

Designing an Ontological-Linguistic Model of Complex Sentences with a Spatial Ratio of Components

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Abstract. The article is devoted to the issue of designing an ontological-linguistic model of complex sentences with a spatial ratio of components that is relevant for modern linguistics. The concept presented in this paper allows us to understand subordination in a new way as a global structure of language that fixes and classifies in a certain way the semantic space of knowledge about anthropologically relevant relations between events, phenomena, and properties of objective reality. As a result of the research, the specificity of structuring subordinate relations at the pre-verbal stage of generating a complex sentence was revealed, and the operational support for the process of language coding of spatial relations was established. This allowed us to obtain an adequate description of the ontological component of the intellectual program for semantic and structural analysis of complex sentences with a spatial ratio of components, which provides interaction with the linguistic component of the program and is aimed at recognizing and interpreting the described sentences. The paper also describes an intellectual program developed by the authors, the functionality of which solves the problems of data mining of semantic and syntactic organization of complex sentences with a spatial ratio of components, their classification and their communicative and functional significance in the text-forming process. The software product operating implies using an artificial neural network that allows you to successfully solve fuzzy and complex tasks similar to those set above.

Keywords: language reality, ontological and linguistic model, operational support, complex sentence, concept DETERMINISM, prescriptive rules of the hierarchy of influences, speech-thinking operations, non-anthropological ontological event, intelligent program, artificial neural network.

1 Introduction

In recent decades, there has been a steady trend towards expanding the subject of linguistic research, which leads to the formation of a «cluster» of disciplines that form an anthropocentric linguistic paradigm: neofunctionalism, cognitive linguistics, psycholinguistics, linguosynergetics, theory of speech communication, text theory, computational linguistics, etc. There is a change of vector from the description of lan-

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guage phenomena and processes to the design of «language reality» (the term K. I. Belousov) – a theoretical construct of anthropocentric linguistics, within which the categories of objectivity of the language personality are realized [1; 4; 7, P. 94–97; 8; 9, P. 179–184; 10; 14, P. 72–80; 16; 18].

The design of language reality assumes that the language personality, perceiving and reflecting a fragment of objective reality, transforms it into an ontological linguistic object in the process of embedding this object in a super-system of classifications. The result of the design is the creation of a unique picture of objective reality by the language personality, which turns out to be subtly adjusted to its cognitive needs and communicative intentions.

This research is devoted to designing an ontological-linguistic model of complex sentences with a spatial ratio of components. The relevance of the chosen topic is determined by the need for information that allows not only to increase the accuracy and realism of the scenario for structuring subordinate relationships in a complex sentence, but also to identify the entire system of semantic relationships recorded in a complex sentence.

The scientific novelty of the study lies in the fact that it presents for the first time an intelligent program developed by the authors for semantic and structural analysis of complex sentences with a spatial ratio of components, the functioning of which is based on an artificial neural network and data from speech-thinking processes of structuring subordinate relations.

The aim of the research is to create a theory of subordinate connection as a global structure of language that fixes and classifies the semantic space of knowledge about anthropically relevant relations between events, phenomena, and properties of objective reality.

Achieving this goal involves solving the following tasks:

- identifying the specifics of structuring subordinate relationships at the preverbal stage of generating a complex sentence;
- establishing and describing the operational support for the process of language encoding of spatial relations in a complex sentence;
- based on the theoretical generalization of empirical research data, developing an intelligent system for searching and semantic-structural analysis of complex sentences with a spatial ratio of components.

The paper uses methods of psycholinguistic experiment with elements of restoring degrammaticalized syntactic constructions, multi-aspect analysis of semantic and syntactic organization and functioning of complex sentences, as well as of design technologies for intelligent information processing systems.

The research material is complex sentences with a spatial ratio of components extracted from the literary texts of German writers of the XX century.

2 Structuring subordinate relations at the pre-verbal stage of generating a complex sentence

The psychological basis of the internal program of a complex sentence is formed in the process of so-called «event-based» understanding of objective reality. Objective reality is not initially set, but it takes shape and becomes meaningful when the language personality participates in some non-anthropological ontological event. It is a non-anthropological ontological event that reveals the reality of things as something that the language personality comes into contact with and interacts with. Ye. V. Bakeeva notes: «Free action, as a movement towards completeness and order, which I cannot know in advance (i.e., I cannot find as «predicated» to me), is thus the only possible way of being in the context of the ontology of an event» [5, P. 355].

The connection of non-anthropological ontological events can develop in two directions: coordinating or subordinating. The need for a subordinate relationship arises in a language personality when, at the pre-verbal stage of generating a complex sentence, the concept of DETERMINISM, which we understand after Ye. S. Kubryakova as an operational content-conceptual unit of the human psyche that has a language «binding», requires syntactic expression [13, P. 90–91]. The concept of DETERMINISM specifies the dependence of the state of the world perceived and reflected by the consciousness of a language personality at a given time off the laws of objective reality. Hence, the key elements of the concept we are interested in are «world-at-a-moment-in-time» and «laws-of-objective-reality».

As shown in a psycholinguistic experiment conducted by the authors, in the framework of the concept of DETERMINISM the world must have a certain condition or description of such a state at the time determined by the language personality as the actual. At the same time, the question of what the state of the world in due time is, ultimately, belongs to the sphere of experience and specific cognitive activity of a language personality who creates coordinate systems of time and space that form the horizon of non-anthropological ontological events [22, P. 242–257; 20, P. 1401–1412]).

It was found that within the concept of DETERMINISM, the laws of objective reality are universal generalizations, the logical formula of which can be formulated as a correlation «whenever the condition Y is met» [21, P. 609–620; 19, P. 551–574]. The question of what laws of objective reality exist is the question of what laws can be revealed in the general mosaic of non-anthropological ontological events present in the continuum.

The key elements of the concept of DETERMINISM are directly dependent on each other, and no single element can separately (the coordinate system of time and space, a number of non-anthropological ontological events) play a privileged role to the detriment of the other. Moreover, together they serve as the foundation for the syntactic configuration of a complex sentence. Thus, a complex sentence is a binary syntactic construction that profiles the semantic-syntactic dependence of non-anthropological ontological events that unite within it, which is regulated by the rules of the hierarchy of influences. The latter ones reflect the dynamic functional coher-

ence of categorically diverse and paradigmatically inconsistent elements of the language system in lexical and semantic terms as well as their compatibility in speech.

3 Operational support for the process of language coding of spatial relations in a complex sentence

Having emerged as an ontological expediency of the cognitive system of a language personality, subordination is syntactically implemented in the positional structure of a sentence, within which units of the lexical and grammatical level are arranged in the order determined by their role and degree of participation in a fixed series of non-anthropological ontological events [12, P. 107–108; 17, P. 43; 3, P. 238]. Here it is necessary to point out one important fact, namely, the complication of the linguistic encoding operational process of the complex sentence. The fact is that one or the other position in the sentence structure is not just populated with associated pieces of lexical-grammatical level, but serves as a semantic-functional basis for their secondary syntaxisation on the basis of subordinating relation. Thus, the language encoding of a complex sentence is a dynamic functional system consisting of standards of formal language values, all sorts of prescriptive rules and leading them to the action of speech-thinking operations:

1. choosing potential components of a complex sentence (qualitative and quantitative aspects);
2. choosing communicative means of a complex sentence components (relativistic-nominative aspect);
3. choosing the order of placement of a complex sentence components (actualizing aspect).

3.1 Selection of potential components of a complex offer (qualitative and quantitative aspects)

In the process of intra-position design, the components of a complex sentence are selected and the semantic-syntactic relations that are formed between non-anthropological ontological events that combine according to the rules of the hierarchy of influences are interpreted. Special attention should be paid to the fact that characteristic components play a leading role in parameterizing the formal-semantic configuration of the positional structure of a complex sentence. Differing in active valence properties, the characteristic components determine the participants of a non-anthropological ontological event on the basis of compatibility or, on the contrary, incompatibility of the semantic properties of the latter with their meaning and positional plan and correlate them through the act of predication with objective reality [11, P. 220; 15, P. 127–128; 2, P. 133].

The language material we examined shows that in complex sentences with a spatial ratio of components, as a rule, function the characteristic components of the following semantic classes:

1. characteristic components of localization and position in space (sein, bleiben, befinden sich, liegen, stehen, in Berührung kommen, etc.);
2. characteristic components of directional movement (anfliegen, bringen lassen, einwerfen, heimgehen, herkommen, hingehören, hinterherlaufen, hinwegsetzen, zurückkommen, etc.);
3. characteristic components of non-directional movement (bringen, fahren, gehen, laufen, springen, etc.).

The named classes of characteristic components allow us to distinguish two types of complex sentences with a spatial ratio of components, namely complex sentences of localization and vector orientation. Compare:

Er war da, wo er sein wollte (L. Feuchtwanger); Er (der Mond) hing über dem Trümmerfeld, wo Würzburg gewesen war und dreißig Kirchtürme tausend Jahre zeitlos im den Himmel gestanden hatten (L. Frank);

Er kannte es (Paris) ja bis in den letzten stinkenden Winkel, er führte es mit sich, wohin immer er ging (P. Süskind); Meistens er fahre sie (Herren und Damen, Männer, Frauen und Kinder), wohin sie beehrten (A. Zweig).

In the first two sentences, the place of implementation of the non-anthropological ontological event of the main part is fixed. The last two sentences indicate the movement of the subject in space, and the movement is not ordered, and if it follows a certain direction, it is devoid of an internal goal.

The environment of a feature component is formed by indivisible semantic and syntactic units, which are signified by syntactic actants. Depending on the function of the subordinate part, performed by it in relation to the characteristic component of the main part, they differ:

1. complex actant sentences in which the subordinate part replaces the position of the spatial localizer (Überhaupt haben wir Haare nur noch dort, wo sich ein Duft länger frisch halten soll (E. von Hirschhausen));
2. complex sircorstant sentences in which the subordinate part relates to the main part in its entirety and structures the space of the language personality by establishing relationships between objects and configurations that make up the topology of space, i.e., forming a set of dependent points of spaces that have an extension (Woher das Banner und das grüne Kreuz auf dem Gerüst zu sehen waren, setzte sich der Zug in Marsch (Der Spiegel, 1998, no. 23); Alma nimmt Sich Zeit, zu schauen, wohin der Hahn geschleudert wurde (A. Geiger));
3. complex attributive sentences in which the subordinate part gives a detailed characteristic of some actant of the main part by establishing its locative function (Aber im Westen, woher die Wolken gekommen sind, klart es bereits wieder auf (A. Geiger)).

3.2 Choice of means of communication of components of a complex sentence (relativistic-nominative aspect)

In the process of selecting the means of communication of components of a complex sentence, the search for optimal ways to explicitly update the concept of

DETERMINISM is carried out. The specificity of the described speech-thinking operation is that intra-positional design is implemented in two stages: at the first stage, communication tools are selected as representatives of the hierarchy of syntax levels, which profile the relations between two non-anthropological ontological events at a given time, defined by the syntactic categorization of the concept of DETERMINISM; at the second stage, a system-forced linear deployment of subordinate components is implemented, the direction of which is determined by the hierarchy of influences, formally designated by the position of communication tools in speech utterance. These stages are mutually determined. For example:

«[(Wo) allied word Glaube subject 2 ist feature component 2] non-anthropological ontological event 2, so spricht Hans Johst, ↔ [(dort) correlative element ist feature component 1 Allmacht subject 1!] non-anthropological ontological event 1» (D. Noll).

In this complex sentence, the means of communication (the union word *wo* and the correlative element *da*) profile the relations of spatial localization. At the same time, the proper lexical meaning of communication tools, as well as the direction of system-forced linear deployment of subordinate components determined by their positional location, allow us to designate anthropically relevant coordinates of the space in which a non-anthropological ontological event 1 develops at a given time. Non-anthropological ontological event 2 in this sentence serves as a localizer.

As for the system-forced linear deployment of subordinate components, the order of subordinate components is determined by their cognitive and/or textual hierarchical organization when the union word is prepositioned.

3.3 Choosing the order of placement of components of a complex offer (updating aspect)

Strategies for system-forced linear deployment of components of a complex sentence, i.e. virtual scenarios of their functioning in speech, are defined within the scope of the described speech-comprehension operation. Since the rules of the hierarchy of influences are both operational units of language ability and the type of cognitive operations, they determine semantic-syntactic and communicative-pragmatic strategies for linear deployment of components in a speech utterance with subordination. When distinguishing semantic-syntactic and communicative-pragmatic strategies for linear deployment of components, it should be borne in mind that both are essentially semantic. Linear deployment of subordinate components as a way of representing knowledge adds additional semantic content to the meaning of a speech utterance.

In cases where the subordinate part occupies a postpositive position, information about the spatial localizer or direction of movement is used as the rheme of the utterance: «subject – localization – localizer» or «subject – determining the direction of movement – locative». For example:

Ich soll weiterleben, wo es einen Menschen gibt, wo es einen Mann mit einem Bein gibt, der meinetwegen nur das eine Bein hat? (W. Borchert); Wo Mario Telatin herkommt, sind Einrichtungen dieser Größe noch verboten (B. Schrep).

The dominant role of the subordinate part in the expression of the semantic and syntactic strategy of linear deployment of components is determined not only by its lexical nature, structural features, but also by morphological processes, i.e. morphological methods by which the characteristic components in the main and subordinate parts are mutually differentiated.

In cases where the subordinate part occupies a prepositive position, the subject of localization or movement in space falls into the rhematic position: «localizer – localization – subject» or «locative – determining the direction of movement – subject». For example:

Wo sie stand oder bei Kaffee und Kuchen saß, war sie Mittelpunkt (G. Grass); Wo sie mit Luisa ging, saugten sich die Augen aller Männer an Luisa fest und sie, sie selbst, wieder in diesen gefürchteten Zustanddes Nichtvoerhandenseins verfallen mußte (Ch. Wolf).

The prepositive subordinate part has a communicative incompleteness, acting as a topic, and consequently extends to all subsequent utterances. According to L. D. Bednarskaya, being semantically abstract, the relationship between parts in complex sentences of this kind is at the same time the most concrete from the point of view of the semantic and syntactic strategy of linear deployment of components. It has a full set of grammatical means for its expression (synonymous series of semantic conjunctions expressing the finest shades of meaning, certain relations of forms of characteristic components in the main and subordinate parts, various lexical and morphological connectors, etc.) [6, P. 28].

The presented description of the operational support for language encoding process concerning spatial relations in a complex sentence is an ontological component of an intelligent search system as well as semantic and structural analysis of the described type of sentences. This ontological component provides interaction with the linguistic component of the system and is aimed at recognizing and interpreting complex sentences with a spatial ratio of components.

4 Intelligent program for semantic and structural analysis of complex sentences with a spatial ratio of components

The functioning of the developed software product is carried out using an artificial neural network that allows you to successfully solve fuzzy and complex problems, such as text analysis and semantic and syntactic classification of complex sentences with a spatial ratio of components. The fact is that the basic element of an artificial neural network is an artificial neuron that is able to receive signals from many inputs, process them uniformly, and transmit the result to other artificial neurons. Connections between artificial neurons are called synapses. The synapse has one key parameter, namely the weight coefficient. Depending on its value, one or another correction of information is carried out in the process of its transmission from one artificial neuron to another. It is due to this circumstance that the input information is processed and becomes the result. Neural network training is based on the experimental selection of a weight coefficient for each synapse, which leads to the desired result – se-

semantic and structural analysis of complex sentences with a spatial ratio of components.

An intelligent program for semantic and structural analysis of complex sentences with a spatial ratio of components consists of an input data input module, data selection and processing elements, and an output module for the required results.

In the process of creating the input data input module, selection elements, and data processing, we used both associated lexical and grammatical units (conjunctive words and correlative elements, attributive syntagmas) and units that have a significant impact on the parameterization of the formal and semantic configuration of the positional structure of a complex sentence (feature components). For actant and circostant compound sentences strategies of system-forced linear component deployment were described. The following algorithm of the module operation was proposed.

Table 1. Combinations of basic components in the positional structure of complex actant sentences of spatial localization

VARIANT 1						
COMPLEX ACTANT SENTENCE OF SPATIAL LOCALIZATION						
BASE COMPONENT 1	MEANING	BASE COMPONENT 2 FEATURED COMPONENT		MEANING	POSITION RELATIVE TO BASE COMPONENT 1	
WO	indicates the complete occurrence of spaces related to each other in a complex sentence	sein ² sich befinden bleiben stehen sitzen hingeraten fehlen es gibt		localization semantics, indicating the position of the subject at a certain point in space	in the main part of a complex sentence	
VARIANT 2.1						
COMPLEX ACTANT SENTENCE OF SPATIAL LOCALIZATION						
BASE COMPONENT 1	MEANING	BASE COMPONENT 2 FEATURED COMPONENT	MEANING	BASE COMPONENT 3 CORRELATIVE ELEMENT	MEANING	POSITION RELATIVE TO BASE COMPONENT 1
WO	indicates the complete occurrence of spaces related to each other in a com-	sein ² sich befinden bleiben stehen sitzen hingeraten fehlen es gibt	localization semantics, indicating the position of the subject at a certain point in	DA	denotes a certain place in space where the main action of a com-	it is located in the post-positive main part, i.e. it is immediately after the comma

	plex sentence		space		plex sentence proceeds; the semantics of static presence in space is brought to the fore	
VARIANT 2.2						
COMPLEX ACTANT SENTENCE OF SPATIAL LOCALIZATION						
BASE COMPONENT 1	MEANING	BASE COMPONENT 2	MEANING	BASE COMPONENT 3	MEANING	POSITION RELATIVE TO BASE COMPONENT 1
		FEATURED COMPONENT		CORRELATIVE ELEMENT		
WO	indicates the complete occurrence of spaces related to each other in a complex sentence	sein ² sich befinden bleiben stehen sitzen hingeraten fehlen es gibt	localization semantics, indicating the position of the subject at a certain point in space	localization semantics, indicating the position of the subject at a certain point in space	denotes a certain place in space where the main action of a complex sentence proceeds; the semantics of static presence in space is brought to the fore	it is located in the prepositive main part, i.e. it is located before the comma
VARIANT 2.3						
COMPLEX ACTANT SENTENCE OF SPATIAL LOCALIZATION						
BASE COMPONENT 1	MEANING	BASE COMPONENT 2	MEANING	BASE COMPONENT 3	MEANING	POSITION RELATIVE TO BASE COMPONENT 1
		FEATURED COMPONENT		CORRELATIVE ELEMENT		
WO	indicates the complete occurrence	sein ² sich befinden bleiben	localization semantics, indicating	DORT	denotes a certain place in	it is located in the postpositive main part,

	of spaces related to each other in a complex sentence	stehen sitzen hingeraten fehlen es gibt	the position of the subject at a certain point in space		space where the main action of a complex sentence proceeds; the semantics of static presence in space is brought to the fore	i.e. it is immediately after the comma
VARIANT 2.4						
COMPLEX ACTANT SENTENCE OF SPATIAL LOCALIZATION						
BASE COMPONENT 1	MEANING	BASE COMPONENT 2 FEATURED COMPONENT	MEANING	BASE COMPONENT 3 CORRELATIVE ELEMENT	MEANING	POSITION RELATIVE TO BASE COMPONENT 1
WO	indicates the complete occurrence of spaces related to each other in a complex sentence	sein ² sich befinden bleiben stehen sitzen hingeraten fehlen es gibt	localization semantics, indicating the position of the subject at a certain point in space	DORT	denotes a certain place in space where the main action of a complex sentence proceeds; the semantics of static presence in space is brought to the fore	it is located in the prepositive main part, i.e. it is located before the comma
STRATEGY 1						
SYSTEM-FORCED LINEAR DEPLOYMENT OF COMPONENTS OF A COMPLEX ACTANT SENTENCE OF SPATIAL LOCALIZATION						
SUBORDINATE PART		MAIN PART		MEANING		
subordinate part is in postposition i.e. after the comma		main part is in preposition i.e. before the comma		information about the spatial localizer: "subject – localization – localizer"		
STRATEGY 1						
SYSTEM-FORCED LINEAR DEPLOYMENT OF COMPONENTS OF A COMPLEX ACTANT SENTENCE OF SPATIAL LOCALIZATION						

SUBORDINATE PART	MAIN PART	MEANING
subordinate part is in preposition i.e. before the comma	main part is in postposition i.e. after the comma	information about the subject of localization: "localizer – localization –subject"

The table below shows possible combinations of basic components in the positional structure of complex actant sentences of spatial localization. In this case, you should pay attention to the following circumstances. First, the number of the base component ("BASE COMPONENT 1", "BASE COMPONENT 2", "BASE COMPONENT 3", and so on) corresponds to the priority of its search in a complex sentence. The program "searches" and identifies first allied words associated not only with the subordinate relation, but also with the semantics of localization in space, then – feature components, correlative elements, and, finally, defines strategies for linear deployment of components in complex actant sentences of spatial localization. Second, each of the basic components listed in the table is accompanied by a brief description of its semantics. This is necessary while creating a dictionary based on which the program determines the type of semantic and syntactic relations represented in a complex sentence, classifies them, and establishes their communicative and functional significance in the text-forming process.

It should be noted that similar algorithms for the module were developed for complex circumstantial and attribute propositions.

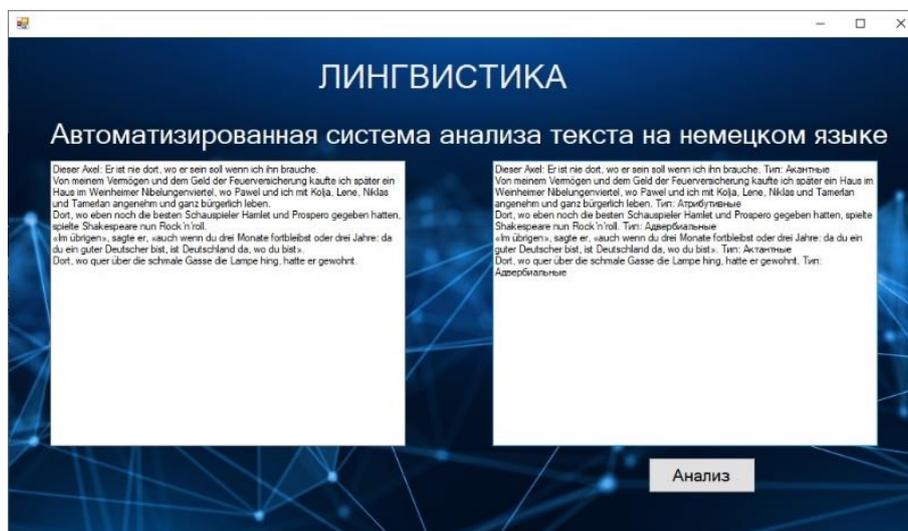


Fig. 1. Example of program operation

5 Conclusion

As the research has shown, the subordinate relationship is a relatively autonomous integral structure of the language, designed to represent the concept of DETERMINISM and ways of its syntactic categorization. Subordinate relations in a complex sentence reflect the process of verbalization of «quanta» of event-based understanding of objective reality by a language personality, which have sufficient similarities and differences in system-relevant characteristics and are thus fundamentally subsumed under the syntactic form of subordination.

It was found that a complex sentence is a binary syntactic construction that profiles the semantic-structural dependence of non-anthropological ontological events that combine within its limits, which is regulated by the prescriptive rules of the hierarchy of influences.

The analysis revealed that the structuring of subordinating relations is a multi-level process characterized by simultaneity of mutually deterministic operations: 1) the selection of potential components of the complex sentence (qualitative and quantitative aspect), 2) selection of communication components of complex sentences (relative-nominate dimension), 3) selection of order in which the components of the complex sentence go (actualized ability).

In the course of a psycholinguistic experiment, it was found that the basic elements of the qualitative and quantitative aspects of structuring subordinate relationships are characteristic components. Depending on the function of the subordinate part performed by it in relation to the feature component of the main part, they differ: 1) complex actant sentences in which the subordinate part replaces the position of the spatial localizer; 2) complex subordinate circumstantial sentences, in which the subordinate part structures the space of the linguistic personality by establishing relationships between objects and configurations that make up the topology of the space; 3) complex attributive sentences, in which the subordinate part gives a detailed characteristic of any actant of the main part by establishing its locative function.

The basic elements of the relativistic-nominative aspect are the means of communication, which assume the mandatory presence of two semantic actants that represent non-anthropological ontological events, which makes the mechanism of syntactic categorization of the concept of DETERMINISM «integral». Depending on the semantics of communication tools, the following types are distinguished: 1) complex sentences expressing relations of spatial localization; 2) complex sentences expressing relations of vector orientation (separative, directive, linear motion).

The actualizing aspect regulates the system-enforced linear deployment of components of a complex sentence. The position occupied by the subordinate part in relation to the main one brings to the fore either information about the spatial localizer or the direction of movement, or information about the subject of localization or its movement in space.

During the research an intelligent program for semantic-structural analysis of complex sentences with spatial ratio of the components was developed. It was based on the prescriptive rules established in the course of the study and leading them to action intelligent operations, prescriptive as well as on the standards of the formal language

values. The program in question tackles data mining concerning semantic-syntactic organization of complex sentences with spatial ratio of components, their classification, as well as establishing their communicative and functional significance in the text-forming process.

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