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Ludmila SHAPA

PhD in Philology, Associated Professor at the Foreign Languages Department, National University "Odesa Polytechnic", Shevchenko ave., 1, Odesa, Ukraine, 65044

ORCID: 0000-0002-3502-4577

shapa.od@gmail.com

Olena PETROVA

Senior Lecturer at the Foreign Languages Department, National University "Odesa Polytechnic", Shevchenko ave., 1, Odesa, Ukraine, 65044

ORCID: 0000-0003-0637-0806

olpet132@gmail.com

Yuliana DOBROVOLSKA

Senior Lecturer at the Foreign Languages Department, National University "Odesa Polytechnic", Shevchenko ave., 1, Odesa, Ukraine, 65044

ORCID: 0009-0009-7414-537X

dojulia7@gmail.com

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INTERACTION OF STATISTICAL AND LEXICAL-SEMANTIC CHARACTERISTICS OF ADJECTIVES IN DIFFERENT SYNTACTIC FUNCTIONS IN THE ENGLISH ELECTRICAL ENGINEERING TEXTS

The aim of the proposed article is to describe the results of the study concerning the interaction of statistical and lexical-semantic characteristics of adjectives in the attributive and predicative functions, which are found in the English texts referred to scientific and technical discourse. The research was based on the text corpus of the specialty "Electrical Engineering". The sources of the text corpus were scientific articles published in the relevant scientific journals of UK and the USA: IEEE Transactions on Power Apparatus and Systems, Proceedings of the Institution of Electrical Engineers. The total volume of the corpus is 200 thousand tokens. The analysis included three stages. The main methods used in the study were the following: literature review, contextual analysis, expert assessment method, i.e. survey of electrical specialists, statistical methods of calculation and others. The first stage involved the creation of a text corpus, compilation of a frequency dictionary of word forms (probabilistic-statistical model), selection of a list of adjectives and determination of their statistical characteristics, as well as their distribution regarding syntactic functions. A significant predominance of attributive adjectives over predicative ones was discovered. The second stage was devoted to stratification of the list of adjectives into three lexical layers, calculation of quantitative indicators of units of each lexical layer. Calculations showed that the most numerous is the commonly used layer, in second place is the general scientific layer, and the terminological layer turned out to be the most insignificant in terms of the number of lexemes. At the third stage, the interaction of statistical, lexical-semantic and grammatical characteristics of adjectives was considered. As a result, significant coincidences were found (with a small degree of exceptions), which could be caused by the undoubted dependence of the three analyzed characteristics on each other during their interaction in texts.

Key words: statistical data, lexical layers, lexemes, attributive, predicative.

Людмила ШАПА

доктор філософії (філологія), доцент кафедри іноземних мов, Національний університет «Одеська Політехніка», просп. Шевченка, 1, м. Одеса, Україна, 65044

ORCID: 0000-0002-3502-4577

shapa.od@gmail.com

Олена ПЕТРОВА

старший викладач кафедри іноземних мов, Національний університет «Одеська політехніка», просп. Шевченка, 1, м. Одеса, Україна, 65044

ORCID: 0000-0003-0637-0806

olpet132@gmail.com

Юліана ДОБРОВОЛЬСЬКА

старший викладачка кафедри іноземних мов, Національний університет «Одеська політехніка», просп. Шевченка, 1, м. Одеса, Україна, 65044

ORCID: 0009-0009-7414-537X

dojulia7@gmail.com

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ВЗАЄМОДІЯ СТАТИСТИЧНИХ ТА ЛЕКСИКО-СЕМАНТИЧНИХ ХАРАКТЕРИСТИК ПРИКМЕТНИКІВ У РІЗНИХ СИНТАКСИЧНИХ ФУНКЦІЯХ В АНГЛІЙСЬКИХ ТЕКСТАХ З ЕЛЕКТРОТЕХНІКИ

Метою запропонованої статті є опис результатів дослідження взаємодії статистичних та лексико-семантичних характеристик прикметників в атрибутивній та предикативній функціях, які зустрічаються в англійських текстах, що належать до науково-технічного дискурсу. Дослідження базувалося на текстовому корпусі спеціальності «Електротехніка». Джерелами текстового корпусу були наукові статті, опубліковані у відповідних наукових журналах Великої Британії та США: *IEEE Transactions on Power Apparatus and Systems*, *Proceedings of the Institution of Electrical Engineers*. Загальний обсяг корпусу становить 200 тисяч токенів. Аналіз складався з трьох етапів. Основними методами, що використовувалися в дослідженні, були такі: огляд літератури, контекстуальний аналіз, метод експертної оцінки, тобто опитування фахівців-електриків, статистичні методи розрахунку й інші. Перший етап передбачав створення текстового корпусу, складання частотного словника слів (імовірнісно-статистична модель), вибір із нього списку прикметників та визначення їх статистичних характеристик, а також їх розподілу за синтаксичними функціями. Виявлено значну перевагу атрибутивних прикметників над предикативними. Другий етап був присвячений стратифікації списку прикметників на три лексичні шари, розрахунку кількісних показників одиниць кожного лексичного шару. Розрахунки показали, що найчисленнішим є загальнонавчальний шар (172 слова, що становить 7149 слововживань), на другому місці – загальнонауковий шар (162 слова і 4953 слововживання), а термінологічний шар виявився найменш значним за кількістю лексем (47 слів, які становлять 2284 слововживання). На третьому етапі розглядалася взаємодія статистичних, лексико-семантичних та граматичних характеристик прикметників. За результатами дослідження було виявлено суттєві збіги (з невеликим ступенем винятків), які могли бути зумовлені безсумнівною залежністю трьох аналізованих характеристик одна від одної під час їхньої взаємодії в текстах спеціальності «Електротехніка».

Ключові слова: статистичні дані, лексичний шар, лексеми, атрибутивна функція, предикатив.

Adjectives are considered to be already described quite fully by linguists, whom we usually call classics (Curm, 1958; Nesfield, 1910; Quirk, 1972). However, at present, in the era of corpus (Arianto, Haq, & Jufrizal, 2023; Biber, Gray, Staples, & Egbert, 2022; Parviz, 2023), cognitive,

psycholinguistics (Hwang J.-W., 2025) neurolinguistics, etc., the linguistic objects that have long been considered known and understandable are acquiring completely different, unexpected qualities. And adjectives can be attributed precisely to such objects.

Credit should be given to the generation of linguists who paved the way for the emergence of corpus linguistics and who themselves became its main promoters (Перебийніс, 2002; Teyssier, 1968).

Thanks to their work, young linguists are beginning to realize that adjectives can be approached from completely different perspectives. For example, from the perspectives of corpus linguistics, when the emphasis is placed on the adjective not as an element of the language system, but as a unit of speech (Неврева, 2014; Tsanova, 2014; Parviz & Lan, 2023). With such an analysis, it is possible to discover characteristics that could not be described previously, but only in the case for using a text corpus as a basis. We are talking about the stratification of parts of speech (including adjectives) into lexical layers and their constituents (Шепітько, 2004; Сліпецька, 2023), the description of cognitive and psychological processes based on text corpora (Wulff, 2003; Breban, 2010). However, support for the principles of corpus linguistics does not mean that researchers have stopped analyzing language system units and comparing them (Cinque, 2009), and this indicates the possibility of implementing the interaction of objects of the “language – speech” dichotomy.

Corpus linguistics also makes it possible to study some problems that concern the interaction (mutual influence) of various parameters of linguistic objects. However, unfortunately, the results of such studies were not found in the available literature. Therefore, such an analysis could be considered quite timely and relevant, making some contribution to the developments of this problem.

Thus, the purpose of the proposed article is to describe the results of the study concerning the interaction of statistical and lexical-semantic characteristics of adjectives in the functions of attributive and predicative, which can be found in English texts related to scientific and technical discourse. In our case, these are texts on the specialty “Electrical Engineering”.

The first stage of the study is devoted to solving the following problems: 1) determining the source on the basis of which the text corpus of the specialty “Electrical Engineering” was created; 2) compiling a frequency list (dictionary) reflecting all word forms recorded in the text corpus; 3) selecting all word forms of adjectives from the frequency dictionary and compiling a list of words; 4) consid-

ering the statistical characteristics of adjectives, their number and the share they occupy in the text corpus; 5) determining the statistical quantities of adjectives in different functions. The methods used at this stage were the following: semantic space formation for creating a text corpus, review of scientific and technical literature, expert assessment method, i.e. a survey of electrical specialists to determine whether texts belong to the specialty “Electrical Engineering”.

First of all, a text corpus was created, on the basis of which a probabilistic-statistical model of the specialty “Electrical Engineering” was subsequently created. For this purpose, scientific articles from UK and US journals were selected as a text resource, which in their content corresponded to technical problems developed in electrical engineering and reflected the results of modern research carried out in this field of technology. Preference was given to such publications as IEEE Transactions on Power Apparatus and Systems, Proceedings of the Institution of Electrical Engineers. The total volume of the text corpus was 200 thousand tokens. Then, on the basis of the corpus, a frequency dictionary (or probabilistic-statistical model) was formed, in which the units were arranged in descending order of frequencies.

Next, adjectives were extracted from the created frequency dictionary (list). The main characteristics that were of interest to the authors and were necessary for the future research are quantitative and qualitative features of adjectives. That is, statistical parameters and lexical-semantic features.

Regarding the use of adjectives in postposition to a noun in technical texts, there are several aspects worthy of note. Firstly, according to many theoretical linguists, adjectives in postposition are quite outdated and function extremely rarely; secondly, when examining the text corpus of the specialty “Electrical Engineering”, it was found that postposition in adjectives constitutes few cases, which confirms the point of view of the above-mentioned scientists. Thus, the statistics of such a phenomenon demonstrate that these data can be neglected (Teyssier, 1968).

The statistical (quantitative) characteristics were considered first. It was determined that the entire list of adjectives includes 381 units, which were recorded in 14,386 tokens. Consequently, the share of adjectives in the total volume of the text corpus is 7.2%. It should be noted that among all

parts of speech presented in the list, adjectives are in the third place in terms of frequency of use.

The following statistical studies concerned the numerical values in the distribution of adjectives regarding their functions: attributive and predicative. Moreover, the same adjective could be found in both functions. Let us give the examples of several of the most frequent adjectives that were found simultaneously in both functions:

‘necessary’ – in the attributive (F = 51), in the predicative – (F = 72);

‘possible’ – in the attributive (F = 66), in the predicative – (F = 73);

‘good’ – in the attributive (F = 124), in the predicative – (F = 8);

‘long’ – in the attributive (F = 118), in the predicative – (F = 4);

‘practical’ – in the attributive (F = 25), in the predicative (F = 2);

‘effective’ – in the attributive (F = 47), in the predicative (F = 21), etc.

Thus, it is obvious that in the quantitative calculation of adjectives occurring in the functions, we need to take into account not only the adjective itself as a word, but also to distribute it according to its function; therefore the analysis was carried out in tokens rather than words, as the former register the frequency of use.

Thus, the results of calculation were as follows: 378 adjectives were used in the attributive and 154 in the predicative (we remind you that the same adjective could be used in both functions). It was found that the percentage of adjective tokens occurring in the attributive is approximately 90% of the volume of all the tokens in the list, i.e. 12.856. In the predicative, the share of adjectives is 10%, which corresponds to 1530 tokens. From this it follows that, on average, the ratio of the number of tokens in the attributive function to the number of tokens in the predicative function is approximately 8:1.

It is obvious that in the specialty “Electrical Engineering” texts there is a tendency for attributive adjectives to prevail over the predicative ones. Such a tendency is predetermined by the absence of an addressee of speech and, due to this, by the descriptive nature of works referred to scientific and technical discourse. If we consider the distribution of adjectives according to frequencies of the list, we can note that adjectives in the attributive function have a consistently high frequency

of presence in almost all frequency zones, starting from the highest frequency zone – 504 tokens, to the lowest one – 7 tokens. The number of adjectives everywhere, in all frequency zones in the attributive function is equal to 25–27 words. In the predicative, there is a somewhat chaotic presence of adjectives – from 7 to 15 words in different frequency zones, which does not allow using statistical justification for such a distribution, and is common for units functioning with low quantities.

At the second stage of the study, the following issues were analyzed: 1) determining the number of lexical layers; 2) justifying the principles of dividing the list into lexical layers; 3) stratifying the list of adjectives into lexical layers and counting lexemes in each layer.

When stratifying the list of adjectives into lexical layers, the following methods were used: contextual analysis, expert assessment method, i.e. the method of surveying specialists in the field of electrical engineering, and the statistical method of rank correlation.

The first question, as has already been said, concerned the number of stratification layers. Previously, the linguists performing analysis in the field of lexical and semantic features of parts of speech in scientific and technical discourse texts assumed, as a matter of course, that lexical units of the text are, firstly, terms, and secondly, commonly used words that have an auxiliary importance for describing technical objects or phenomena. However, the further development of this topic (Педебийніс, 2002) and accumulation of lexicographic resources contributed to the understanding that a technical text has one more stratification layer of vocabulary – general scientific. The authors of the article verified this fact when analyzing text corpora of several specialties including the curriculum of technical universities, and a comparison of the contents of frequency dictionaries compiled on the basis of these corpora helped to identify three lexical layers – common, general scientific and terminological.

In linguistics, there are two most significant directions for identifying lexical layers: the choice of a lexical-semantic variant, which is selected from the context, and the use of statistical methods, in particular, the rank correlation method, which involves comparing several frequency dictionaries in order to determine the difference in ranks for any unit. Since in this article the object of stratification

is adjectives, i.e. a part of speech that is directly related to and depends on the meaning of the nouns combined and context associated with it, then, of course, the contextual analysis method was recognized as the most productive method. With the help of this method, the commonly used lexical layer was first identified.

The layer of common lexis is the most significant in terms of the number of units. It includes 172 words, which account for 50% of all the tokens in the list of adjectives, i.e. 7149 tokens. For example, 'high' (F = 504), 'low' (F = 419), 'large' (F = 240), 'short' (F = 175), 'small' (F = 193), 'good' (F = 124), 'far' (F = 120), 'long' (F = 122), 'various' (F = 120), 'single' (F = 118), 'new' (F = 105), 'great' (F = 96), 'similar' (F = 91), 'little' (F = 88), 'significant' (F = 83), etc. This layer was identified exclusively with the help of contextual analysis and contained lexemes that are used in everyday communication. As can be seen from the quantitative data of the frequency of use of the adjectives given as the examples, the lexemes of this layer are referred to the high-frequency zone of the list.

In selecting the terms, two methods were used: contextual analysis and a survey of electrical engineering experts who could accurately identify the terminological units expressing technical concepts referred to electrical engineering. The terminological units include 47 adjectives, i.e. 12% of the entire list (381 words), but they make up approximately 16% of all tokens in the adjective list, i.e. 2284 units, for example, 'direct' (F = 281), which is used in the texts exclusively in the combination 'direct current'; 'transient' (F = 165) in the combination 'transient resistance'; 'total' (F = 145) is used only in the combination 'total current'; 'positive' (F = 89) in the combination 'positive charge'; 'open' (F = 24) is used in the combination 'open circuit', etc.

The general scientific layer turned out to be the most difficult to analyze. The fact is that in order to identify units of this layer it was necessary to solve a double problem – to separate adjectives from commonly used units and from terms. Three methods were used for this: contextual analysis, expert assessment method, and the statistical method of rank correlation were introduced. When using the contextual method, adjectives were found that can have both terminological and commonly used meanings. For example, the word 'short', which can be attributed to the

commonly used layer, for example, in the phrase 'short wire' and to the terms in the phrase 'short circuit'; 'characteristic' – 'characteristic feature' and 'characteristic resistance', etc.

The expert assessment method was to determine to what extent a lexeme possesses the term properties. That is, firstly, the units of this lexical layer should be common to all or most technical specialties. Therefore, the frequency dictionary of the specialty "Electrical Engineering" was compared to the ones of the specialties "Acoustics", "Chemical Engineering", "Automobile Engineering" and dictionaries of other specialties. It was determined that common lexemes are primarily mathematical terms, for example, 'maximum', 'negative', 'equal', 'minimum', 'functional', 'parallel', etc. Secondly, it must contain words that can be found in any scientific work (and here confirmation from technical specialists was required), for example, 'basic', 'uniform', 'practical', 'experimental', 'standard', 'vacuum', 'mechanical', 'theoretical', etc. Next, to confirm that the obtained data really differ from both common lexemes and terms, a third method was used – the rank correlation method, when the ranks of adjectives in the frequency list of the technical specialty "Electrical Engineering" were compared simultaneously with the ranks of adjectives in one of the frequency dictionaries of another area of technical knowledge and adjectives in the frequency list of The Teacher's Word book by Thorndike E. and Lorge I. (Thorndike & Lorge, 1968). In this case, the measure of the terminological correspondence of an adjective from the dictionary "Electrical Engineering" relative to the mentioned specialties and adjectives of the dictionary of Thorndike E. and Lorge I. is the difference in numbers (ranks) of any adjective in the specified text corpora. The rank correlation was calculated using the formula $r_s = 1 - 6 S_d^2 / N(N^2 - 1)$.

The number of words in the general scientific layer was 162 lexemes and 4953 tokens, which is 34% of the entire list of adjectives. It should be noted that the common lexemes are concentrated mainly in the high-frequency zone of the described frequency dictionary; general scientific vocabulary – in the mid-frequency zone (immediately after the high-frequency zone). Terminological lexemes are located almost throughout the entire area of the dictionary, i.e. without a specific order. In terms of their numerical values in the high-frequency zones, and then in the subsequent frequency

zones of the list of adjectives, common units initially prevail in terms of the amount of words and tokens. However, the general scientific adjectives soon catch up with them and practically identical figures can be observed stably in the mid- and low-frequency zones both in terms of the number of lexemes and in terms of the number of tokens. As for terms, only the most basic terms of the specialty “Electrical Engineering” are concentrated in the high-frequency zone, then the frequency of use and the number of words decreased and sometimes reached their minimum (1, 2 lexemes).

The third stage is devoted to determining the possible dependence between the lexical-semantic and syntactic characteristics of adjectives. That is, it was at this stage that the authors had the opportunity to demonstrate the interactions envisaged by the purpose of the article and determine whether there is a real dependence of all three characteristics on each other.

First of all, we would like, based on the opinion of theoretical linguists, to present a description of the main lexical characteristics of adjectives functioning in the attributive and predicative, their abstract meanings.

It is known that different syntactic functions of adjectives contribute to the realization of different characteristics of its lexical-semantic structure. Thus, the attributive connection is considered to be stronger, closer, turning the attributive combination into a complete unit, although not constituting a complete judgment. The predicative connection carries a different load. It is the freest syntactic connection, therefore the adjective in this function acts as an independent syntactic unit. It is believed that the elements of the predicative group express a complete judgment (Teyssier, 1968: 243; Guglielmo Cinque, 2009).

An attributive combination that carries a nominative function expresses a constant feature that is characteristic of an object not only at a given moment, i.e. it shows something given, established in advance. A predicative combination is a means of expressing something new. An adjective that is a part of a predicative group expresses a variable, temporary feature. The following functional property is characteristic of adjectives in their various positions in a sentence. An adjective that occupies the position of an attributive implies a certain quality, i.e. it is characteristic of it to perform an identifying, qualifying function.

An adjective in a predicative makes a statement, a direct indication of the presence of a feature, quality, and performs only a qualifying function (Curme, 1947).

The first thing that needed to be done was to calculate and then demonstrate quantitative data on the functioning of adjectives of the three lexical layers in the attributive and predicative. First, the layers that included the largest number of lexemes were taken. Common adjectives had an overwhelming majority in the attributive function – 169 words, i.e. almost all the adjectives of this layer. The exceptions are the words ‘able’ (F = 16), ‘impossible’ (F = 7) and ‘responsible’ (F = 7), which were used only in the predicative. The number of tokens also shows a huge predominance of common lexemes in this function – 6189 units. Accordingly, in the predicative, common units were used much less frequently – 89 words, which made up 960 tokens. The ratio of adjectives in the attributive to predicative, respectively, is approximately 2:1 and tokens 6:1.

General scientific lexemes are represented in the attributive by 160 words and 4389 tokens; in the predicative – by 51 lexemes and 564 tokens. As we can see, here attributive adjectives also prevail both in words and in tokens; in words in the ratio 3:1, and in tokens approximately 8:1.

In the terminological layer in the attributive function 47 units of this layer are recorded, which are represented in 2278 tokens, and 6 words with the number of tokens 6 – in the predicative function.

To find out the numerical values of the use of adjectives of all lexical layers, as well as their frequency of use in both functions, we sum up the obtained quantities of all lexical layers: the number of words in the attributive is 376, the number of words in the predicative is 146 (recall that the same word can be used in both the attributive and predicative functions). The number of tokens in the attributive in general is 12856 units, the number of tokens in the predicative is 1530 units.

So, based on the results of the analysis, the following conclusions can be made.

Firstly, there is a certain connection between quantitative values and the adjective belonging to a particular lexical layer, which comes down to the following: the higher the frequency of use, the less likely it is that a lexeme will be a term. However, we must not forget that the text corpus pertains to

one of the specialties of technology, so exceptions were also found, although in small quantities, when a commonly used lexeme contributed to the formation of a term, for example, the commonly used word 'short' when added to the word 'circuit' is one of the most important concepts in electrical engineering. In addition, the analysis shows that the number of general scientific lexemes does not differ very significantly from the commonly used ones (162 common – 172 general scientific), but differs significantly in frequency of use (4389 common – 6189 general scientific), by almost 2 thousand tokens. And the frequency of adjective terms (2284 tokens), and even more so their number of words (47 lexemes) already quite clearly confirms our conclusions that the further a word is from a term, the greater the frequency of its use. Therefore, we can say with a high degree of probability that there is a certain relationship between the frequency of a word and its belonging to a particular lexical layer.

Secondly, there is certainly a direct dependence between the use of adjectives in the attributive and predicative function and their numerical values: in the attributive function, both in the number of words and in the number of tokens, there is a significant predominance of adjectives in the attributive function over the ones in the predicative function, almost 8:1. At the same time, the presence of adjectives in the attributive function is statistically stable, which is natural for large values; while in the predicative one, there is a chaotic functioning of adjectives, the total frequency of which is low.

Thirdly, there is a relationship between the lexical layer to which an adjective belongs and the function in which it is used. Adjectives of all layers have an overwhelming superiority in the attributive function – 12856 tokens – compared to the ones in the predicative function – 1530 tokens.

However, different lexical layers possess different numerical values. In the common layer, the greatest difference is observed both in words and in the frequency of use: 169 words in the attributive and 89 in the predicative (the difference of almost two times); 6189 tokens in the attributive function and 960 in the predicative, i.e. more than six times. The general scientific layer, although it is typical, like the commonly used lexemes, to prevail in the attributive, but with smaller values: 160 words in the attributive and 51 lexemes in the predicative; and the frequency of use is 4389 in the attributive and 564 in the predicative. And, finally, in the terminological layer, the interdependence is presented extremely clearly: the number of words is 47 in the attributive and 6 in the predicative function; the frequency of use is 2278 units in the attributive and 6 in the predicative function.

Such arrangement of quantitative values can lead to the conclusion that the common and terminological layers of vocabulary are extreme phenomena in technical text lexis, and the general scientific layer is a kind of intermediate link between them. If we quote the opinion of classical linguists, then the attributive function expresses a constant, given quality of an object, and the predicative combination expresses something new and original. Therefore, based on this definition, we can say that electrical engineering prefers traditional solutions of problems and does not offer anything radically new and unusual. And to a greater extent, this is characteristic of objects described by lexemes of the common layer, to a lesser extent – of the general scientific layer, and presumably the terms that are included in the terminology system of electrical engineering are most often supplemented with new concepts that are conditioned by scientific inventions.

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