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Tsapenko L. Yu.,
Candidate of Philological Sciences,
Associate Professor at the Department of Foreign Languages
National University "Odesa Polytechnic"
https://orcid.org/0000-0002-5088-2393

Lysun D. S.,
Senior Lecturer at the Department of Foreign Languages
National University "Odesa Polytechnic"
https://orcid.org/0009-0004-2481-9974

IMPLEMENTATION OF THE SEMANTIC STRUCTURE OF THE NOUN 'VOLUME' IN TEXT CORPORA (BASED ON THE TEXTS OF SCIENTIFIC AND TECHNICAL DISCOURSE)

Summary. This article describes the semantic structure of the noun 'volume', which appears in the texts referred to scientific and technical discourse. As the material the three text corpora of three technical disciplines – "Automation of Thermal Processes," "Chemical Engineering," and "Acoustics" – were compiled. All text corpora are based on the articles from American and Great Britain scientific journals in relevant technical fields. Although they are all disciplines of engineering, they differ significantly in the topics they address. "Automation of Thermal Processes" and "Chemical Engineering" focus on production processes, while "Acoustics" focuses on communication equipment and means. This choice was made to obtain general conclusions, as well as possible stylistic markers with integral characteristics. The noun 'volume' belongs to the mid-frequency zones of probabilistic-statistical models (frequency dictionaries) of these three specialties and is a lexeme of the general scientific lexicon. Such units of the general scientific lexicon are typically found in texts of virtually all specialties. Indeed, we also find them in the texts of the three selected specialties. According to many theoretical linguists, lexical units found in technical texts significantly reduce their semantic structure. Based on an experiment with the noun 'volume,' it was determined that of the ten definitions of semantic structure recorded in Webster's Standard Dictionary, only five were used, which significantly supports this view. However, a lexical-semantic variant not represented in Webster's was also found in the specialized texts. Thus, along with a significant narrowing of the semantic structure of the noun 'volume,' its transformation and some possible expansion are observed. In terms of the hierarchy of definition presentation in the standard dictionary and its reflection in texts, this point also violates the order established by Webster's Dictionary: lexical-semantic variants are not found in texts with the corresponding hierarchy.

Key words: frequency of use, probabilistic-statistical model, definition, standard dictionary, lexical-semantic variant.

Statement of problem. Literature review. Until recently, linguistic phenomena reflected in the language system (language-in-system) and speech (language-in-action) were considered completely different objects in linguistics, practically unrelated. Therefore, at the end of the last century, a sharp division was observed between scholars studying linguistic phenomena based on lexicographic resources and professionals focusing exclusively on speech objects functioning in textual bodies.

However, researchers now prefer to approach linguistic objects from a dichotomous perspective, i.e., a combination of means that simultaneously describe linguistic and speech phenomena. This approach allows linguists to conduct a comparative analysis of the elements of the language and speech systems in their work. Similar studies have already been carried out both from a grammatical perspective [1], [2] and in terms of describing the complex semantic structure of words with many lexical and semantic components [3], [4].

Furthermore, the availability of statistical tools, which are widely used in modern research, in turn facilitates the identification of key frequency characteristics that determine the quantitative parameters of texts of various types [5]. At the same time, statistical approaches that provide a complete picture of the functioning of a given linguistic object can at least approximately (and perhaps even more accurately) determine the main trends in linguistic system change [6], [7], [8].

The authors of this paper are consistent adherents of the dichotomous method for studying linguistic phenomena recorded in standard dictionaries and embodied in texts. As previously stated, this approach allows not only to record linguistic objects in texts and present their description as a semantic structure using standard dictionaries but also to determine the possible influence of speech elements on the language system as a whole.

Goal of the article. The purpose of this article is to examine the semantic structure of the noun 'volume' and identify all lexical-semantic variants that correspond to elements of this structure and are found in text corpora from the three technical specialties.

Basic material. The study was performed using text corpora of three disciplines within the scientific and technical discourse: "Automation of Thermal Processes" (ATP), "Chemical Engineering" (CE), and "Acoustics" (Ac). The total quantity of three corpora is 600,000 tokens, making the data obtained from the analysis com-

pletely representative. The texts were taken from English and American scientific journals in these technical areas: "Power," "Power Engineering," and "Process Engineering" for the ATP discipline; "IEEE International Conference on Acoustics, Speech, and Signal Processing"; "The Journal of the Acoustical Society of America," "Acoustics Letters," and "Journal of the Audio Engineering Society," and "Acustica," for "Acoustics" and "Chemical Engineering" for the CE discipline.

The main methods used in the analysis were the following: contextual analysis; use of the Webster standard dictionary to compare definitions recorded in the dictionary and lexical-semantic variants implemented in the text corpora; a survey of experts-specialists in these fields of technology; statistical methods for calculating the frequency of occurrence of a particular text unit, etc. In addition to the Webster standard dictionary, industry dictionaries containing terminological meanings of words were used.

In the previous articles [1], [2] describing the implementation of semantic structure of the words found in the texts and functioning with high frequency of occurrence as an object. But in this paper, it was decided to examine lexical units that occur in the texts with the lowest frequency. The following considerations have motivated this choice. The most frequent words with high occurrence value in the texts ('system, unit, temperature', etc.) covered virtually the entire entry for these words presented in the standard dictionary. This allowed us to draw the corresponding positive conclusions that the narrowing of semantic structure in technical text corpora did not occur, as many linguists had predicted.

This study analyzes the lowest-frequency words, allowing us to determine what portion of the semantic structure, that is, how many definitions that are present in the standard dictionary are met in the text corpora under study in the form of lexical-semantic variants. The noun 'volume' will be used as an example.

The noun 'volume' has the following frequency values in the text corpora studied: ATP (F = 34), CE (F = 180), and Ac (F = 43).

A summary list of definitions in modern English is copied from Webster's Standard Dictionary [9]. The list consists of 10 definitions:

1: the degree of loudness or the intensity of a sound
also: loudness

2: the amount of space occupied by a three-dimensional object as measured in cubic units (such as quarts or liters): cubic capacity
see Metric System Table, Weights and Measures Table

3a(1): amount, also: bulk, mass

(2): a considerable quantity

b: the amount of a substance occupying a particular volume

c: mass or the representation of mass in art or architecture

4a: a series of printed sheets bound typically in book form: book

b: a series of issues of a periodical

c: album sense 1b

5: scroll sense 1a.

An analysis of industry dictionaries data and verification of the lexical-semantic variants (LSVs) presented therein with the help of contextual analysis allowed us to identify the lexical-semantic variants that reflect the semantic structure of the noun 'volume' in the technical text corpora examined.

By comparing these semantic structures, we can conclude that the dictionary definition "the degree of loudness or the intensity of a sound" is the etymologically original meaning of this noun.

Let us move on to a direct analysis and see to what extent the definitions of the word 'volume' were implemented in the text corpora.

(ATP) – first place was taken by LSV1, which corresponds to the dictionary definition (2): "the amount of space occupied by a three-dimensional object as measured in cubic units (such as quarts or liters)", e.g., *Even in drum-type boilers, evaporation rates are so great relative to the steam drum volume that rapid response of feed-water flow is essential*.

The second most frequently used word is LSV2, which corresponds to the definitions of Webster's dictionary 3a(1) "amount, also: bulk, mass", and 3a(2): "a considerable quantity", e.g. *The turbo furnace program accurately models radiation heat transfer through the entire volume including the effects of recirculation and turbulent flow on pulverized coal combustion kinetics.*

LSV3, used in ATP texts, corresponds to definition 3b(2): "the amount of a substance occupying a particular volume," e.g., *Use of low-NO burners to retro-fit industrial oil- and gas-fired boilers is limited, since their larger flame volumes generally require additional clearances to complete combustion.*

Thus, it is obvious that out of the 10 meanings presented in the dictionary, only 4 meanings are embodied in the texts of the APR specialty, which correspond to the thematic problems of this specialty.

CE Specialty: First in the frequency hierarchy of words functioning in the texts on chemical engineering is LSV1, which corresponds to definitions 3a(1) "amount, also: bulk, mass" and 3a(2): a considerable quantity, e.g. ... *where T is absolute temperature, Ma and Mb are molecular weight, P is total pressure, and Va and Vb are atomic volumes.*

LSV2 corresponds to dictionary definition (2): "the amount of space occupied by a three-dimensional object as measured in cubic units (such as quarts or liters)", e.g., *If high pressures (excluding 50 lb sq. inch) or large vessel volumes (excluding 5 ft dia.) are encountered, the other materials may be economically attractive.*

LSV3 is not listed in Webster's dictionary entry and has the lexical meaning "load," e.g., *A centrifugal compressor is basically a constant-head machine, but with properly designed impellers, it will more nearly approach the constant-volume characteristics of a reciprocating compressor*.

In the texts of the specialty Ac, LSV1 is the most frequently used, corresponding to dictionary definitions 3a(1): "amount, also: bulk, mass" and 3a(2): "a considerable quantity", e.g., *The volume of turbowater mixture of interest is enclosed in a square area of length 2 per side and of a unit length in the other dimension.*

LSV2 corresponds to dictionary definition (2): "the amount of space occupied by a three-dimensional object as measured in cubic units (such as quarts or liters): cubic capacity," e.g., *The figures of merit per unit volume of several commonly used piezoelectric ceramics for both the 33 and hydrostatic modes are listed in Table 1*.

And finally, the last lexical-semantic variant, recorded in texts specializing in "Acoustics," corresponds to definition (1): "the degree of loudness or the intensity of a sound," *e.g., The basic theoretical approach is that outlined in Westervelt, in which the secondary pressure wave is generated by a volume distribution of acoustic sources whose strength depends on the primary pressure.*

From the above, we can conclude that dictionary definitions 3a(1): "amount, also: bulk, mass", and 3a(2): "a considerable quan-

tity" largely coincide with the LSVs "mass, magnitude," "quantity" of the semantic structure of the noun 'volume' in the texts on the specialties of ATP, Ce, and Ac, e.g.

For this reason, it was decided that the greatest production in discharge volume could be affected by raising the cycles of concentration, thereby reducing tower blowdown (LSV in the AHP texts – 'quantity').

Since most controls are based on affective volume flow, a lesser controller response is required with a steeper curve to achieve the needed change in head (LSV in the texts Ce – 'bulk').

The total change in the volume of the mixture due to this is Vm + V + Vt (LSV in the texts Ac – 'bulk').

The Webster dictionary's definition (2) b: "the amount of a substance occupying a particular volume" largely coincides with the dictionary definition 3a(1): "amount, also: bulk, mass".

By applying the method of lexical transformations, the Webster dictionary's definitions (2) b and 3a(1) can be reduced, eliminating unnecessary fragmentation of meanings, to a single definition: "a considerable quantity of a substance," which represents an invariant, combining the meanings of (2) b and 3a(1) as variants.

The lexical-semantic variant of the semantic structure of the noun 'volume', expressed by Webster's definition (2), as mentioned above, correlates largely with the lexical-semantic variant of the semantic structure of this noun in the texts on acoustics – "loudness". The functioning of this lexeme in the texts of this specialty is explained by the presence of a corresponding concept in the topic of "Acoustics." This meaning is not reflected in the texts of the specialties ATP and CE.

Dictionary definitions (3c2), (4a), (4b), (4c), (5) of the noun 'volume' according to the Webster dictionary express meanings that have lexical and syntactic compatibility that is not characteristic of the specialties of ATP, CE and Ac., and therefore are not realized in the texts of these specialties.

Thus, it is evident from the presented examples of lexical-semantic variations realized in the texts of three corpora–"Automation of Thermal Processes," "Chemical Engineering," and "Acoustics", that of the 10 definitions of the word 'volume' recorded in Webster's Dictionary, only four are used. This demonstrates a significant reduction in the semantic structure of this word, as confirmed by many linguists. Linguists-theoreticions, in particular, have insisted that the subject matter of many specialties simply does not include many concepts that are incorporated into the semantic structure of many dictionary units.

However, it's noteworthy that the "Chemical Engineering" corpus contains a lexical-semantic variant that is not present in the semantic structure of the word 'volume' in the Webster dictionary entry. It has the lexical meaning 'load' (*A centrifugal compressor is basically a constant-head machine, but with properly designed impellers, it will more nearly approach the constant-volume characteristics of the reciprocating compressor*).

Conclusions. A lexical transformation analysis of Webster's Dictionary and specialized dictionaries, coupled with contextual analysis carried out in the text corpora of three specialties, leads to the following conclusions.

1. In the text corpora for specialties related to scientific and technical discourse, a significant narrowing of the semantic structure of the noun 'volume' is observed. This semantic structure in all three text corpora is represented by only 4-5 LSVs.

The reason for such a significant narrowing of the semantic structure, which is represented by the lexical-semantic variants realized in the texts, may be the low frequency of occurrence of the noun 'volume'.

2. Of the ten definitions that make up the semantic structure of the noun 'volume' according to Webster's Dictionary, five are relevant in the texts for the specialties ATP, CE, and Ac, and one more in the texts on "Acoustics," namely:

VOLUME (1): "the degree of loudness or the intensity of a sound"

VOLUNE (2) "the amount of space occupied by a three-dimensional object as measured in cubic units (such as quarts or liters)"

VOLUME (2) b: "the amount of a substance occupying a particular volume"

VOLUME 3a(1) "amount, also: bulk, mass"

VOLUME 3a(2) "a considerable quantity"

3. Along with the significant narrowing of the semantic structure presented in the texts of the specialties under consideration, there is a phenomenon not anticipated by theoretical linguists: the realization of a LSV that is not recorded in the Webster dictionary entry for the noun 'volume.' In the CE text corpus, this noun has the lexical meaning "load," which is absent in the semantic structure of the word 'volume.'

4. The hierarchy of LSVs implemented in the texts does not coincide in hierarchy with the semantic structure of the noun 'volume' recorded in the standard Webster dictionary.

As already mentioned, the first definition in the dictionary entry for 'volume' is its etymologically original meaning. However, according to the specific subject matter of scientific and technical objects, as was taken into account in the technical texts presented in the specialties "Automation of Thermal Processes" and "Chemical Engineering," this dictionary entry cannot be used. However, in the texts on acoustics, which consider phenomena associated with increasing or decreasing noise level values, the use of LSV, which coincides with the definition "the degree of loudness or the intensity of a sound," is entirely appropriate.

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Цапенко Л., Лисун В. Реалізація семантичної структури іменника ‘volume’ у текстових корпусах (на матеріалі текстів науково-технічного дискурсу)

Анотація. У цій статті описується семантична структура англійського іменника ‘volume’, який зустрічається в текстах, що стосуються науково-технічного дискурсу. Як матеріал було складено три текстові корпуси з трьох технічних дисциплін – «Автоматизація теплових процесів», «Хімічне машинобудування» та «Акустика». Усі текстові корпуси базуються на статтях з американських та британських наукових журналів у відповідних технічних галузях. Хоча всі вони є інженерними дисциплінами, вони суттєво відрізняються за темами, які вони розглядають. «Автоматизація теплових процесів» та «Хімічне машинобудування» зосереджені на виробничих процесах, тоді як «Акустика» зосереджена на комунікаційному обладнанні та засобах. Цей вибір було зроблено для отримання загальних висновків, а також можливих стилістичних маркерів з інтегральними характеристиками. Англійський іменник ‘volume’ належить до середньочастотних зон ймовірнісно-статистичних моделей (частотних словників) цих трьох спеціальностей і є лексемою загальнонаукової лексики. Такі одиниці загальнонаукової лексики зазвичай зустрічаються в текстах практично всіх спеціальностей. Дійсно, ми також знаходимо їх в текстах трьох вибраних спеціальностей. На думку багатьох лінгвістів-теоретиків, лексичні одиниці, що зустрічаються в технічних текстах, значно знижують свою семантичну структуру. На основі експерименту з іменником ‘volume’ було встановлено, що з десяти визначень семантичної структури, записаних у Нормативному словнику Вебстера, було використано лише п’ять, що суттєво підтверджує цю точку зору. Однак у спеціалізованих текстах було виявлено також лексико-семантичний варіант, не представлений у словнику Webster. Таким чином, поряд зі значним звуженням семантичної структури іменника ‘volume’, спостерігається її (семантичної структури) трансформація та деяке можливе розширення. З точки зору ієрархії представлення визначень у нормативному словнику та її відображення в текстах, цей пункт також порушує порядок, встановлений словником Webster: лексико-семантичні варіанти не зустрічаються в текстах з відповідною ієрархією.

Ключові слова: частота використання, ймовірнісно-статистична модель, визначення, нормативний словник, лексико-семантичний варіант.

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