

**MATHEMATICAL ANALYSIS OF "COMPUTER LINGUISTICS"  
LOGIC AND ITS RELATIONSHIP WITH OTHER FIELDS**

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**Abstract**

The process of algorithmic description of language requires analysis and synthesis of the text. This shows that the "content - text" problem is not only a purely linguistic problem, but also a complex one, requiring a number of logical-mathematical interpretation processes of the text. All of these processes are related to the elements of mathematical logic. Logic, grammar, semiotics, and algorithms are important factors in computational linguistics. They serve as the basis for understanding the process of functionalization of language and speech, and for creating systems for automatically solving linguistic problems.

**Keywords**

logic, logical functions, grammar, semiotics, algorithm, use of mathematical methods in linguistics, mathematical logic, formal theory of reasoning, dialectical logic.

Logic, grammar, semiotics, and algorithm are closely related concepts that complement and require each other within the framework of computer linguistics. Mathematical logic was initially used in the natural sciences, and later it was also applied to the humanities. Logic is the science of the laws, methods, and forms of reasoning, in which logical processes such as concepts, judgments, and conclusions are studied. Thus, logical concepts are present in one sense or another in the essence of each science.

Logic first began to take shape in Ancient China and India in the 5th century BC, inextricably linked with grammar. In Ancient Greece, logic acquired the status of an independent science in the 4th century BC. This phenomenon is associated with the name of the Greek philosopher Aristotle, who is the founder of the science of logic. The scientist wrote the work "Organon" (this word means "weapon", "tool"), first explaining the laws of thought, showed the theory of deduction - the formal nature of logical inference, and characterized logic as a tool of thought. Aristotle developed the logic of nominative (noun) expressions. Later, followers of Aristotle and representatives of the Stoic school created sentence logic. Aristotle's teachings were continued by such great scientists as Faroubi, Beruni, Hegel, Frege, Leibniz. The science of logic began to develop in various directions. Initially, formal logic emerged, in which phenomena are explained only on a formal basis. In this direction, the law of the excluded third applies. According to it, one of two contradictory statements is true, the other is false, but there cannot be a third. This law is given by the formula "A is -V or V is not". For many years this view has been considered correct.

In the 18th and 19th centuries, the dialectical doctrine, which studies phenomena in their constant development and interaction, began to influence logic in philosophy. As a result, the direction of dialectical logic emerged. This direction was founded by the German philosopher Georg Wilhelm Friedrich Hegel. He outlined his views in his 4-volume monograph "The Science of Logic". The scientist introduced the *intermediate third* rule into logic. According to it, when evaluating phenomena, between two mutually exclusive phenomena neutral - the "intermediate third" state is also distinguished. Later, Leibniz and Gilbert introduced mathematical symbols into the science of logic. The German philosopher and mathematician G.

Leibniz (1646-1716) was one of the first to show that logical thinking has a computational character. In his opinion, the basis of all scientific concepts and reasoning is logical elements. These logical elements can be designated by certain symbols. Leibniz's ideas were realized only in the 19th century. The foundations of symbolic logic were created in the works of the German scientist G. Frege, the English scientist J. Boole, and the Russian scientist V. Poretsky. 9 In particular, J. Boole used the following symbols for logical operations:

- to indicate the presence of objects: the letters **x, y, z** ;
- to designate the quality of objects: the letters **X, Y, Z** ;
- **the perpendicular**  $\perp$  symbol for reflections reflected on each other ;
- **the symbol " 0 "** indicating absence in the comments being made ;
- **" + "** as a symbol indicating the logical addition of statements ;
- **" sign** , indicating that the 2nd statement contradicts the 1st statement ;
- U "** to indicate the presence of common word combinations in the sentence ;
- "∩"** symbol to indicate unusual combinations in a sentence offered.

In both antiquity and the Middle Ages, grammar and logic were taught side by side. In the Middle Ages, especially, grammar and logic were included in the "seven liberal arts" (*artes liberes*) that formed the basis of classical education . In this, grammar, rhetoric (the art of oratory), and logic were combined into *the trivium (triad)* as the "formal arts" (*artes-formales*) . *the quadrivium* as the "real arts" (*artes-reales*) . Only a person who mastered these sciences was considered mature and perfect. In the study of the structure of natural language, logic, grammar, and semiotics work inextricably linked. The connection between logic and grammar is manifested in the dialectical relationship of such categories as language and thought, word and concept, sentence and judgment, possessor and subject, clause and predicate.

Language is closely related to thinking, it is a tool that materializes thought and ensures the exchange of ideas between people. Language and thinking are inseparable phenomena that require each other. Just as there is no thinking without language, language cannot exist without thinking. Thinking is the activity of the higher nervous system of a person, that is, the brain, and finds its expression in speech, is realized through any form of expression consisting of words. The representation of thinking is language. Consciousness actually exists in the form of language. Language and thinking form a complex, contradictory dialectical unity. While language is a material phenomenon formed on the basis of the laws of phonetics and grammar, thinking is an ideal phenomenon that is the highest form of objective existence reflected in the human brain. The structure and development of the laws of language and the laws of thinking are identical.

not. Grammar studies the laws of language as a system. Thought  
The laws and units of grammar are studied in logic. Grammatical categories and  
The relationship between logical categories is also very complex.  
Grammatical categories are logical, logical categories are grammatical.  
cannot be subordinated to categories or mixed up. This  
Sometimes the categories overlap, sometimes they don't.  
possible.

Modeling human thought and language in computational linguistics

The issue of natural language processing is a central issue. Artificial intelligence, natural language processing

processing (NLP), linguistic processors, computer-based natural

Research on language interfaces includes logic, grammar, semiotics, computer technology, and

Much progress has been made in this area, but there is still much to be done.

natural language, human thought is not fully modeled. This is the same issue – Modeling language and thought is a promising area of computational linguistics. direction is considered.

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