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Dyachenko G. F., Tsynovaya M. V., Sirotenko T. V.

THE VERBS OF COMMON LEXICAL LAYER IN THE TEXTS OF SCIENTIFIC STYLE “ACOUSTICS AND ULTRASONICS”

The paper represents the description of the results of analysis of lexical, statistical and semantic features of the verbs in common lexical layer. The text corpus “Acoustics and Ultrasonics” is based on the articles from scientific journals of the USA and Great Britain.

Key words: lexical-semantic group, polysemous word, stratification layer, word token.

Дьяченко Г. Ф., Цинова М. В., Сиротенко Т. В. Дієслова загальноживаного шару лексики в текстах наукового стилю «Акустика й ультразвукова техніка». – Стаття.

Стаття подає опис результатів аналізу лексичних, статистичних і семантичних особливостей дієслів, які входять у загальноживаний шар лексики. Матеріалом для текстового корпусу «Акустика й ультразвукова техніка» послуговували статті з наукових журналів США та Великої Британії.

Ключові слова: лексико-семантична група, багатозначне дієслово, слововживання, стратифікаційний шар.

Дьяченко Г. Ф., Циновья М. В., Сиротенко Т. В. Глаголы общеупотребительного слоя лексики в текстах научного стиля «Акустика и ультразвуковая техника». – Статья.

Статья представляет описание результатов анализа лексических, статистических и семантических особенностей глаголов, входящих в общеупотребительный слой лексики. Материалом для текстового корпуса «Акустика и ультразвуковая техника» послужили статьи из научных журналов США и Великобритании.

Ключевые слова: лексико-семантическая группа, многозначные глаголы, словоупотребление, стратификационный слой.

Cross-disciplinary researches carried out in different fields or in different parts of the same field are more and more preferred in the world science. In theoretical linguistics, in the authors' opinion, lexical stratification, breaking of the word list into lexical layers with the purpose to reveal lexical meaning of a word, performs the necessary role of a “connector” of different parts of the language. Lexical stratification makes it possible to carry out analyses which help to state definite dependencies, often escaping grammar researchers' notice, concerning exclusively grammar description of functioning of various units in the language or speech, and find out the real cause of frequency usage or absence of these grammar units which probably lies in their lexical nature, i.e. in lexical meaning of the words.

That is why recently full attention is given to lexical stratification [2; 10; 11]. Novelty of the present article is the following. Firstly, it is in the study material itself that is the text corpus of the technical specialty “Acoustics and ultrasonics” (A&E) which is quite in demand in naval shipbuilding. The text corpus in this branch of knowledge has been investigated for the first time. Secondly, in the article there is not just one of the methods for determining stratification layers but a number of methods: statistical method, contextual method, expert evaluation method, quantitative method of calculation, etc.

The purpose of the article is to describe the results of common lexical layer formation (one of the stratification lexical layer) of the class of verbs belonging to the vocabulary of the probability statistical model (frequency vocabulary) of the technical specialty “Acoustics and ultrasonics” (A&E).

The following tasks were performed:

– the probability statistical model (frequency vocabulary) of the technical specialty “Acoustics

and ultrasonics” (A&E) was created on the basis of “Acoustics and ultrasonics” (A&E) text corpus which was formed by the continuous sampling method;

– the list of verbal word forms was selected from A&E frequency vocabulary and then they were brought into initial infinitive form;

– all frequency list of verbal units was divided into lexical layers to determine common lexical units;

– common lexical layer verbs were divided into lexical semantic groups.

The articles from the corresponding scientific journals published in the USA and Great Britain: Journal of Acoustic Society of America, Journal of the Audio Engineering Society, Applied Acoustics, IEEE Transactions of Antennae and Propagation, Journal of the Society of America, were used for the text corpus.

To determine common lexical meaning of a verb, statistical analysis or so called range correlation, i.e. range comparison of words registered in two frequency dictionaries was carried out. With this purpose frequency common-literary dictionary by Thorndike, Lordge [13] was used. Correlation resulted in the verbs giving the minimum range difference, i.e. the most similar to common-literary lexis. All of them were sorted to the common lexical layer.

Common verbs have high frequency of usage in texts of various scientific and technical branches and that is proved by research of some frequency dictionaries in other scientific technical fields [4; 8; 11]. These verbs are also used in fiction, publicistic texts, and as it was mentioned above, the corresponding ranges of verbal units in Thorndike, Lorge dictionary are evidence of that, not only in the English language, but in other languages [5, p. 7].

Statistical analysis of A&E text corpus showed that the quantity of common verbal units (202 verbs,

24 334 word tokens) is more than terminological ones (96 verbs, 3360 word tokens), and common scientific ones (107 verbs, 7 003 word tokens); common verbal units are the most numerous as in quantity of different words as in quantity of word tokens and make 43, 4% of the total quantity of verbs in A&E frequency dictionary.

The most frequently used unit in the group of common lexical verbs turned out to be the verb *be* (F= 9 956), and the least frequently used was the verb *assess* (F= 9). Research of common verbs showed that the frequency range of the given group is quite big: from F= 9 956 to F= 9, but nevertheless, the main quantity of common verbs is concentrated in high frequency zone of A&E frequency list.

The common lexical verb corpus is heterogeneous by its composition because this group includes auxiliary and modal verbs along with full verbs. First of all, let's consider full verbs. Most full verbs are neutral as for style, for example: *show* – показывать, обнаруживать, демонстрировать; *receive* – получать, принимать; *follow* – следовать; *require* – требовать; *find* – находить, обнаруживать; *correspond* – соответствовать; *study* – исследовать; *present* – представлять; *take* – брать, принимать значения; *express* – выражать, отражать, and others.

Despite the fact that common full verbs in fictional texts are used as polysemantic ones and have a lot of meanings, for example: *achieve* – достигать, доводить до конца; *appear* – оказываться, показываться, проявляться, появляться, казаться; *employ* – предоставлять работу, употреблять, применять; *satisfy* – удовлетворять, утолять (жажду), убеждать; *depend* – зависеть, рассчитывать /на/, находиться на иждивении; *discuss* – обсуждать, дискутировать, смаковать; *consist* – состоять /из/, заключаться /в/, совпадать /с/, and others, in A&E corpus, semantic structure of the verbs of this layer registered in standard English dictionaries [12, p. 14], is revealed incompletely. Even mentioned above verbs became actual in one meaning, sometimes in two ones, and less commonly in three meanings, for example: *achieve* – достигать, оказываться, *employ* – использовать, *satisfy* – удовлетворять, *depend* – зависеть, *discuss* – обсуждать, *consist* – состоять /из/, and others. Thus, in A&E text corpus the verb “achieve” is registered only in the meaning «достигать», for example: *Nondestructive testing is of course the key requirement to achieve the necessary reliability for this type of equipment.* – «Испытание без нарушения образца, безусловно, является основным требованием для того, чтобы достигнуть необходимую прочность оборудования этого типа».

One more example: *In order to reject interference and achieve optimum array performance, we seek a set of shading coefficients ...* – «Для того чтобы

отклонить помехи и достигнуть оптимальной характеристики антенной решетки, мы находим ряд экранирующих коэффициентов ...».

It follows from the examples that narrowing of semantic verb usage in the analysed texts is caused by the particular qualities of the functional style. First of all, it is emotional neutrality of the words, definite stereotype of described phenomena and processes, etc. Besides, the fact of narrowing of semantic word usage can be explained by peculiar “selectivity” of scientific texts as for selection of common vocabulary. As Galperin I.R [3, p. 424] noted lexis selection in scientific style texts pursues one objective to bring the described phenomenon to the reader adequately considering all diversity of features characterizing this phenomenon.

However, monosemous usage of verbs in technical texts is not a standard, polysemous verbs were also registered, for example: *associate* – ассоциировать, объединять; *observe* – наблюдать, обнаруживать; *occupy* – иметь место, случаться; *form* – образовывать, формулировать; *illustrate* – иллюстрировать, пояснять; *vary* – изменять(ся), различать(ся); *need* – нуждаться; требоваться; *display* – обнаруживать, показывать, and others. This phenomenon is quite explicable if it concerns common vocabulary of any classes of words. Strict topic areas in which terms function are not characteristic for common vocabulary. They can be used in various textual situations, describe various objects of special character because they are not strictly connected with one technical area.

Full verbs representing most verbal units (193 verbs, 10 965 word tokens) make 31,6% of all word tokens of verbal vocabulary and 45,1% of verbal word tokens of the common lexical layer.

Verbal units functioning in A&E texts as auxiliary verbs are not numerous, only 3 verbs (11 188 word tokens): *be* (F=9 956), *have* (F=1040), *do* (F=192), but they make a considerable fraction of all verb word tokens of the text corpus, that is 32, 3%, and the fraction of word tokens in the common lexical layer is 45, 9%. These verbs are of high frequency in A&E frequency dictionary.

The modal verbs: *can* (F=1115), *will* (F=345), *may* (F=292), *would* (F=199), *must* (F=151), *should* (F=69) represent a separate group of the verbs registered in the common lexical layer of A&E corpus. The modal verbs represented by 6 units make 2 171 word tokens, i.e. 6,3% of all verbal word tokens functioning in A&E text corpus and 8,9% of verbal word tokens of the common lexical layer.

The results of this research allowed to reveal regularity of common verb usage in acoustics and ultrasonics text corpus. Since common verbal vocabulary make 43,4% of all verbs of A&E corpus, it means that approximately each second verb should belong to the common lexical layer.

To prove the conclusion that common verbs make each second verb, the control text that was not in A&E corpus was used. Research of the control text corroborated correctness of our conclusion made in the result of the statistical analysis of the verbs. Below, an abstract of the article “Fast beam forming processor” from the journal “Acoustical Holography” is cited; the abstract belongs to one of the subtopics of A&E specialty and it was used to check the mentioned above thesis.

“A beam former implementation is described which combines the computational efficiency of a Fast Fourier Transform algorithm with the speed and economy of analog signal processing hardware. The fast transform algorithm enables single processor module to provide 32 simultaneous beams when used with a line array of 32 equidistantly – spaced transducers. The signal processing required to implement this function is the equivalent of performing, in real – time, a 32 point Fast Fourier Transfers on 32 continuous 100 kilometers input signals, 100 kilohertz being the isonifier frequency. The fast analog transform techniques allow this amount of processing to be performed on a single circuit board, whereas a digital implementation would require a great number of high speed calculations. The operational amplifier circuit configurations which perform the multiplications and summations, and the algorithm characteristics which facilitate analog implementation, are described. The use of multiple Fast Beam forming Processor modules for the real-time generation of two-dimensional images is also discussed.

Two-dimensional image formation con to accomplished by the multiple execution of a one-dimensional transform. An acoustic 1 waging system has been developed which implements a Fast Fourier Transform (FFT) algorithm in analog circuitry. The basis one-dimensional FFT circuit is followed by phase-shifting and combining network to produce a complete, efficient one-dimensional beam former. When used with a line array of N equidistantly-spaced transducers, the beam former provides 1 separate output. One output corresponds to the broadside beam aimed slant the normal to the array. Two groups of $(N/2)-1$ outputs each correspond to beams aimed at Increasing positive and negative angles of incidence. The one is remaining output responds to wave fronts arriving at both positive and negative maximum viewing angles. The angle magnitudes are determined by the transducer spacing, the isonifier operating frequency, and the wavelength of the acoustic radiation in the media. Beam forming in two dimensions with an orthogonal array of $N \times N$ transducers in provided by 2H Past Beam forming Processor modules whose final outputs produce N^2 simultaneous beams. Image processing for an $N \times N$ planar array is accomplished in two stages”.

In the cited above text consisting of 300 word token, 54 verbal word forms were selected; having

been reduced to the lexeme, the main calculation unit of our research, they made 28 verbal lexemes. After comparing the list of verbs from the control text and the list of verbal lexemes from the frequency dictionary of A&E sublanguage, it resulted in the fact that 15 verbs from the control text belong to the common lexical layer: *accomplish, allow, be, can, correspond, describe, develop, discuss, enable, facilitate, follow, have, perform, require, use*; 10 verbs – to the general scientific one: *combine, determine, increase, image, implement, operate, produce, provide, shift, space*; and 3 verbs – to the terminological one: *aim, phase, process*.

Thus, the analysis of the verbal units from the control text corroborated the conclusion that in acoustics and ultrasonics technical texts each second verb is of common meaning.

It should be noted that it is rather difficult to draw a clear distinction between separate lexical layers. Firstly, statistical analysis used for emphasizing the units of stratification layer and, in particular, of common lexis does not give necessary accuracy when defining such characteristic as degree of lexical unit terminology that leads to necessity for contextual analysis. Secondly, among the verbs functioning in the A&E text corpus the phenomenon of common lexis terminologisation is observed when lexical units of one layer pass into another one, i.e. quite often common verbs become the source of forming terminological and general scientific vocabulary. And, as a consequence, it is possible to observe the phenomenon of simultaneous occurrence of the same verbal lexical unit in different stratification layers. For example, polysemous common verbs can belong both to their “native” layer and to the terms depending on the meaning they are used in the context. Thus, the verb “behave” in A&E texts is used as a common verb meaning “work or function in a specified way”, for example, *The tubes lens will behave according to the ray-theory description if the frequency is large enough.* – «Если частота будет достаточно большой, то линза электронно-лучевой трубки будет вести себя в соответствии с теорией луча». However, functioning in the word combination “behave logarithmically” with the meaning “change according to the logarithmic law” used in A&E texts, the verb “behave” serves as a term.

As appears from the above example, under the conditions of the definite context the lexical units pass from one layer into another one, in other words it is possible to talk about relativity of the results when discriminating lexical layers with great probability. That is why in the event of controversial cases the authors consulted specialists in the given subject matter.

One of the points of the research of common layer of verbal vocabulary was lexicological classification, i.e. breaking down verbs into lexical-semantic groups.

Since polysemous verbs function in verbal vocabulary of the common layer, their classification into lexical-semantic groups is of considerable difficulties. Due to the fact that a verb in the text has this or that meaning, it can belong to different lexical-semantic groups. In this case the context is considered as the aggregate of definite linguistic conditions in which the content of the polysemous lexeme is revealed unambiguously [7, p. 95]. Thus, with the help of contextual analysis it was ascertained that the verb “result” in A&E sublanguage is used in three meanings: 1) occur as the consequence of something, 2) bring about, 3) arise out of. When the verb “result” is used in the first or third meanings, it can be put down to lexical-semantic group with the meaning “outcome of an action”, for example: *This method results from a set of linear simultaneous equations which can be solved easily.* – «Этот метод вытекает из ряда систем линейных уравнений, которые могут быть легко решены». One more example: *Conclusions that result from this article are very important.* – «Выводы, которые вытекают из данной статьи очень важны».

In the second meaning “bring about” the verb “result” belongs to the lexical-semantic group of verbs with the meaning “achieving outcome of an action”, for example, *The sequential interpolation algorithms will result in a specific example.* – «Последовательное использование интерполяционных алгоритмов приведет к характерному примеру». The mentioned above classification of the meanings of the verb “result” according to lexical-semantic groups is one of the examples of difficulties which the authors of the article met in the process of analysis of common verbal units on the lexicological level. Nevertheless, after investigating the given lexical layer we have managed to distinguish some lexical-semantic groups quite precisely.

To distinguish lexical-semantic groups of verbs, i.e. the verbs having rather close basic semantic content and belonging to the same semantic field, we used transformation of explanation [1, p. 94] that lies in replacing the word in one or another meaning by its dictionary definition. The definition, being the synonym with periphrasis to word, acts in the form of a syntagma composed in the described language and, consequently, according to its syntactical and lexical structural rules it indicates the elements which make it possible to distinguish (recognize, understand) the signifier: a word or a sign [6, p. 292]. With the knowledge of different types of interpretation of the given group of verbs in monolingual dictionaries we have distinguished the following lexical groups on the basis of commonness of at least one of semantic components of the meaning:

1) verbs of information (utterances): *speak, comment, explain, suggest, state, report, resolve, predict, discuss, say, express, note, mention, answer, etc.*;

2) verbs of statement of facts: *find, describe, represent, note, state, confirm, justify, verify, emphasize, etc.*;

3) verbs of assumption: *consider, let, predict, expect, propose, see, suppose, understand, account, believe, notice, imply, etc.*;

4) verbs of indicating start or end of an action: *accomplish, approach, arrive, reach, begin, leave, complete, perform, achieve, etc.*;

5) verbs indicating display of an action, phenomenon, event: *show, illustrate, display, demonstrate, exhibit*;

6) verbs meaning movement: *go, direct, pass, travel, recall, enter, advance, jump, etc.*;

7) verbs of perception: *see, recognize, realize, look, surprise, view, distinguish, idealize, prefer, assess, etc.*;

8) verbs meaning an action in publishing: *form, publish, work, check, write, rewrite, list, establish, describe, trade, up-date, etc.*

Analysis of the verbs belonging to the given lexical-semantic groups shows that they mainly have frequency from F=90 to F=9. Verbal lexical units situated in this interval are, as a rule, monosemous, whereas the verbs having higher frequency are not monosemous quite often; this fact causes objective difficulties when grouping them according to their lexical-semantic meaning.

Due to the fact that common verbal vocabulary is characteristic not only for scientific and technical texts but also for fictional ones, and subject classification provides for subdivision within some one specialized vocabulary, common lexical verbal units were not grouped thematically.

It should be noted that common verbs represent the group of relatively independent units used for linking scientific concepts consequently serving for providing text coherence, and also for material description when estimating the research results.

Summing up the results of the research of A&E common verbal vocabulary it is possible to conclude the following:

1. Common lexical layer of verbal vocabulary is the most numerous in a quantitative sense. The quantity of various words is two times more than terminological and general scientific layers, and the quantity of word usage is eight and three and a half times more, correspondingly. Its fraction in all verbs used in the analyzed texts of A&E specialty makes 43,3%, i.e. practically every second verb of A&E text corpus has common meaning.

2. Most units of common lexical layer are notional verbs: 193 verbs used in 10965 word tokens. Their fraction makes 31,6% of all verbs, 45,1% of verbal word token of common lexical layer.

3. Not numerous group, only three verbs make auxiliary verbs. They are on the very top of A&E probability statistical model, that is why the quantity of their

word tokens is quite considerable, it makes 11 188, i.e. 32,3% of all verbal word tokens in the text corpus and 49,5% of word tokens in the common lexical layer.

4. Modal verbs are quite small in numbers, the group includes just six verbs. The quantity of word tokens makes 6,3% of all verbal word of A&E text corpus and 8,9% of verbal word tokens in the common lexical layer.

5. Along with monosemous verbs, polysemous verbal lexemes were registered in the common lexical layer, and that fact complicated forming the analyzed stratification layer.

6. When investigating verbal lexis some cases of terminologisation of common lexis and also presence of the same verb having several lexical meanings in different lexical layers simultaneously were observed.

7. Verbal vocabulary of the common lexical layer is quite various in its lexicological character and make eight lexical-semantic groups.

The authors suppose that further research will be devoted to the analysis of the two other stratification layers of verbal vocabulary: general scientific and terminological ones.

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