in various fields of terminology bearers, and linguists.

The system of scientific and technical terminology was investigated in various branches of modern linguistics of the twentieth century, first of all, attention was paid to such questions as lexico-semantic formation of terminology (Prokhorova, 1996: 12), theory questions, where basic information on termination and classification of concepts, on language basis of terms, special vocabulary were given by such scientists as Superanskaya A.V, Kudashev I.S., Grinev-Grinevich S.V.; special attention was paid to the scientific study of Leychik V.M., where the author's concept of the scientific discipline – terminology studies was stated. According to V. M. Leychik “a term grows on a lexical unit of a given language or a lexical unit of this language is a natural-language substrate of a term” and, therefore, “a term is a lexical unit of a certain language for special purposes, denoting a general, concrete or abstract concept of theory

of a certain special field of knowledge or activity” (Leuchik, 2007:31-32). It is important to note the difference between the term and words and phrases (objects of linguistics), as well as the difference of normative requirements imposed respectively on those and others. And only in this case is it legitimate to assert that terms are special words (Ryabova, 2009: 86-92).

But despite the development of the above researchers-scientists in the field of terminology, various issues concerning the field of scientific and technical terminology are still relevant.

Various problems arise in connection with modern trends in the development of languages, which is due to the processes of globalization, internationalization. All this has an impact on the development of our educational system, in our case Kazakhstan.

Material and Methods

Among these processes, semiotically complex term formation is especially important. A sign formation is complex (partitive) in this its meaning, if this meaning has an analytical character, being

fully formed from the meanings of components, which are identical in form and meaning to similar components of other complex sign formations simultaneously available in the language (Popova, Sternin, 2007: 75). This principle can be formulated as follows: a simple combination of two or more signs gives a semiotically complex formation.

The purpose of the study is to identify the main distinctive features of semiotically complex formations of scientific and technical terminology. To achieve the purpose of the study, the method of system-structural and functional analysis was used. Semiotically complex formation may represent a simple exponent of a construction, such as the construction “adjective plus noun”, or act as a particular case of the implementation of a particular structural-semantic model, in which the values of the components, as well as their choice, to a certain extent are determined by the nature of the model itself.

The main part of special and professional vocabulary, their core is terminological vocabulary, i.e. terms – the main bearers of names of objects and phenomena of special, professional activity. The designation of an objectified feature of the term with suffixes, as well as the study of the metalanguages of science allow us to make interesting comparisons of a logical nature (Kurmanbaeva, Zhuanganova, 2018: 132).

The more specific the terminology, the less likely it is that the studied terms of the professional sphere appear in the form of monosyllabic, or one-component, terms. Since the language of professional spheres and special areas of knowledge is most often formed on the basis of the material of the common language, then, as a rule, new terminological lexemes arise as a result of the addition of various common tokens (Dörre, 2010: 36).

In our article, we will consider terms that refer to electric power industry, the main type of energy source, which are produced by the following main types of power plants: thermal, nuclear, wind, solar and hydroelectric power plants.

Examples of semiotically complex exponent formations of the construction “a noun formed from a transitive verb plus a noun in the genitive case (with or without definition)” are such combinations of special vocabulary, names of objects: *счетчик количества электричества* / *electrical quantity meter* (integrating instrument that measures the amount of electricity in ampere-hours), *счетчик полной энергии* / *total energy meter* (instrument that measures total energy in voltampere-hours), *счетчик активной энергии* / *active energy meter* (instrument that

measures active energy in watt-hours), *счетчик реактивной энергии* / *reaction meter* (instrument that measures the amount of electricity in watt-hours). From the examples above, it is easy to conclude that the word ‘meter’ means “a combining, integrating device that measures ... (the corresponding electrical quantity in the corresponding units)”. Thus, the word ‘meter’ and the second components in the considered formations have their usual special meanings. This is confirmed by the fact that the definitions given do not reveal the meanings of these word formations, but only repeat them. Thus, the meanings of the considered formations ‘*счетчик количества электричества* / *electrical quantity meter*’ and others have an analytical character, and the combinations themselves are simple exponents of the named construction.

Examples of exponents of structural-semantic models, where values of components are supplemented by values of the model itself, may be formations like *амперметр* / *ampere meter* (device for direct or indirect measurement of current voltage in amperes), *вольтметр* / *voltmeter* (device for direct or indirect measurement of current voltage in volts), *ваттметр* / *wattmeter* (device for direct or indirect measurement of power in watts), *омметр* / *ohmmeter* (device for direct or indirect measurement of resistance in ohms), etc. All of these formations follow the model “unit of measurement of a certain electrical quantity plus the morpheme *-meter* = the name of the device measuring that quantity in such units”. The value of an individual exponent of this model directly follows from the values of the components, but the components here are not only the sign-components (*volt-* and *-meter*), but also the model itself, which also has the value disclosed in its formulation.

Literature review

Static-synchronic semiotic analysis, when applied to the special vocabulary of a particular sublanguage, allows us to identify an inventory of language signs, including terms used to express special concepts of the relevant branch of knowledge and characterizing a certain state of that language, which is taken as a given. A very wide range of phenomena may be qualified as the definition of a sign, so signs are classified. Of a special nature are the so-called natural signs. This is due to the fact that they signify by a natural or causal connection and act as a manifestation of objectively occurring natural processes and phenomena (Rogalev, 2012: 134). But both language as a whole, and its

separate sublanguages are not frozen, unchanging formations, but complex systems of interrelated and interdependent units, being in the process of continuous development. Linguistic systems and subsystems, as a rule, have an open character, including, along with the established elements of structure, transitional elements at various stages of inclusion in one or another system of language units or dropping out of it. In the static-synchronic analysis of various systems of linguistic units, such transitional elements, reflecting the tendencies of language development, remain outside of the study, since their transitive nature does not allow us to attribute them to one or another system. We can assume that in the sign systems of sublanguages, which serve the developing branches of knowledge, the number of such transitional elements will be quite significant. It seems that the identification of such transitional elements in the linguistic systems of special sublanguages, and through them the trends of development of these systems, constitutes one of the most important tasks of terminological work and is a necessary prerequisite for the development of specific recommendations on the formation and use of terms.

Semiotic analysis of language units, aimed at identifying transitional formations reflecting trends in language development, is a dynamic-synchronic analysis. Its goals can be formulated as follows: to identify linguistic units of the transitional type that are at different stages of transformation of a set of language elements into a linguistic sign or, conversely, transformation of a linguistic sign into a simple set of language elements, to identify linguistic signs of the transitional type that are at different stages of transformation of a complex sign into a simple or simple into a complex one (stages of contraction and decomposition or transposition of linguistic signs). One of the aspects of the dynamical-synchronic analysis can be the identification of the stages of formation, contraction or decomposition of structural-semantic models.

Dynamic-synchronic analysis must be based on the same criteria of signification as semiotic analysis in the static aspect of synchronicity, but is reduced not to a statement of the fact of signification or non-signification of the relevant unit, possessing or not possessing the necessary set of principles, but to identify the presence or absence of individual features of signs which characterize this or that set of language elements, which is not a sign. These are such features as repeatability in form and (or) in meaning of presence or absence of own meaning, coincidence or noncoincidence of own meaning with

special meaning. As an additional feature may be used the feature of separability, which characterizes the language signs.

Let us illustrate the technique of semiotic analysis in the dynamic aspect of synchronicity by several examples.

Example 1. Analysis of the terms *spectrometer* and *spectroindicator*.

Comparing the word *spectrometer* with formations such as *dosimeter*, *radiometer*, we can assume that the component *-meter* in this word is a sign, with which the corresponding element of the meaning of the word *spectrometer* (device for measurement) corresponds. A similar assumption can be made with respect to the second component of the word *spectroindicator*, comparing it with the formation, *indicator of spectral lines* (device allowing one to detect the spectral color lines of absorption and radiation of bodies or rays), where the word *indicator* can be ascribed an independent meaning (device allowing one to detect...). These assumptions would be justified only if the first components of these words, which coincide in form (*spectro-*), were signs as well. But, as the previous analysis has shown in the static aspect of synchronicity, these components of the words *spectrometer* and *spectroindicator* have no special meaning in these words and are not signs. However, in both cases, the component *spectro-* has the same proper meaning, which consists in its correlation with the concept of *spectrum* and is present in the proper meanings of both words (respectively a meter of color ray bands and a indicator of color ray lines). And thus, a false impression is created about the supposedly signifying character of this unit, which in reality performs in both words (in their special meaning) a distinctive function only. Therefore, such units, acting as signs in the proper meaning of formation and as non-signs in its special meaning, would be rightly called quasi-signs.

As for the second components of the words *spectrometer* and *spectroindicator*, they have a familiar character according to the recurrence of form and meaning, but, being functionally and semantically related to quasi-sign (i.e., non-sign) *spectro-*, they cannot be recognized as independent signs-informants. Such units, representing in terms of diachrony the first stage of sign dying out or the last stage of semiotization of language elements, can be called as connected language signs, but the functions can have different (Platygina// <http://chemanalytica.com/book>).

It follows from the thesis about semantic integrity of a language sign that in terms of

synchronicity a language sign, including a term, can be either completely arbitrary (unmotivated), or motivated only partially, but not completely. “In terms of motivation, they speak not only of terms, but also of words in general. In terms of orientation, we can talk about terminological units only; the difference between motivation in the lexicological understanding and the orientation of the term lies in the fact that motivation is based on a simple sum of the meanings of the parts that make up a linguistic unit, and orientation is based on such a sum of meanings that should indicate the concept; the concepts of the motivation and orientation of the term, in the presence of common features, nevertheless differ significantly, and the use of the unit orientation of the term for the study of terminology seems ... more effective, since it allows one to study a whole complex of problems of the term: its origin, morpheme composition, structure, relationship between form and meaning, and the latter – not only in the linguistic, but also in the psycholinguistic, sociolinguistic, linguo-cultural, pragmatic and other aspects” (Rebrushkina, Ariskina, 2012: 208). So, for example, the proper and special meanings coincide, as in the case of the word combination *electric motor* or the words *contactor*, *inverter*, motivation becomes complete, or rather ceases to be simply motivation, since in this case the special meaning of formation is identical to its proper meaning and has, thus, the character of analytical naming, which meaning is completely unambiguously derived from the values of components and model.

It is important to note that in terms of synchronicity of language the associative connection between the proper and special meaning of a complex sign, especially an unmotivated one, in principle has the same conditional, arbitrary character as the connection between the meanings of the individual components of the intangible form of the sign. And even the motivation of formations such as *primary engine*, *generator*, *meter*, *transformer*, *spectrometer*, etc. removes this arbitrariness partially only: the proper meaning of a formation allows us to judge to a certain extent only about the general nature of the special meaning, without revealing its specificity.

Let us compare, for example, the proper meanings of the German synonyms Generator (which generates), Stromerzeuger (which produces current) and Stromerzeuger-maschine (current-producing machine). The proper meanings of these words consistently come close to their special meaning (electrical machine for converting mechanical energy into electrical energy), and in this respect the term Stromerzeugermaschine is the most motivated

(Russian-Kazakh-English Polytechnic Dictionary, 2010: 521).

In German, multicomponent one-word terms are especially common, traditionally called “Schlangen – “snakes”, or multi-word combinations of terms” (Leuchik, 2007:37). For example, the technical terms *der Gasmotor* – gas engine, *das Brennverfahren* – combustion method (Bauer, Auer, Stiesch: 2013: 300). But even this word in its special meaning does not lend itself to semiotic division, since its proper meaning lacks an indication of the nature of the current (electric) and the fact that the current is produced by the transformation of mechanical energy into electrical energy. These elements of meaning are associated with the word as a whole, rather than with its individual components, conditioning its semantic and semiotic integrity. However, in a semiotically complex formation whose meaning is analytic, the connection between the proper and the special meaning is no longer conditional (arbitrary), but unconditional, since the special meaning of the formation is directly and unambiguously derived from the meaning of its components. Thus, for example, the meaning of the word combination *induction counter* (counter in which fixed coils with alternating blocks act on conducting moving parts, usually disks, which these coils induct currents) is completely derived from the special meanings of the words *induction* and *counter*. That the word *induction* has its usual special meaning in this combination is confirmed by comparing this combination with the combination *induction device* (device which uses the action of fixed circuits through which alternating currents induced by those circuits in moving conductive parts flow). The terminological validity of the second component *meter* is confirmed by comparing it with other free combinations like *totalizing counter*, as well as the possibility of replacing this word in the definition of the combination *induction counter* with its analytical equivalent of the *integrating device* or the definition *device* which shows every moment of the integral of some value over a period of time, starting from the set moment of counting the readings of the device. This confirms the unconditional non-arbitrary analytical nature of the special meaning of the combination *induction counter*.

Results and discussion

It follows from the foregoing that in terms of the synchronic semiotic analysis, the motivation of language signs is a dynamic-synchronic category, associated with the intermediate stages of the

diachronic process of sign formation, accompanied by two opposing processes: the development of motivation and its fading. On the one hand, as a result of development of new meanings and the emergence of new signs, previously unmotivated (and, therefore, semiotically indivisible) language signs acquire intralingual associations (paradigmatic connections) and become motivated. “The emergence of a word or morpheme from the state of isolation, the appearance of other words including a given morpheme, contributes to the creation of association between them and other elements of the dictionary, an unmotivated sign becomes motivated” (Zubkova, 2010: 257).

Based on the ratio of the lexical and motivated meaning of a new lexical unit, it is possible to determine the level of its motivation. The more similar they are, the higher the level of motivation of the word (Fleischer, Barz, 2012: 45).

The limit of development of this process is unconditional motivation, i.e. the final decomposition of a previously non-membered linguistic sign into two independent sign-informants. On the other hand, as a result of loss of separate meanings and loss of some signs from the sign system of language, separate components of semiotically partitioned formations gradually lose associative (paradigmatic) connections in language and formation becomes nonarticulated, transforming into one sign. But as long as at least one of the components of the sign retains to some extent associative links with similar in form and meaning components of other formations, the sign is motivated and lends itself to semiotic division in the dynamic aspect of synchronicity. The limit of development of this process is the final loss of associative connections between components of the given sign and components of other formations, which leads to simplification of a sign to its transformation into a simple sign, not amenable to dynamic-synchronic division.

Consequently, K. Morgenroth believes that technical terminology only partially consists of formalized or artificial, i.e. unambiguous elements, such as numbers, mathematical equations or graphic images. A technical special language should also include lexical units of natural languages, i.e. words that already exist in the language, which may undergo semantic changes and can no longer guarantee unambiguity (Morgenroth, 2000: 282).

Returning to the question of the distinction between a term and its definition, and proceeding from the sign nature of the term as a semiotically integral unit of language, the nominative definition of the term can be characterized as a free combination

of linguistic signs organized in such a way that their combined meaning expresses the same concept as the term defined, not coinciding at the same time with own meaning of this term, if it exists. Obviously, if the individual parts of a nominative definition clearly relate to the individual components of the definable one, this may serve as an indication of the analytic character of the meaning of the definable one, which is made up of the meanings of these components. Thus, for example, the definition to the combination *inductive relay* – a relay, which operation is based on the interaction of the magnetic field of stationary windings, streamlined by currents supplied from outside, with currents induced in a movable conductive element (disk, drum, etc.) – is completely distributed between the *induction* and *relay* components: the word *relay* is simply repeated in definition in its meaning, and the rest of the definition can be attributed to the *induction* component. This allows us to draw a preliminary conclusion about the analytical character of meaning of the combination *induction relay*, which is confirmed by a comparison with the combinations *induction meter* and *induction device*, where the word *induction* has the same meaning (Ismagilov, Shakhmaev, Pashali., Sattarov, Volkova, Babikova, 2008: 186).

A nominative definition for an analytical combination expressing a special concept is, therefore, a union of definitions of the components of this combination and should disclose the meaning of each of them. And if necessary – the meaning of the structural or structural-semantic model. But in practice, such definitions often reveal the meaning of one of the components only. So, the definition of a combination *electrical device* (device in which the measurement is carried out using an electronic device) reveals the meaning of the component *electrical* only, and the second component – *device* – is repeated in the definition only.

In some cases, the nominative definition of a free combination reveals only the meaning of the model that unites its components, and the meanings of the components remain not disclosed. This is, for example, the definition of a combination *DC motor*: electric motor suitable for DC operation. Since the meaning of the model can usually be interpreted using different words, the wording of such definitions can often vary widely. Consequently, the following equivalents can be given to this definition: *electric motor* that can operate on direct current; electric motor capable of operating on direct current; electric motor that can be powered by direct current, etc. Obviously, definitions for

free combinations, interpreting the meaning of a model only, do not carry any new information for speakers of a given language, since knowledge of a language presupposes knowledge of its grammatical structures and the ability to understand the meaning of structural and structural-semantic models.

Conclusion

Thus, free combinations such as *AC motor*, *synchronous generator*, *spectrometer*, *electronic device*, etc. in general should not be objects of nominative definitions due to the analytical nature of their special meaning. To such combinations, expressing special concepts, only detailed real definitions are appropriate that reveal and describe the content of these concepts. It seems expedient to give nominative definitions only to terms and

individual signs that have a special meaning and are used in one or another sublanguage to express special concepts.

The simplest nominative definition of a term can be an analytical combination of two or more signs naming the generic and species characteristics of the corresponding concept and, therefore, having in their totality the same special meaning as the term. In general, the nominative definition to the term *meter* can be a combination, *integrating device*, to the term *booster* – volt increasing (electric) machine.

Such free formations, which are, as a rule, the shortest form of analytical expression of concepts, function in scientific and technical speech in parallel with the terms. Based on the analysis above, it should be noted that the understanding of semiotically complex formations and the motivation of terms helps the correct use of the concept in speech.

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