Popular abstract of the research project

Philosophical and metalogical foundations of logic of names: semantics, tableau methods and axiomatization

Logic of names is a branch of logic that studies the various forms of names and the functors acting on tchem and the logical relationships between the sentences in which these names and functors appear. It is constructed using the so-called logical schemes method, which consists in the fact that, based on the analysis of the Surface the syntactic structure of sentences and natural language expressions, specific schemes are introduced in which various types of schematic letters appear instead of names.

Logic of names is an intermediate link between propositional logic and predicate logic. In propositional logic, we study relations between sentences, but we are not interested in the syntactic structure of sentences without connectives. We examine only those relations that depend only on connectives. In the logic of quantifiers, it is just the opposite; we analyze the deep structure of sentences using quantifiers that bind the variables and introduced connectives. These are methods characteristic of the modern, so-called mathematical stage of formal logic.

The logic of names can be considered a systematic development of specific fragments of traditional, premathematical formal logic. It includes the most famous piece: Aristotle's syllogistic and research on compound names and relative names. The latter, as *sylogismus obliquus*, were already considered by Aristotle in *Prior Analytics* and Joachim Jungius in *Logica Hamburgensis*. Still, their systematic theory appeared only in the 19th century in the works of Hamilton, Schroder and de Morgan. The latter analyzed reasoning: since every horse is a mammal, every head of a horse is a mammal's head.

The traditional syllogistic of Aristotle dealt with categorical sentences falling under one of four forms: 'Every S is P', 'Some S is P', 'No S is P' and 'Some S is not P'. For some reasons, Aristotle's syllogistic was applied only to non-empty general names, that is, names referring to some objects. Inmodern logic, however, we also allow empty names that do not denote anything. In this case, we have a problem with interpreting categorical sentences. For this reason, Tadeusz Kotarbiński and Czesław Lejewski proposed to use an additional sentence of the form 'Any S is P', which is true for any empty name standing in place of the subject 'S' (no matter what the name stands for 'P'). They believed that in the colloquial sense of the phrase 'any S', there is no objection to the emptiness of S. That is, the objection is associated implicitly with the phrase 'every S'. Therefore, the sentences of the form'Every S is P' are true only when the subject has a non-empty name; otherwise, it is false. Thus, the sentence 'Every S is P' is no logically equivalent to the negation of the sentence 'Some S is not P', which is also false when it has an empty subject. Therefore, it seems natural to assume that the sentence 'Every S is P' with an empty subject – since it says nothing – are truth-valueless at all, i.e. it is neither true nor false. For the same reasons, the same can be said of the other three kinds of categorical sentences.

The logical schemes method allows the study of a broad class of natural language sentences. In addition to categorical sentences, we can also examine unit sentences of the form 'a is P' and 'a is not P', in the subject of which there is a name that is intended to refer only to one object. We also have a whole spectrum of sentences related to categorical sentences; for example: 'S is the same as P', 'only some Ss are Ps', 'only some Ss are not Ps', 'exactly one S is P', 'atmost one S is P', 'exactly two Ss are Ps', 'at least two Ss are Ps', 'the only S is P' etc. We can also study modal versions of these sentences in which 'is', replace with one of the phrases: 'must be', 'may be'; the phrase 'is not' is replaced with one of the phrases 'must not be', 'may not be'. It is also allowed to analyze sentences in subjects or predicates with complex names: 'S and P', 'S or P', 'not-S'. The same applies to relative names such as 'friend', 'mother', etc. The latter can also be transformed according to the transformation of a relative name being a participle of a transitive verb fromactive voice to passive voice (from'readers' to 'read by') and to create a third relative name from two such names (e.g. 'mother's father'). You can see that we do not have to limit ourselves to relative names but extend our approach to verbs (e.g. instead of 'is a reader', we take 'read').

On the material mentioned above, as in other branches of logic, one can conduct rich metalogical research: introduce various types of set-theoretic semantics and axiomatization of various fragments of name logic and use appropriate tableau methods.