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## **COMPARATIVE ANALYSIS OF DICTIONARY DEFINITIONS AND LEXICAL-SEMANTIC VARIANTS OF THE NOUN 'SYSTEM' FUNCTIONING IN THE TEXT CORPUS "CHEMICAL ENGINEERING"**

*The presented article describes the process and results of comparing the system of definitions of the noun 'system', recorded in the normative dictionary, with the list of lexical-semantic variants of this word functioning in the text corpus "Chemical Engineering" in order to find integral and differential characteristics between them. The noun 'system' was chosen as the most frequent among all nouns occurring in the text corpus of the specialty "Chemical Engineering" which is the object of this study. On its basis a probabilistic-statistical model (frequency dictionary) was created in order to determine the most frequent nouns that can be found in the "Chemical Engineering" texts and whose semantic structures will be analyzed in the future. The text corpus "Chemical Engineering" was created on the basis of scientific articles taken from the journals of the USA and Great Britain: Chemical Engineering Progress, Chemical and Process Engineering. The size of the text corpus is 200 thousand tokens. To compile a list of definitions, Webster's dictionary was chosen among the normative dictionaries, which has the most complete list of definitions of the word 'system' in the dictionary entry. The list of lexical-semantic variants that are encountered in the text corpus is presented in descending order of the frequency of their use in the texts. The results of this comparison clearly demonstrate the degree of implementation of the semantic structure of the word 'system' embedded in dictionary definitions in the researched text corpus. Although out of ten definitions recorded in the Webster dictionary and constituting the semantic structure of the word 'system' in the language, only three of them are actually implemented in the "Chemical Engineering" text corpus, in the process of contextual analysis the new semantic shades of the lexical-semantic variants, that are not fixed in the normative dictionary, were marked. It is likely that the presence of the mentioned shades of meanings can contribute in the future to the corresponding development of the semantic structure of the noun 'system' and the emergence of new definitions that have independent meanings.*

**Key words:** *semantic structure, differential and integral characteristics, token, frequency, text corpus.*

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## ПОРІВНЯЛЬНИЙ АНАЛІЗ СЛОВНИКОВИХ ДЕФІНІЦІЙ І ЛЕКСИКО-СЕМАНТИЧНИХ ВАРІАНТІВ ІМЕННИКА 'SYSTEM', ФУНКЦІОНУЮЧОГО В ТЕКСТОВОМУ КОРПУСІ «ХІМІЧНЕ МАШИНОБУДІВНИЦТВО»

У представленій статті описано процес і результати порівняння системи значень іменника 'system', зафіксованої в нормативному словнику, з переліком лексико-семантичних варіантів цього слова, що функціонують у текстовому корпусі «Хімічне машинобудування» з метою визначення інтегральних та диференціальних характеристик між ними. Серед усіх іменників, що зустрічаються в текстовому корпусі спеціальності «Хімічне машинобудування», який є об'єктом дослідження, обрано найчастотніший іменник 'system'. На його основі створено імовірно-статистичну модель (частотний словник) для визначення найбільш частотних іменників, які зустрічаються в текстах «Хімічне машинобудування» і семантичні структури яких будуть проаналізовані в майбутньому. Текстовий корпус «Хімічне машинобудування» створено на основі наукових статей із журналів США та Великої Британії: *Chemical Engineering Progress*, *Chemical and Process Engineering*. Розмір текстового корпусу становить 200 тис. слововживань. Для складання списку дефініцій серед нормативних словників було обрано словник Вебстера, який у словниковій статті має найповніший список дефініцій. Список лексико-семантичних варіантів, які зустрічалися в текстовому корпусі, подається в порядку зменшення частотності їх вживання в текстах. Результати цього зіставлення наочно демонструють рівень реалізації у текстовому корпусі семантичної структури слова 'system', закладеної в словникових дефініціях. Хоча фактично з десяти дефініцій, зафіксованих у словнику Вебстера, які складають семантичну структуру слова 'system' у мові, у текстовому корпусі «Хімічне машинобудування» реалізуються лише три з них, у процесі контекстуального аналізу були відзначені лексико-семантичні варіанти з новими семантичними відтінками, не зафіксованими у нормативному словнику. Цілком імовірно, що наявність згаданих відтінків значень надалі може сприяти відповідному розвитку семантичної структури іменника 'system' і появі нових дефініцій, що мають самостійні значення.

**Ключові слова:** семантична структура, диференційні та інтегральні характеристики, слововживання, частотність, текстовий корпус.

Analysis of the implementation of the semantic structure of a word in text corpora is one of the most interesting, but at the same time the most difficult problems in linguistics. Such an analysis became real for researchers only after the possibility of obtaining text corpora of large sizes. At the early stage of the development of corpus linguistics, one could already observe an extraordinary enthusiasm of young linguists for statistics, quantitative analysis, mathematical linguistics and an almost complete denial of the role of the language system in their theoretical and applied research (Тарасова, 1980; Шестопалова, 1980; Лошакова, 1983; Мельник, 1984; Трофимова, 1988; Шапа, 1991). Even at the present stage of development of applied linguistics which, according to many researchers, has long since taken a stable position, there is also a certain opposition between

the traditional one, which uses data from various dictionaries, and the new approach to collecting linguistic material which involves referring to text corpora. This is noted by young researchers who apply corpus methods for the analysis of linguistic phenomena (Ганиева, 2007; Шилихина, 2014).

The further development of linguistics showed the need for a comprehensive study of linguistic phenomena, which provides for the simultaneous appeal to both language and speech. Such a synthesis allows us to trace the mutual influence of both parts of the "language-speech" dichotomy on each other. On the one hand, to analyze how the system of definitions fixed in dictionaries is used in texts, and on the other hand, to determine lexical-semantic variants (LSVs) in a text corpus that are not yet in this set of definitions. Thus with the help of the study of the functioning of

a word in text corpora a certain prediction of the further development of the semantic structure of words become possible.

Despite the modern possibilities of information processing the analysis of the implementation of the semantic structure of a word in a text corpus remains quite laborious, which can explain the very small number of works on this topic. Nevertheless the data of such analysis already appear in the scientific literature, although there are still few such works (see above). This is especially true for the processing of text corpora that belong to scientific and technical discourse (Неврева, 1984; Неврева, 1986; Борисенко, 1989; Почтарук, 1989; Шапа, 1991). Here, in addition to the complexity of the task itself, there is another real problem – the lack of experts experienced in any field of engineering, whose help is simply necessary in determining this or that lexical-semantic variant and its correspondence to the generalized meanings of the definitions presented in the normative dictionaries. However, the experience of working with technical texts, as well as the real help of the aforementioned experts, makes it possible to successfully cope with contextual analysis and obtain reliable results.

In the given article the **object** of the research is the text corpus of one of the technical specialties – “Chemical Engineering” (CE). On its basis, a probabilistic-statistical model (frequency dictionary) was created in order to determine the most frequent nouns that can be found in the texts “Chemical Engineering” and whose semantic structures will be analyzed in the article. They turned out to be a few words, but the most frequent of them is the noun ‘system’, which is considered in the given article.

**Aim.** The goal of the article is to describe the process and results of comparing the set of definitions of the noun ‘system’ fixed in a normative dictionary to the list of LSVs of this word functioning in the text corpus “Chemical Engineering” in order to find the integral and differential characteristics between them. This comparison clearly demonstrates the extent of implementation of the semantic structure of the word ‘system’ embodied in the dictionary definitions.

**Basic material.** The text corpus was created on the basis of scientific articles used in US and UK journals: Chemical Engineering Progress, Chemical and Process Engineering. The total amount of textual content is 200 thousand tokens.

The analysis of the semantic structure of the English noun ‘system’ was carried out on the basis of definitions fixed in the English normative dictionaries Longman Dictionary Of Contemporary English, Merriam-Webster’s Collegiate Dictionary, Webster’s

Third New International Dictionary, some industry bilingual dictionaries of this specialty. Comparison of normative dictionaries has showed that in almost all the sets of definitions are presented in the same way in them. However it (set) is most fully represented in Webster’s Third New International Dictionary (Webster’s, 2002).

Based on Webster’s Dictionary a list of dictionary definitions of the noun ‘system’ was determined for the further comparison with the LSVs occurring in the text corpus. Particular attention was paid to the terminological meanings included in the terminological system of the technical area “Chemical Engineering”.

As we have already mentioned in the **Aim** that the description of the semantic characteristics of the noun ‘system’ is presented by comparing the definitions of the dictionary entry of the word ‘system’, recorded in the normative dictionaries, with the lexical-semantic variants of this word, found in the CE text corpus by contextual analysis, which makes it possible to determine integral and differential characteristics of both lists and to realize to what extent the semantic structure of the word ‘system’, reflected in the language system, is implemented in speech, i.e. – in the text.

The article provides the following order of analysis. First of all, the set of dictionary definitions presented in the normative English dictionaries is considered, which is the semantic structure of the word ‘system’. Then all lexical-semantic variants that implement the semantic structure of the word ‘system’ in the CE text corpus are given in full confirmed by the corresponding examples. It should be noted that the basis for the hierarchy, i.e. the order in which definitions are presented, is the one given in the normative dictionary, and for the LSV hierarchy – the frequencies of their use in the corresponding meanings in the text corpus. Therefore along with the examples the statistical data on the LSV occurrence in the text corpus is presented. And finally a comparative analysis of language and speech units is carried out.

So the dictionary entry of the noun ‘system’ contains the following ten definitions: 1) *a set or arrangement of things so related or connected as to form a unity or organic whole*; 2) *the world or the universe*; 3) *the body considered as a whole functioning organism*; 4) *a set of facts, principles, rules, etc. classified or arranged in a regular, orderly form so as to show a logical plan linking the various parts*; 5) *a method or plan of classification*; 6) *a regular orderly way of doing something*; 7) *a number of bodily organs acting together to perform one of the main bodily functions*; 8) *an arrangement of rocks showing evidence as through fossils, of having been formed during a given geological period*; 9) *a group of transportation lines*

under a common owner; 10) in chemistry, a group of substances in or approaching equilibrium.

We present a list of lexical-semantic variants that reflect the semantic structure of the noun 'system' in the CE text corpus. As already noted in addition to examples confirming the presence of an LSV with the corresponding meaning in the text corpus, we provide statistical data, i.e. a percentage that various LSVs occupy when they function in a text corpus:

a) *installation, instrument* (53,8 %) e.g. *An outline sketch of the **system** is known in Figure 1 with elevation to the steam drum noted;*

b) *device, set*, (11%) e.g. *In summary this article has discussed the operation of a hierarchical computer **system** consisting of host/satellite computers for automation of process and laboratory analyzer;*

c) *complex of parts*, (10%) e.g. *The computer **system** combines the information of each of the items above to complete the tabular entries for standard DDC type control program;*

d) *unit*, (9,7%) e.g. *The mechanisms for elevating or convey is also pneumatically operated, and both **systems** are connected to the works' air line;*

e) *technique, technology*, (9,4%) e.g. *The boiler water treatment was the conventional caustic-phosphate **system**;*

f) *set of elements (steps, units, junctions), cycle, combination, conjunction*, (2,1 %) e.g. *Other applications include piping for caustic cell liquor first stage evaporators in a waste treatment **system**, tanks as large as 12 ft x 36 ft for waste solvent recovery **systems**, alkaline, plating solution tanks, and tank wagons, fans, blowers and stocks as tall as 200 ft and a barometric condensing **system** handling 200–250 degrees of Fahrenheit organics, acids and alkalines for over 12 year;*

g) *coordinate system* (1%) e.g. *Nomenclature "Rotational velocity ordinate **system**";*

h) *one indivisible whole*, (1%) e.g. *The third opportunity for instrument involved the removal of the reclaimer to change the unit into a closed operating **system**;*

i) *computer*, (1%) e.g. *The probe-type Oxygen Analyzer is mounted directly into the flue gas steam and requires no sampling **system** of any type;*

j) *company, firm* (1%) e.g. *To monitor implementation of the Workshop proposals by the various computer manufacturers and **systems** houses, the Workshop is considering the establishments of a set of evaluation programs to test s strict compliance with the proposals.*

A comparative analysis of the dictionary definitions and lexical-semantic variants found in the CE text corpus shows the following:

– dictionary definition 1) "*a set or arrangement of things so related or connected as to form a unity or organic whole*", which obviously represents the etymologically original meaning of the noun 'system', is used in the CE text corpus, but is only in eighth place by the frequency of use and is implemented by LSV h);

– dictionary definition 2) of the normative dictionary "*the world or the universe*" to a certain extent coincides with dictionary unit 1); in many normative dictionaries, dictionary definition 2) is absent as an independent unit of the dictionary entry. The context of the CE text corpus under consideration does not confirm dictionary unit 2);

– dictionary definition 3) "*the body considered as a whole functioning organism*" also coincides to a certain extent with dictionary definition 1) of Webster's normative dictionary, as well as LSV a), b), d), h) and i) of this noun in the text corpus;

Thus, with the help of the method of lexical transformations, dictionary definitions 1), 2), 3) turned into one 1)-3) "*a group of related parts working together*", which is an invariant that combines the meanings 1)-3) on the rights of options. Such procedures are very justified when researchers are dealing with literary texts, because this helps to eliminate an excessive fragmentation of the meanings recorded in dictionaries, which is unnecessary for literary texts (Dianova 1979). However for texts referred to scientific and technical discourse the fragmentation of semantic structure of a word often becomes a necessity when using additional semantic meanings or shades of meanings to describe the object as accurately as possible. Therefore, although LSVs a), b), d), h) and i) in the CE text corpus largely coincide, they have the right to independent existence, which is confirmed both by industry dictionaries belonging to this field of science and by the presence of the corresponding examples of LSVs encountered in the corpus under study.

– dictionary definition 4) of the normative dictionary "*a set of facts, principles, rules, etc. classified or arranged in a regular, orderly form so as to show a logical plan linking the various parts*" partly coincides with dictionary definitions 1) and LSVs b), c), f), j). Still, the observed differences in their content give reason to consider these LSVs as quite independent, being included in the semantic structure of the noun 'system' as full-fledged semantic units. For example,

*The functions of the hierarchical **system** for automation of the process stream analysis are ... (LSV b) device, set);*

*Control **system** design effectively divides itself into two separate areas: 1) the regulation of the pro-*



cess and 2) supervisor or economic optimizing control (LSV c) complex of parts);

Thus, a mixture of **systems** must be used by each applications group to achieve its desired results (LSV f) set of elements (steps, units, junctions), cycle, combination, conjunction).

Dictionary definitions of Webster's normative dictionary 5) "a method or plan of classification; and 6) "a regular orderly way of doing something" are identical to the LSV e) 'technique, technology' and to a certain extent coincides with the LSV g) 'coordinate system' in the text corpus under study.

**Conclusions.** The analysis of the dictionary definitions of the previously mentioned English normative dictionaries and bilingual branch dictionaries referred to the described scientific area, carried out by the method of lexical transformation, logical generalization operations, and their (definitions) comparison with the lexical-semantic variants implemented in the CE text corpus, made it possible to draw the following conclusions as to the integral and differential characteristics of the two lists of language and speech units under comparison:

1. Quantitative analysis shows that the noun 'system' is the most frequent noun in the text corpus "Chemical Engineering".

2. Despite the fact that according to a number of theoretical linguists in any field of technology a sharp narrowing of the semantic structure of a word should be observed, the contextual analysis data showed that the semantic structure of the noun 'system' in the studied text corpus is quite branched, although does

not cover all the definitions of this word taken into account in the normative dictionaries.

3. The semantic structure of the word 'system' in the texts of the CE specialty is represented by ten LSVs. However, in fact, out of ten definitions recorded in Webster's dictionary and constituting the semantic structure of the word 'system' in the language, only three of them are implemented in the CE text corpus: 1) a set or arrangement of things so related or connected as to form a unity or organic whole; 4) a set of facts, principles, rules, etc. classified or arranged in a regular, orderly form so as to show a logical plan linking the various parts; 6) a regular orderly way of doing something.

4. The remaining LSVs of the noun 'system' in the analyzed text corpus of the CE specialty represent new semantic shades that are potentially embedded in the semantic structure of this noun in the language system, but are not fully reflected in dictionary definitions. Such LSVs are the following: *devices, set, complex of parts; technique, technology; one individual whole; company, firm.*

It seems that the presence of the mentioned shades of meanings can further contribute to the corresponding development of the semantic structure of the noun 'system' and the emergence of new elements in the form of corresponding definitions that have independent meanings.

5. The hierarchy of definitions in Webster's normative dictionary of and LSVs in the texts of the CE specialty does not match, which is also confirmed by the given statistical data.

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