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LEXICAL FEATURES OF NOUN PREFIX MORPHEMES (ON THE MATERIAL OF THE ENGLISH TECHNICAL DISCOURSE FIELDS "CHEMICAL ENGINEERING", "AUTOMOTIVE ENGINEERING", "ELECTRICAL ENGINEERING")

The article presents an attempt to describe the prefix morphemes attached to noun stems in terms of their lexical characteristics which allow them to be attributed to different stratification layers: common, general scientific and terminological ones. The material for the study are the text corpora of the English technical fields "Chemical Engineering", "Automobile Industry", "Electrical Engineering", based on the articles from scientific journals corresponding to these specialties and published in the United Kingdom and the USA. A list of prefix morphemes (and their semantic characteristics) was created using morpheme classifications known in the linguistic literature, the morpheme-by-morpheme correspondence method, as well as the method of contextual analysis. Then all the prefixes were distributed about stratification layers. The procedure of distinguishing stratification layers is not particularly difficult with the units of common layer because they are used in everyday life and are understandable to all members of society, as well as the units of terminological layer that can easily be determined by experts in the technical fields of chemical engineering, automotive and electrical engineering. But for identification of the prefixes of general scientific layer the several methods have been applied. Except for semantics of prefixes their statistical features are described – frequency of usage and productivity. The number of prefixes is 29. The largest group of prefixes is formed by the lexemes-terms – 15 prefixes, total frequency of use – 1 563 units. As a whole there is the interdependence of the frequency and productivity in this layer. The second place in the number of prefixes is occupied by the general scientific layer – 7 units. However, total frequency of using lexemes with these prefix morphemes is significantly higher than the terms – 2 209, i.e. almost one and a half times more. The interdependence of the frequency of use and productivity in this layer is very clear. The third place is occupied by the units of common layer – 3 prefixes, total frequency – 1 006. In this layer, a strictly inversely proportional interdependence of frequency of usage and productivity is observed. A lexeme group is selected that can function not in one but in several stratification layers, they are only four but their total frequency is 2 699 morphemes.

***Key words:** meaning, productivity, statistics, stratification layer, text corpus, total frequency.*

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ЛЕКСИЧНІ ОСОБЛИВОСТІ ІМЕННИХ ПРЕФІКСАЛЬНИХ МОРФЕМ (НА МАТЕРІАЛІ ОБЛАСТЕЙ АНГЛІЙСЬКОГО ТЕХНІЧНОГО ДИСКУРСУ «ХІМІЧНЕ МАШИНОБУДУВАННЯ», «АВТОМОБІЛЕБУДУВАННЯ», «ЕЛЕКТРОТЕХНІКА»)

У статті подано спробу описати префіксні морфеми, які приєднані до іменникових стебел, з погляду їх лексичних характеристик, що дозволяє віднести їх до різних стратифікаційних шарів: загальновживаного, загальнонаукового та термінологічного. Матеріалом для дослідження є текстові корпуси англійських технічних галузей «Хімічне машинобудування», «Автомобілебудування», «Електротехніка», створені на основі статей із наукових журналів, котрі відповідають цим спеціальностям та опубліковані у Великобританії та США. Список префіксних морфем (та їх семантичні характеристики) був створений за допомогою класифікацій морфем, відомих у лінгвістичній літературі, методу морфемної розмітки, а також методу контекстуального аналізу. Потім усі префікси були розподілені за стратифікаційними шарами. Процедура розрізнення шарів стратифікації не є особливо складною з одиницями загальновживаного шару, оскільки вони використовуються в повсякденному житті і зрозумілі всім членам суспільства, а також одиницям термінологічного шару, які легко визначаються фахівцями в технічних галузях хімічного машинобудування, автомобілебудування та електротехніки. Але для ідентифікації префіксів загальнонаукового шару застосовано кілька методів. За винятком семантики префіксів, описані їх статистичні особливості – частота використання та продуктивність. Загальна кількість префіксів – 29. Найбільшу групу префіксів утворюють лексеми-терміни – 15 префіксів, загальна частота використання – 1 563 одиниці. Загалом у цьому шарі є взаємозалежність частоти і продуктивності. Друге місце за кількістю префіксів займає загальнонауковий шар – 7 одиниць. Однак загальна частота використання лексеми з цими префіксними морфемами значно перевищує терміни – 2 209, тобто майже в півтора рази більше. Взаємозалежність частоти використання та продуктивності в цьому шарі дуже чітка. Третє місце займають одиниці загальновживаного шару – 3 префікси, загальна частота – 1 006. У цьому шарі спостерігається суворо обернено пропорційна взаємозалежність частоти використання та продуктивності. Відібрана група лексем, які можуть функціонувати не в одному, а в декількох стратифікаційних шарах, їх усього чотири, але їх загальна частота становить 2 699 морфем.

Ключові слова: *загальна частота, значення, продуктивність, статистика, стратифікаційний шар, текстовий корпус.*

Analysis of Publications and Problem Statement. Modern studies devoted to various parts of speech and reflected in dissertations almost traditionally include morphemic analysis as a component which is intended to complete the full description of a grammatical object analyzed (Ivanova, Donchenko, 2012; Martemianova, 2011; Scherbakova, 2005). Therefore, this type of analysis can be considered a "conventional wisdom".

It wouldn't seem that anything new can be said about the word-formation typology of the word. However from the point of view of the authors of this article the issue of morphemic components of the word has not been exhausted yet. For example, there is a characteristic of morphemes that is not taken into account in the above-mentioned dissertations. It concerns the lexical meaning of a morpheme from the point of view of its reference to a particular stratification layer – common, general scientific or terminological – in accordance with its (morpheme) semantics.

Why the researchers of the young generation of scientists haven't focused on the lexical-semantic meanings of a particular morpheme. One of the reasons that can be mentioned was the assurance that the base style-distinguishing criterion which had to be taken into account when considering text units are the statistical parameters – frequency of usage, quantity, etc. (Арнольд, 2004). Therefore other features of word-forming units were not given the sufficient attention.

The goal of the study. The given article is an attempt to compensate for this gap in the research of

the noun word-formation typology. It describes one of the word-formation units, namely, noun prefix morphemes, in terms of their lexical characteristics which allow them to be attributed to different stratification layers: common, general scientific and terminological. So a stratification classification of noun prefix morphemes is presented here.

The material for the study were the electronic text corpora of the English technical specialties –Chemical Engineering (CE), Automotive Engineering (AE), Electrical Engineering (EE) – based on the articles from scientific journals published in the UK and the USA: "Chemical Engineering" – Chemical Engineering Progress, Chemical and Process Engineering; "Automotive Engineering" – Automobile Engineering, Auto Industry; "Electrical Engineering" – IEEE Transactions on Power Apparatus and Systems, Proceedings of the Institution of Electrical Engineers.

Methodology. The first task that needed to be solved was the creation of the prefixal morphemes inventory. To do this the following steps were taken.

Firstly, the selection of prefixal morphemes was carried out on the basis of specific characteristics of prefixes, namely: derived words in their lexical meanings practically do not differ from underlying ones, i.e. the lexical meaning of the noun stem remains mainly in the derived word, and the prefix only clarifies the noun stem (for example, *load – overload*); and also the fact that prefixes do not possess a transposing function and cannot form nouns from other parts of speech is taken into account. Therefore, we consider prefix nouns formed by attaching a prefix exclusively to a noun stem.

Secondly, due to the fact that one of the most time-consuming and responsible tasks of the described study was the task of determining the semantic meanings of prefix morphemes, which later formed the lexical classification of prefixes, several sources that represent the semantics of prefixes in linguistic literature were used:

1) semantic classification of morphemes in the work by M.D. Stepanova, V.F. (1968), Novodranova, N.V. (2008), Amosova (1956). However, her classification cannot be considered exhaustive for our article. In addition, since, as indicated above, the purpose of the article is to describe not semantic, but lexical meanings of morphemes, the classification of N. V. Amosova was used in the article only as an indirect source;

2) the list of morphemes by H. Marchand (1960), which was used as a base in some studies (Nevreva et. al., 2017);

3) the interlinear glossing method, and specifically, the morpheme-by-morpheme correspondence method, which is considered in rule № 2 of the Leipzig Glossing Rules (Leipzig Glossing Rules) where each word form is divided into morphemes, and each morpheme is provided with translation. Currently most international linguistic publications use this particular technique;

4) some sources presented in Internet (English prefixes; Latin prefixes). In addition, any semantic meaning of the prefix functioning in the text corpora was checked with the help of the contextual method.

Thirdly, several methods were implemented in forming the stratification layers since this procedure requires a certain technique. The selection of common and terminological units is not particularly difficult because in the first case these are units that are typical for daily usage and are understandable to all members of society, and in the second case these are units of term systems that are easily indicated by experts in the technical fields of chemical engineering, automotive engineering and electrical engineering. However the units of the general scientific layer that occupy an intermediate place are difficult to determine. To do this the comparison of the lexis of the text corpora under consideration and distinguishing the common lexical units was carried out. As a result of such a procedure the words related to fundamental sciences – physics, mathematics, chemistry which most modern branches of science and technology were branched off at the time as well as the words common to these technical specialties and found in the text corpora with almost the same frequency were included into general scientific layer.

Fourthly, it is known that statistical methods are also often used in the process of distinguishing the stratification layers, especially one of them – the method of rank correlation. In this case, usually some dictionary source that is not related to the object described in the article is taken for comparison. In linguistics the role of such kind of source the frequency general literary dictionary by Thorndike and Lorge (Thorndike, Lordge, 1968) plays. For example, the units of the most problematic general scientific layer are compared by the formula $r_s = 1 - 6 \sum d^2 / N(N^2 - 1)$ with the same units included in the Thorndike and Lorge dictionary, and if the difference in the ranks is small, then the word is included in the common lexical layer, and if it is significant, then it is referred to the general scientific layer.

However the authors of the given paper have come to the conclusions that, although such a comparative procedure would be an additional advantage in forming the lexical layers, it should be rejected due to the fact that Thorndike-Lorge Dictionary was formed in the middle of the last century and, of course, contains a lot of outdated information. But other sources of

such level and contents do not exist in linguistics nowadays.

Finally, in order to determine the most correct lexical variants of prefixal morphemes, contextual conditions of prefix noun usage in the mentioned text corpora were taken into account.

The research material description. So nouns including prefixal morphemes were extracted from the text corpora "Chemical Engineering" (CE), "Automotive Engineering" (AE), "Electrical Engineering" (EE). Here are some statistical characteristics of prefixes. The total number of prefixes is 29 units, i.e. almost half of prefixes existing in the English language (according to the classification by G. Marchand. It was determined that about eight percent of nouns in the studied text corpora were formed using prefixal morphemes. The table below shows the quantitative data on prefixes.

Table 1

Text corpus	Quantity		
	Prefixes	Productivity	Frequency of occurrence
Chemical Engineering	26	79	4328
Automotive Engineering	28	81	3922
Electrical Engineering	24	66	2835

The table shows that the values that indicate the number of prefixal morphemes, the frequency of their occurrence as well as their productivity (the number of different nouns used with these prefixes) in the text corpora CE and AE are very close and quite high but in EE corpus these values are significantly lower.

The list of the noun prefix morphemes found in the text corpora CE, AE and EE and common for them is as follows (the list is presented in decreasing order of frequency; in addition to the frequency of usage a statistical characteristic of productivity is also given): *co- / com- / con-* (F = 1491, 40 lexemes), *re-* (F = 1014, 27 lexemes), *auto-* (F = 627, 3 lexemes), *trans-* (F = 591, 6 lexemes), sur- (F = 566, 3), *di-/dia-* (F = 555 , 8), *dis-* ((F = 304, 7), *over-* (F = 259, 7), *sub-* (F = 249, 3), *ac- / ad-* (F = 193), *inter-* (F = 186, 14 lexemes), *out-* (F = 152, 3 lexemes), *ex-* (F = 150, lexeme), *in-* (F = 150, 4), *poly-* (F = 97, 5) *under* (F = 85, 3), *micro-* (F = 73, 3), *pro-* (F = 72, 4 lexemes), *hydro-* (F = 57, 3), *pre-* (F = 52, 12), *anti-* (F = 42, 2 lexemes), *semi-* (F = 39, 1), *counter-* (F = 38, 1 lexeme), *non-* ((F = 38, 2), *ultra-* (F = 38, 2), *aero-* (F = 24, 2), *thermo-* (F = 23, 1), *super-* (F = 19, 1), *uni-* (F = 16, 1 lexeme).

The entire inventory of prefixal morphemes was distributed across three lexical layers in accordance with the principles described above.

The first group contains prefixal morphemes which give terminological meaning to the noun stems when joining them. This is the largest group of prefixes, it contains more than half of prefixal morphemes of the list – 15 units, and the total frequency of occurrence is 1 563. In addition to the quantitative data the relevant examples are provided. Prefixal morphemes are presented in decreasing order of frequency: *trans-*, (*transformer, transposition*) (F= 591, 6 lexemes), *sub-* (*substream, substation*) (F= 249, 3 lexemes), *ex-* (*exchanger*) (F=150, 1 lexeme), *poly-* (*polypropylene, polyamide, polyester*) (F= 97, 5), *under-* (*undervoltage, underload*) (F=85, 3 lexemes), *micro-* (*micrometer, microfiber*) (F=73, 3), *hydro-* (*hydrocarbon*) (F= 57, 3), *anti-* (*antifreeze*) (F = 42, 2), *semi-* (*semiconductor*) (F=39, 1), *counter-* (*countercurrent*) (F=38, 1), *non-* (*noncondensables, nontransposition, nonalignment*) (F= 38, 2 lexemes), *ultra-* (*ultrafiltration*) (F=38, 2), *aero-* (*aerospace*) (F=24, 2), *thermo-* (*thermocouple*) (F= 23, 1), *super-* (*superferrite*) (F=19, 1).

From the above terminological prefixes it follows that the quantitative characteristics of frequency and productivity in the terminological layer are not always interdependent, and, basically, the overall picture of these two characteristics is rather chaotic. For example, one can observe how the prefix *ex-* with a significant frequency (F = 150) joins only one lexeme, forming the term *exchanger*, and the prefix *non-* with a much more modest frequency F = 38 – to two lexemes. However, this single fact can be considered an exception, and in general the list demonstrates that the values of frequency of usage and productivity have a very stable tendency to be dependent on each other.

If to observe how these prefixal morphemes are distributed among different text corpora the result will be as follows. The largest number of prefixes was found in the texts of the specialty "Electrical Engineering" – eight prefixal morphemes: *trans-, sub-, under-, semi-, counter-, non-, ultra-, thermo-*; the second one in terms of the number of different prefixes is "Chemical Engineering" – seven prefixal units *ex-, poly-hydro-, super-, (thermo-), (ultra-), (non-).* The three prefixes *non-, thermo-, and ultra-* are used both in texts on chemical engineering and in electrical engineering. The text corpus "Automotive Engineering" has only three prefixes *anti-, aero-, micro-*. The presence of three identical prefixes in such specialties that are different in their scientific and technical subjects can be explained by only one thing – there is a single section both in electrical engineering and in

chemical engineering that can be considered common to some degree. In electrical engineering, it is operation of conductors, semiconductors, dielectrics and their chemical composition, and in chemical engineering, of course, the chemical component of these devices.

The second, less numerous group contains prefixal morphemes that express general scientific notions and are included in this stratification layer. Their inventory is as follows: *re-* (*restart, recycle, repair, recovery*) (F=1014, 27 lexemes), *sur-* (*surface*) (F= 566, 3), *sub-* (*substation*) (F=249, 3 lexemes), *out-* (*outlet, output*) (F=152, 3), *in-* (*inlet, input*) (F=150, 4), *pro-* (*proportion*) (F = 72, 4), *uni-* (*uniform*) (F=16, 1). The quantitative characteristics of this group of prefixes are – seven units, i.e. almost two times less compared to the previous group of terms. Besides, although the number of different prefixes in the general scientific lexical layer is two times less, the frequency of occurrence of the prefixes of this layer is 2 209 units, i.e. almost one and a half times more than the terms. In addition, the productivity of the prefix having the highest frequency is much higher than the productivity of the most frequent prefixal morphemes of the terminological lexical layer even in relative values. The interdependence between frequency of usage and productivity can be observed very clearly in general scientific prefixes, and productivity tends to smooth gradual decrease with decreasing the frequency.

The distribution of these prefixal morphemes across the text corpora is as follows. The prefixes *re-, sur-, out-, in-* are found in the texts of all three technical areas. The *pro-* and *sub-* prefixes are found in the texts on chemical engineering and electrical engineering specialties and this fact again indicates the presence of related subject sections of these two areas of knowledge. The prefix *uni-* is attached to the noun stems only in "Automotive Engineering".

The prefixes that when attached to the noun stems form lexemes referred to the common lexical layer are three units with the total frequency value of 1006: *auto-* (*automobile, autoservice*) (F = 627, 3 lexemes), *ac-/ad-* (*account , advantage*) (F = 193, 7 lexemes), *inter- (Internet, interface)* (F = 186, 14 lexemes). Here one can observe a strict inversely proportional dependence between frequency and productivity, i.e. the lower the frequency of noun usage with a certain prefix the higher its productivity. Distribution in text corpora: prefixes *ac- ad- and inter-* are used with nouns in all three corpora; prefix *auto-* exclusively in the AE corpus.

There is one more remark on the semantics of prefixal morphemes *auto-* and *inter-*. At the beginning of their emergence in the scientific literature the nouns that these prefixes formed were considered exclusively terms. In the process of development of science and technology, objects that reflected these terms gradually became more public and commonly used, so the words lost their terminological specificity. Nowadays, when they have entered everyday life and any member of society knows about the Internet or has a car, the prefixes *inter-* and *auto-* are common, in extreme cases have general scientific character.

Then when considering examples for the *ac-/ad-* prefix, it may seem that the word *account* by its semantic features may well be introduced into the general scientific stratification layer. However in all three text corpora this word functioned exclusively as the part of the phrase *take into account*. This explains its presence in the common lexical layer.

Prefixal morphemes which appear in several lexical layers were identified into a separate group. Their number is four morphemes, the total frequency is 2699. The prefix *co-/com-/con-* can join both commonly used nouns (*co-author,* F = 290, 4) and general scientific ones (F = 1291, 26 lexemes) (*compound, coefficient, concept*). The prefix *dis-* joining the term forms the term (*discharge*, F = 201, 5 lexemes), and joining the commonly used word (*disadvantage*) (F = 103, 2 lexemes) enters the common lexical layer. The prefix *over-* is a unit of both the terminological lexical layer (*overlap, overvoltage*) (F = 202, 5 lexemes) and the general scientific lexical layer (oversize, F = 57, 2 lexemes). The prefix *di-/dia-* is attached to both the nouns of the general scientific layer (*diameter*, F = 78, 1) and the terms (*dielectric, dioxide*, F = 477, 7 lexemes).

Conclusions. So based on the foregoing we can draw the following conclusions.

1. The total number of prefixal morphemes that are found in the considered text corpora in the technical fields is 29 units. Their number and frequency of occurrence in the three text corpora are not similar. In the texts "Chemical Engineering" and "Automotive Engineering" these statistical parameters practically coincide, and in the ones of specialty "Electrical Engineering" their quantitative values are much smaller.

2. The prefixal morphemes joining noun stems can form prefix nouns that have the following lexical meanings: common, general scientific and terminological.

3. The largest group of prefixes is made up of morphemes which form lexemes-terms when joining the noun stems – 15 prefixes, the total frequency of usage is 1 563. Such an important characteristic as the interdependence of the frequency of usage and productivity as a whole is maintained in the list of terminological lexemes.

4. The second place as to the number of prefixes is occupied by the general scientific lexical layer – 7 units. However, the total frequency of occurrence of lexemes with these prefixal morphemes is significantly higher than that of the terms – 2 209, i.e. almost one and a half times more. The interdependence of the frequency of usage and productivity in this layer can be observed very clearly.

5. The third last place is occupied by the common lexical layer – 3 prefixes, the total frequency is 1 006.

In this layer a strict inversely proportional dependence of the frequency of usage on productivity is observed.

6. A group of lexemes that can function not in a single but in several stratification layers was selected, these types of prefixes are only four but their total frequency is quite high – 2 699.

In the future, it is supposed to carry out appropriate studies on the material of suffixal and root morphemes joining the noun stems and found in various technical areas of scientific and technical discourse.

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