

## THE INTERACTION BETWEEN GRAMMATICAL AND LEXICAL FEATURES OF THE CONSTITUENTS OF MODAL CONSTRUCTIONS WITH THE VERB CAN (ON THE MATERIAL OF SUBLANGUAGES OF SCIENTIFIC-TECHNICAL DISCOURSE)

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The article describes the functioning of the verb *can* in the texts of scientific and technical communication. Using quantitative and distributional methods the frequency of the structural models with different forms of the verb *can* and infinitives which go with it was determined. The lexico-semantic variants of the verb *can* in these models were identified. To describe the lexical meanings of infinitives the entire complex of the infinitives that goes with *can* was divided into lexical layers. This gave the opportunity to test the degree of influence of grammatical forms and lexical meanings of the infinitives as well on the ability of the verb *can* to vary the number of its modal meanings.

**Keywords:** rank correlation, modal meaning, lexical layer, absolute frequency, modal design, syntactical structure

Recently, the problems of grammar theory with its interest to the behaviour patterns of the language units in real discourse have been pushed aside a little by the elaboration in the field of cognitive linguistics which describes the cognitive structures and processes in the human mind [4; 6...9]. This also applies to such issues as modality, which includes not only the specific modal verbs, but covers the entire spectrum of speech elements, expressing the value of modality [1; 3; 10; 12; 14...16; 19]. A small number of works devoted to the units of text corpora, which can be found in the available literature and which can be referred to as examples is the research provided by S. F. Belyaeva [2], which describes the operation of the modal constructions in the texts of scientific and technical communication, and another one by M. B. Umatova [18], which represents a comparative analysis of modal verbs in the languages of different language systems.

However, according to the authors of the paper, the range of problems in theoretical linguistics is still far from being exhausted and requires further research. These points include the analysis of modal verbs functioning in scientific and technical discourse, in particular the verb *can*.

The content of the modal verb *can* and its internal form are precisely analyzed in Oxford Advanced Learner's Dictionary by A. Hornby [13], which represents the verb *can* as a token, which has the following set of «modal meanings»: ability or opportunity; «permission» in everyday conversational style; probability and possibility of what is happening; in the interrogative sentences it gives the shadow of the meaning directed on revealing of surprise, absence of attention; indicates what someone or something is considered possible for the existence or implementation; indicates what is considered to be typical.

It should be noted that all the examples that are used in Oxford Advanced Learner's Dictionary to describe the usage of the verb *can* belong to one functional style, i.e. conversational, where a wide range of modality shades of the studied lexemes in direct dependence on the type of expression is found – from the physical abilities to do something to polite requests. However, they do not reveal the syntagmatic properties of combined word forms, which function specifically in scientific and technical discourse. It can also be observed in scientific and technical dictionaries, which do not even dwell on the meanings of modal verbs [5; 11].

Lack of nomenclature of definitions required for translators and future teachers of non-language universities, including the lexical-semantic variants

implemented in scientific and technical discourse of modal constructions with the verb *can*, as well as research carried on in this direction and based on real scientific texts proves timeliness and *topicality* of the submitted work. Thus, this article states the following *aim*:

- to determine the probable mutual influence of lexical meaning and grammatical form of the infinitive in modal constructions on the extension of implemented in text corpus modal meanings of *can* and vice versa.

For these aims a linguistic experiment was held, where the following *objectives* were stated:

- to identify morphological and syntactical conditions for the functioning of the verb *can* (formulas and models of modal constructions), methods of distributed and quantitative analysis being used for this aim;

- to determine the elements of the semantic structure of *can* (set of modal meanings, reflecting the objective reality – extralinguistic environment) that are implemented in sublanguages included in scientific and technical discourse;

- to fix the possible semantic shades which different grammatical forms of the constituents in the selected models of modal structures can give to each other;

- to group infinitives of modal constructions in accordance with their lexical meanings and to form a common, general and terminological layers of the vocabulary; statistical method of rank correlation and the method of survey of experts who possess background knowledge in these areas of science and technology were used for this purpose.

It should be stressed that for the reason of clarity the body of modal structures does not include the units containing adverbial modifiers or additional elements that may impact the modal meaning of the verb *can*, because the authors wanted to avoid evaluation marks, which could determine the disposition of the speaker (writer), the introduction of which into the semantic structure could provide additional shades of expressiveness as if the headstone in this case was epistemic or intentional modality. The main aim of this work is to present examples of sentences of stative nature with the zero level of evaluation. This position is explained by the fact that, according to the authors, the nature of this study requires, firstly, the focus to be directed neither on the relation of the speaker (writer) to the statement nor on the implications, such as those associated with personal feelings or opinion, but on the correctness and accuracy of the speech message, and secondly, as already

mentioned, the interest is concentrated on the mutual influence of the modal verb and the infinitive in terms of their morphological, syntactical and semantic features.

The material for the experiment was the text bodies of «Power Engineering», «Electrical Engineering» and «Automotive» sublanguages, which are an integral part of scientific discourse and formed by the method of continuous sampling. The basis of text corpora were scientific and technical journals published in the USA and the UK – IEEE Transactions on Power Apparatus and Systems; Power Engineering; Power; Automotive News; Combustion; Control and Optimization; Machine Design; Industrial and Production Engineering; Automotive Engineer. The sample size was 300 thousand tokens. It can be assumed that the usage of the texts that are different as to their research topics in fundamental branches of science and technology will help to make general conclusions, forming style-identifying signs of scientific functional style.

with regard to their total absolute frequency (F\*). The formalized representation of the structures was expressed by the following marking:

- V – infinitive without the particle «to»;
- to V – infinitive with the particle «to»;
- Ven – participle II;
- N – noun;
- A – adjective in the function of predicative;
- prp – preposition.

In the analyzed corpora of «Power Engineering», «Electrical Engineering» and «Automotive» 28 models with a total frequency of 1100 language units were discovered. They are represented in the table 1.

The study showed that the highest priority is possessed by the verb constructions which have the forms of the passive infinitive. There appeared to be only 8 of them, but their total frequency (594 usages) covered more than a half (54%) of all usages of modal constructions. They showed almost all methods of variation of constituents in syntagmatic text corpora. The highest total absolute frequency is possessed by **can be Ven** (F\* = 481) construction, it accounts for 88% of all usages of modal constructions with the passive infinitive. Within this group the vast majority of structures – 522 units – is used with the modal verb **can** in the present tense and only 72 structures with the modal verb in the past tense.

Modal constructions with the infinitive in the active voice appeared on the second place as to their frequency of usage (F\* = 361, which is 33%). Data of the table show that these aspectual-temporal forms of the infinitive are diversified enough in this type of the voice.

To determine the possible influence of grammatical forms of the infinitive on the implementation of modal meanings of the verb **can** a detailed analysis of syntactic structures with passive and active infinitives was carried out, the results of which are shown below.

**can be Ven** – center can be located, the devices can be interconnected;

**can V** – motor can run; turbine can generate;

**could V** – council could take into account, computer could control;

**could be Ven** – electrical circuit could be broken; short circuit could be stopped;

**can V N** – computer can solve the problem; it can generate the power 200 kW;

**can V prp** – device can switch on; it can deal with; **cannot be Ven** – console cannot be mounted; error cannot be found;

**cannot V** – circuit cannot become; wattmeter cannot determine;

**can be Ven to V** – tire can be supposed to be engaged; calculation can be used to obtain;

**can have N** – system can have a device; transformer can have a coil;

**could have Ven** – generator could have energize; motor could have achieved;

**could not V** – carburetor could not include; brake could not work;

**can V N prp** – cylinder can remain the valve in; piston can push the exhaust gases out;

**cannot V prp** – circuit cannot connect to; we cannot draw in;

**could not be Ven** – capacitor could not be included; temperature could not be measured;

**can V to V** – engineer can try to control; ammeter can operate to obtain;

**cannot be Ven to V** – transformer cannot be used to reduce; calculation cannot be assumed to be the same;

**can V Ven** – it can become abstracted; sound wave can appear transmitted;

Table 1

№	Construction	F*	Sublanguages		
			Power Engineering, F*	Electrical Engineering, F*	Automotive, F*
1.	can be Ven	481	228	175	78
2.	can V	231	113	22	96
3.	could V	83	28	24	31
4.	could be Ven	65	18	27	20
5.	can V N	51	19	22	10
6.	can V prp	26	11	10	5
7.	cannot be Ven	24	11	7	6
8.	can be A	21	11	8	2
9.	cannot V	19	11	2	6
10.	can be N	17	1	14	2
11.	can be Ven to V	15	1	4	10
12.	could be A	10	1	4	5
13.	could be N	8	2	2	4
14.	can have N	8	3	3	2
15.	could have Ven	8	3	1	4
16.	could not V	7	-	1	6
17.	can V N prp	6	5	-	1
18.	cannot V prp	5	-	2	3
19.	could not be Ven	4	1	1	2
20.	can V to V	3	1	-	2
21.	cannot be Ven to V	2	-	-	2
22.	can V Ven	2	2	-	-
23.	can V N to V	2	1	1	-
24.	could have been Ven	2	2	-	-
25.	can N be Ven	2	-	1	1
26.	cannot be Ving	1	1	-	-
27.	cannot V to V	1	1	-	-
28.	could not have been Ven	1	-	1	-
		1100	468	332	298

From the database formed by three text corpora all illustrative examples with the verb **can** were selected using the method of characteristics correlation. Then the obtained structures were classified according to the typological features of structural models

**can V N to V** – four-cycle diesel engine can push the piston to obtain;

**could have been Ven** – engine could have been named; system could have been modeled,

**can V N be Ven** – part can possess a detail be used;

**cannot be Ving** – current cannot be flowing;

**cannot V to V** – wattmeter cannot measure to achieve;

**could not have been Ven** – control apparatus could not have been determined.

The results of the contextual analysis of text bodies of «Power Engineering», «Electrical Engineering» and «Automotive» sublanguages, which fragments are presented in the examples, show that the verb **can** implements the only modal meaning of «physical ability to do something». We can also conclude that the variation of the morphological characteristics of constituents in these structures does not influence the implementation of the modal meaning of the entire phrase, and the main modal meaning of «physical ability» is just clarified in time (compare: *can be designed* – *could be designed*; *can be measured* – *could be measured*, etc.), focuses on the possibility or impossibility of the action taken by the subject (*can be checked* – *cannot be checked*; *can be estimated* – *cannot be estimated*), and not any additional semantic (connotative) features are added to the modal meaning of the mentioned above structural types.

The research conducted on the basis of three text corpora, which do not have the same scientific subject, enables us to assume that the modal constructions formed due to the models represented in the table reveals, basically, only one dictionary meaning «can be done» in other sublanguages of science and technology, and the structural diversity of the infinitive does not expand the range of modal meanings or make it more complicated.

To determine the possible influence of the infinitive lexical meanings on the implementation of modal meanings of the verb **can** the differentiation of the entire list of infinitives on lexical layers was carried out. They were grouped according to the lexical characteristics in the following way:

– the verbs that in case of comparing the range of the words in the frequency dictionaries of the three text corpora and Word book by E. Thorndike, J. Lorge [17] gave a small difference of ranks and did not show terminological inclination neither in the direction of general literary dictionary nor in the direction of the remaining three dictionaries were attributed to commonly used ones: **make**, **use**, **announce**, **observe**, **think**, **find**, **take**, **expect**, **become**, **see**, **do**, **meet**, **occur**, **climb**, etc.;

– the verbs that showed a significant difference between ranges when frequency lists of three analyzed sublanguages and Word book by E. Thorndike, J. Lorge were compared, but a slight difference when the three frequency lists were compared, and turned out to be terminological enough compared to common literary lexics, but non-terminological for three technical frequency dictionaries were attributed to the layer of the scientific vocabulary: **add**, **operate**, **set**, **mount**, **control**, **draw**, **solve**, **determine** **estimate**, **calculate**, **construct**, **verify**, **approximate**, **regard**, **apply**, **carry out**, **achieve**, **vary**, **verify**, **predict**, **compare**, **judge**, **accomplish**, **effect**, **assume**, **substitute**, **employ**, **state**, etc.;

– and finally, the following lexemes belong to the terms that were determined not only by the method of rank correlation, but a survey of experts in the fields of science and technology: **turn over**, **interconnect**, **simulate**, **cut**, **digitize**, **process**, **store**, **gauge**, **isolate**, **time**, **coat**, **plot**, **automate**, **feed back**, **shield**, etc.

The analysis of the compatibility of the verb **can** with the verbs belonging to the above mentioned lexical layers in the forms of passive and active voices within each of the three text corpora shows that when the allocation is performed with the lexemes of common and scientific layers, then the limitations in the word usage of these verbs do not exist. If the verb **can** combines with the infinitives of verbs-terms, then there is a semantic correlation, which is characteristic for each area of knowledge. This is naturally explained by the fact that the lexemes of the first two layers are common to virtually all areas of science and technology, while in combination with verbs-terms the modal construction indicates the possibility of performing actions over phenomena, characteristic only to one of the three subject areas – «Power Engineering», «Electrical Engineering» and «Automotive».

Thus, the differentiation in the meanings of the infinitives in the syntactic structures of the considered modal constructions on terminological and non-terminological is possible only due to the influence of extralinguistic factors on the their functioning in a text corpus, rather than implementation of a modal meaning «the ability to fulfil the action over something». In its turn, different lexical meanings of the infinitive do not affect the expansion of the range of «modal meanings» of the verb **can** when using syntactic patterns of the mentioned types.

The construction models «can be + name» (noun, adjective, prepositional attributive structures) were considered next. Regarding its frequency of usage as well as the variety of the formulas used in the text bodies it occupies the last place in the list of modal constructions. The model «can be + name» is represented in the fields of «Power Engineering», «Electrical Engineering» and «Automotive» in only four versions:

**can be A** – circuit can be open; system can be elementary;

**can be N** – they can be blades of the turbine;

**could be A** – plot can be sinusoidal; temperature could be high;

**could be N** – fuel could be the form of spray; fuel could be bensin.

The frequency of their usage was 56 units, i.e. 5% of all modal constructions.

The observations show that reconsidering and transformation of the main meaning of the verb **can**, which is «possibility», take place and as a result of its contact with different parts of speech a new semantic version of «probability» appears, for example, «However, it has suggested that it can be open to diluting its stake to support growth at the carmaker» (Agnellis tighten grip on Fiat Chrysler ahead of Wall Street debut. Automotive News).

Thus, within the framework of scientific-technical discourse the verb **can** expresses the modal meaning of «assumption» or «probability» of objects or phenomena existence, which are represented by the lexemes possessing nominal character. The shift of semantics in this construction in comparison with the structures with the infinitive is quite natural, since it includes a nominal element. But as we can see from the examples, the general trend to be monosemantic is confirmed here, because the nominal constituent of the model-one-word lexeme, which is not complicated by additional elements, is monosemantic.

Based on the above, we can come to the following conclusions.

1. The most frequent modal constructions with the verb **can/could**, functioning in the corpora «Power Engineering», «Electrical Engineering» and «Automotive»



tive» and discussed in this article are constructions with the passive infinitive in various combinations of the constituents. The second place as to occurrence in the text bodies is occupied by the infinitive in the active voice. The most insignificant as to the frequency of usage turned to be constructions «can / could + name».

The predominance of the passive forms over active ones is considered to be one of the main characteristics of the scientific style texts, because the absence of the doer of the action can be observed there. However, it can be seen in our study that the active voice forms are also quite numerous. This point is explained by the fact that the objects themselves (turbines, electrical circuits, brakes, motors, etc.) reveal their functioning activity.

2. In text samples of the investigated fields of science and technology there is a definite tendency to ambiguity of the verb **can**. The only semantic variant in the spectrum of «modal meanings» of the verb **can/could** turned to be «the ability to carry any action over something» and the model «can be + name» has the modal meaning of «assumption» or «probability».

3. The analysis of various tense and voice forms of the infinitive in modal constructions shows that the morphological component does not affect the semantics of the verb **can**.

4. The classification of the infinitives in modal constructions due to lexical layers and further attempt to determine the possible mutual lexical influ-

ence of both constituents of the considered structures shows that the expected interaction does not occur. The extra-linguistic factors affect the lexical meaning of the infinitive and «modal meaning» of the verb **can/could** as well.

5. From the point of view of determining style distinguishing characteristics of high-frequency modal constructions with **can**, which reproduce, basically, the modal meaning of «ability» to perform an action, may be deemed to be the normal implementation of the constructions with the verb **can** in sublanguages of scientific and technical discourse.

6. The knowledge of passive infinitive mainly and active infinitive to a lesser degree is needed for the identification of the semantic structures as to the presented models, because the modal meaning of the verb **can/could** is actualised in its one main meaning, which is rather important for practical purposes of the English language teaching in non-linguistic universities. Difficulties in decoding the construction «can be + name» also do not occur, as the main element is unambiguous, and does not affect the lexical-semantic variant of the verb **can**.

Further research will be devoted to modal constructions with modifiers-adverbs and other additional elements contained in the structures, in order to prove that the introduction of these elements in the structure of modal constructions can or can not affect the implementation of other «modal meanings» of the verb **can**.

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**ВЗАЄМОДІЯ ГРАМАТИЧНИХ ТА ЛЕКСИЧНИХ ОСОБЛИВОСТЕЙ  
КОНСТИТУЄНТІВ МОДАЛЬНИХ КОНСТРУКЦІЙ З ДІЄСЛОВОМ CAN  
(НА МАТЕРІАЛІ ПІДМОВ НАУКОВО-ТЕХНІЧНОГО ДІСКУРСУ)**

**Анотація**

Стаття присвячена опису функціонування дієслова can у текстах науково-технічної комунікації. За допомогою кількісного та дистрибутивного методів визначені найбільш частотні моделі модальних конструкцій з різними формами дієслова can і інфінітивів, які поєднуються з ним. У цих моделях були визначені лексико-семантичні варіанти дієслова can. Для опису лексичних значень інфінітивів весь комплекс інфінітивів, які з'єднуються з дієсловом can, були розділені на лексичні пласти. Це дало можливість перевірити ступінь впливу як граматичних форм, так і лексичних значень інфінітивів на здатність дієслова can варіювати свої модальні значення.

**Ключові слова:** рангова кореляція, модальний сенс, лексичний пласт, абсолютна частота, синтаксична структура.

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**ВЗАИМОДЕЙСТВИЕ ГРАММАТИЧЕСКИХ И ЛЕКСИЧЕСКИХ ОСОБЕННОСТЕЙ  
КОНСТИТУЕНТОВ МОДАЛЬНЫХ КОНСТРУКЦИЙ С ГЛАГОЛОМ CAN  
(НА МАТЕРИАЛЕ ПОДЪЯЗЫКОВ НАУЧНО-ТЕХНИЧЕСКОГО ДИСКУРСА)**

**Аннотация**

Статья посвящена описанию глагола can в текстах научно-технической коммуникации. С помощью количественного и дистрибутивного методов определены наиболее частотные модели модальных конструкций с разными формами глагола can и инфинитивов, которые соединяются с ним. В этих моделях были определены лексико-семантические варианты глагола can. Для описания лексических значений инфинитивов весь комплекс инфинитивов, которые соединяются с глаголом can, были разделены на лексические пласти. Это дало возможность проверить степень влияния как грамматических форм, так и лексических значений инфинитивов на способность глагола can варьировать свои модальные значения.

**Ключевые слова:** ранговая корреляция, модальный смысл, лексический пласт, абсолютная частота, синтаксическая структура.