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**THE FATE OF ONE FORGOTTEN IDEA:  
N.A.VASILIEV AND HIS IMAGINARY LOGIC**

The fate of logical ideas is whimsical. Very often time only gives us the opportunity to appraise the strength of forecasting of the scholar, the scale of his ideas, their orientation to the future, and the role and place of the scholar in the intellectual history of mankind. "Time has a difficult delivery, but never a miscarriage" - as one aphorism put it.

Today, the significance of the logical works - only a few articles - of Kazan University philosophy professor, N.A.Vasiliev (1880 - 1940), is becoming ever more apparent. He was the first to introduce the considerations of inconsistency into formal logic, manifesting at that time an understanding of dialectical spirit (in Kant's or Hegel's sense).

In his early years, Vasiliev was attracted to poetry. As if predicting the fate of his own ideas, he wrote: "We are the quickly dying flame / And again a burning fire".

Actually, his ideas, expressed at the very beginning of the XX-th century, entitle us to call Vasiliev a thinker who anticipated the development of many parts of contemporary non-classical logic, especially its most pioneering and novel parts. Already in 1910 Vasiliev abandoned the law of contradiction and constructed a logic without this law. That is why he is justifiably considered as a forerunner of paraconsistent logic, which incarnates the idea of non-Aristotelian logic. Through his critique (and rejection) of the law of excluded middle, Vasiliev anticipated the birth of another alternative to classical logic, viz., intuitionistic logic. Moreover, due to introduction of new classes of judgements (and, respectively, new meanings of truth) he may be viewed as the predecessor of many-valued logic, which expanded the capability of classical logic. All of this enables us to compare *cum grano salis* the role of Vasiliev in logic with that of N.I.Lobachevskii in geometry: Lobachevskii's ideas gave rise to non-Euclidian, non-classical geometry; Vasiliev's ideas gave rise to non-Aristotelian, non-classical logic. Lobachevskii called his geometry "imaginary"; Vasiliev, too, called his logic "imaginary". Lobachevskii opened new horizons in the development of mathematics; Vasiliev, as well, opened qualitatively new perspectives in the development of formal logic, especially regarding the treatment of contradictory statements. Even though there were no new ideas in Vasiliev's logic, he is worthy of close study as one of the most original and prominent Russian logicians.

A close look at Vasiliev's life and work shows us that he is not only the founder of original non-classical logical theories, but a thinker with very wide interests - philosopher, ethicist, psychologist, historian, poet and even skilled interpreter. At present, Vasiliev, as a logician, is becoming more popular [1]; his non-logical studies have remained almost unknown and the biographical data consisted only of a short - ten lines - review in the *FILOSOFSKAYA ENCIKLOPEDIA*. Nevertheless, as a scientist Vasiliev attracted the attention of those logicians and mathematicians who independently arrived at similar ideas and tried to construct theories without laws of the excluded middle or the law of contradiction and who were interested in the history of psychology, ethics, symbolist poetry in the first quarter of the XX-th century in Russia. Some scholars worked diligently but unsuccessfully to find the archives of the Vasiliev's family (for instance, A.I.Mal'tsev). I too engaged in this search, and was fortunate to find two of his logical manuscripts and the "remains" of archive (diary, letters, photographs, books with Vasiliev's annotations, etc.). This material enabled me to write a scientific biography of Vasiliev and study his way to imaginary logic [2].

## GENEALOGY

We know that Vasiliev's ancestor, Baron von Uexkull, came to Russia in 1545 and was baptised in the Russian Orthodox Church with the name of Fyodor Ivanovich. We next encounter his grandson, Alexei Sokovnin, who was executed with the great grandfather of A.S.Pushkin, Boyarynia (Baron) Morozova, for her part in the plot against Peter I. The closest relatives of N.A.Vasiliev also left their mark on Russian culture. His grandfather - Vasily P.Vasiliev (1818 - 1900) – prominent sinologist, was a full member of the Petersburg Academy of Sciences. One of his sons - Nicolai V. (1857 - 1920) - a well-known Social-Democrat, was a close comrade-in-arms of G.V.Plekhanov. The eldest son - Alexander (1853 - 1929), the father of Nicolai A. Vasiliev, was a prominent mathematician, the founder of the Kazan physico-mathematical society and its first Chairman. A professor, and a member of many foreign societies, he started deep investigations into Lobachevskii's geometry and made his works popular. He was very active in public life and for years was a member of the State Council and First State Duma. A.V.Vasiliev studied in St.-Petersburg together with Aleksander II. Ul'yanov and left reminiscences about the period of their acquaintance. Being a professor, he participated in the University meeting which became famous in the USSR, for this meeting was the starting point of the revolutionary activity of Vladimir II. Ul'yanov (Lenin). Later on, the Vasiliev family was rather close with the Kerensky family.

## COURSE OF LIFE

N.A.Vasiliev was born on June 29, 1880. In his diary he recalled that he was growing into a "capricious, willful and even hypochondrical, but intelligent child. This was promoted by the choice of books and the entire intellectual atmosphere surrounding me." In the Vasiliev family, problems of all kinds - in the natural sciences, mathematics, the humanities - were actively discussed, which explains the extremely wide interests of N.A.Vasiliev. In his early years he studied psychology and logic quite seriously (even wrote an abstract of Ch.S.Peirce's article on the logic of relatives), reflected on the moral problems raised by L.N.Tolstoy and V.S.Solov'yov (he later devoted a special work to their controversy). In 1898 he entered Kazan University medical faculty having realized that psychological studies require deep biological and medical knowledge. In 1904 he graduated with a first-class honors degree, but because of his psychological, logical and philosophical interests, did not work for long. He wrote in a letter in 1904: "I now study Hegel, and fond of it. The idea is to derive the whole world from one concept which sound proudly".

In 1906 he passed examinations at Kazan University in the historical-philosophical faculty, but remained in the University to prepare his habilitation. After visiting Germany and participating with his father at the International Philosophical Congress in Heidelberg, he became convinced that psychology is merely a preparatory stage for logic. In that year his interest turned exclusively to logic.

On May 18, 1910 he gave a lecture in Kazan University to satisfy requirements for obtaining the title of privat-dozent, in which were expounded for the first time the propositions of imaginary logic. Thus the birthdate of the new logic was exactly fixed in Annals of history. On January 13, 1911 he gave a lecture in the Kazan physico-mathematical society entitled "Non-Euclidian geometry and Non-Aristotelian logic" and in April of the same year he gave a lecture before Moscow psychological society entitled "Duality in logic". In the summer of 1911 Vasiliev went abroad for 2 years and worked in libraries in Germany, France and England, while preparing the fundamental manuscript on imaginary logic (which was not published). In 1910 - 1913 his principal works on imaginary logic appeared. In autumn 1914 Vasiliev was drafted into Army as a doctor, which led to a deep depression. It was established that Vasiliev had the same disease as G.Cantor, and thus was dismissed from the Army. Nevertheless, in these periods of remission he

continued to work. He became a Professor in 1918, but after living through the siege of Sviyazhsk, his condition quickly worsened. In 1922, for the reasons other than health, he was obliged to leave the University. In 1925 Vasiliev published in Abstracts of International Philosophical Congress in Naples his last - a rather small and not very good - work (although he indeed continued to elaborate the special "mathematical logic of intensionality"), but his illness advanced, and he died on New Year's Eve, 1941.

### **ON THE THRESHOLD OF IMAGINARY LOGIC**

The analogy with non-Euclidian geometry had suggested the thought of a possible non-Aristotelian logic. "If there is a geometry of curved space, why can't there be a special kind of "curved logic", one prominent scholar reflected in 1910. And again: "The world has seen many new inventions. We can talk over the telephone at almost unlimited distances, and some of our contemporaries fly like birds through the air. Radium has been discovered which is often assumed, with a certain show of plausibility, to upset the laws of physics; but the invention of non-Aristotelian logic would cap the climax" [3]. However the image of such logic, at that time, was vague, only its possibility was recognized. Although there were high scientific hopes for its creation, the path to its discovery was long and bumpy.

### **"I RISK FALLING... UNDER THE CHARGE OF LOGICAL HERESY"**

The central points of the new logic was presented by Vasiliev, for the first time, as I mentioned, on May 18, 1910

in a lecture written as a basis for an article, "On partial judgements, on the triangle of opposition, on the law of excluded fourth", published in October of the same year.

Vasiliev began the exposition of his conception with the affirmation that, already in the logic of the XIX-th century there was a determined opposition to the traditional classification by quality of judgements into general, particular and singular judgements. Attempts to perfect this classification resulted only in giving it a new form. The basis of the opposition, meanwhile, lies in the interpretation of particular judgements. Vasiliev pointed out that actually particular judgements regarding concepts ("rules") are essentially general, and judgements regarding things are subject to traditional classification, whereas judgements about concepts and things required different logics. (Judgement, according to Vasiliev, is judgement about fact, if it includes in itself a temporal or spatial moment ("Ivan was sick today"); Judgements about concepts ("rules") do not contain such moments ("Ivan is a sick man")). The logic of excluded middle remains valid for judgements about things, facts, while for the judgements about concepts the law of excluded fourth is indispensable. "Therefore the law of excluded middle ought to be completely removed from the canons of the laws of thought", - proclaims Vasiliev. And he continued: "I, of course, risk conforming to that, of falling under the charge of logical heresy, or even worse, which is certainly frightening for everyone, and even more for a beginner. But my "logical conscience" does not permit me to reconcile with such laws of thought".

Vasiliev's first logical work attracted commentary. Some Russian logicians (N.O.Losky, I.I.Lapshin) noted that Vasiliev's arguments were very subtle and "succinct". Vasiliev persistently developed his ideas. How far he moved may be judged by his address in January 1911. The situation with which he came into conflict, as noted in the presentation of the discussion of Vasiliev's lecture in a Kazan source, strongly recalls the situation in which Lobachevskii discovered non-Euclidian geometry. As is well known, Lobachevskii rejected the fifth postulate of Euclid and constructed geometry without that postulate. Vasiliev attempted to discard one of the fundamental laws of Aristotelian logic - the law of contradiction, always taken as an axiom. It appeared that without that law it is possible to construct quite "consistent and closed systems", and that Aristotelian logic is one of the many, equally "true" logics. Thus, as a supplement to the

law of excluded middle Vasiliev gave up the law of contradiction, and excluded it from the canons of thought. Meanwhile, he proved that these laws possess deep sense as empirical generalizations and preserve their force in "telluric" things.

In our world, Vasiliev affirmed, only "positive" sensations are possible, by which we can distinguish only contrary qualities (in saying that the object is of a non-white colour a man actually draws the conclusion that the object is red, green, blue...). This is the basis of qualitatively different types of judgements - affirmative and negative. If one imagines a world in which not only positive but negative sensations are possible, then such a world will indeed require a different logic and the introduction of supplementary qualitative judgements. Just as Euclidian geometry possesses an empirical foundation, which makes the fifth postulate sensibly evident, this logic possesses its own empirical foundation through the law of contradiction. If one rejects the law of contradiction, then alongside positive and negative judgements it is possible to introduce still another type which Vasiliev called "indifferent judgements." (According to Vasiliev, this type articulated the presence in the object of contradiction and has the form "A is B and not B"). For the logic which operates with three forms of judgements, the law of excluded middle is not required, but the law of excluded fourth is. As the imaginary world becomes more complex, logic becomes more complex too, and perhaps will be not of two dimensions (as Aristotelian logic), but, generally speaking, of any number of dimensions.

However, not all logical laws represent empirical generalizations (the "material" aspect of logic). In any logic there are laws enabling judgements and reasoning (the "formal" aspect of logic). The division of these aspects presupposes two formal definitions of the law of contradiction. In the case the law forbids the existence of

two incompatible features of an object, in the other it claims that a judgement cannot be true and false simultaneously. The first definition might be rejected (and this is the case in imaginary logic); the second has to be valid for any possible logical construction. Vasiliev proposed to call it the law of absolute distinction of truth and falsity, or the law of non-self-contradiction. The minimum of logical laws required for reasoning constitutes a metalogic - the science of structures valid for every logical system.

In the subsequent works, "Imaginary (non-Aristotelian) logic", "Logic and metalogic", published in 1912 - 1913, Vasiliev provided a more complete picture of new logic. The concept of "imaginary logic" acquired a wider meaning in as much as Vasiliev constructed several types of logics, each of them called imaginary. "Imaginary logic, - he wrote, - inserts into logic the principle of relativity, the main principle of New Time. Many types of logic are possible; it is a ridiculous conceit to suppose that all thinking creatures are bound to Aristotelian logic".

Vasiliev constantly stressed the heuristic parallels between non-Aristotelian logic and non-Euclidian geometry. As he put it: "Imaginary logic is constructed by means of imaginary geometry method. Logic and geometry both enrich each other". Vasiliev understood the firm relation between logic and mathematics. Moreover, he urgently studied mathematical logic through the works of E.Schroder and B.Russell. Following D.Hilbert, who devoted his fundamental work to the foundation of geometry, Vasiliev stressed the importance of studies in the foundations of logic. In this area he was fortunate to discover new classes of judgements, negations, and to construct several systems of imaginary logic.

### **THE FATE OF N.A.VASILIEV'S LOGICAL IDEAS**

Like geometry, logic was one of the first sciences affected by non-classical tendencies. Non-classical logics are constructed in order to increase the capabilities of classical logic (for instance, modal logic), or their basic ideas may provide alternatives to classical logic (e.g., reject certain principles or laws of classical logic). Perhaps the most far-reaching logic in this sense is paraconsistent logic, since it gives up the central

principle of classical logic, mathematics, and even science - the principle according to which a formal system must be consistent. That idea that it is not permissible to have two judgements, one of negates the other is not so much an ideal as an "everyday" norm in classical science (and, strictly speaking, a norm of certain non-classical systems, for instance, intuitionism). If the theory is inconsistent, it is trivial, every formula is provable within it. Only in the late 1950s and early 1960s was it discovered (N. da Costa, D.Nelson) that inconsistent, but non-trivial, formal systems are possible. It is hard to imagine that at the beginning of the XXth century such systems were already constructed by Vasiliev, who was much ahead of his time. (I must note that simultaneously with Vasiliev the law of contradiction was severely criticized by J.Lukasiewicz, although in 1910 he did not propose a system alternative to classical logic).

Due to prolonged neglect of Vasiliev's ideas the critical review of his work by N.N.Luzin, an outstanding mathematician, was all the more significant. In 1927 he wrote: "Vasiliev's works on logic are of great importance in connection with investigations of the principles of thought as a whole, but... on account of the new tendencies in mathematics [intuitionism and effectivism are meant - V.B.] Vasiliev's ideas coincide remarkably with the latest efforts to which mathematicians resort by force of facts".

The conceptual wealth of imaginary logic has steadily come to the fore. First, the new classes of judgements, introduced by Vasiliev, have attracted attention, though it is clear now that this step is only indirectly connected to the rejection of the law of excluded middle. It is worth noting that Vasiliev gave up this law at the same time that Brouwer did, but independently of him. However, Brouwer's ideas had a more fortunate fate. Second, Vasiliev's abandonment of the law of contradiction has been much remarked.

The point is that classical logic is forced to restrict its own linguistic tools due to the implicit threat of inconsistencies and paradoxes. The most radical forms of such tendencies lead to the exclusion of whole fragments of traditional mathematical theories (as, for example, in intuitionism). We may judge that even the pursuit of an unconditionally consistent system is a restriction of a certain kind, the converse of which is the phenomenon of the unprovability of a system's consistency by its own means (Godel's theorem). Meanwhile, the very aspiration for the consistent systems is the main stimulus of restrictive tendencies. Hence, consistency is not a sine qua non condition for formal systems. The only condition of this kind is the non-triviality of formal systems, i.e., not all judgements, expressed in a certain language, are equally provable. Paraconsistent logic is par excellence aimed at studying inconsistent, but non-trivial systems.

The fact that paraconsistent logic separates itself from the classical structure of knowledge endows it with some unusual features. Thus, for such systems the standard proofs of Godel's theorems are not yet valid, and it may be that even their sense will have to be reconsidered. In such systems the relation between provability and truth radically weakens. Moreover, the principle of external premises seems to be more fundamental than that of consistency of the formal systems. The study of paraconsistent systems is in the cradle, so to speak, but to my mind the influence, in the future, of paraconsistent ideology on mathematics may be very profound.

Vasiliev's idea of the plurality of logical systems has been realized. "I am very well aware of the fact, - wrote Vasiliev in 1912, - that my idea of new logic contradicts the millennial conviction of mankind..." Half a century had to pass before the ideas of imaginary logic revived like Phoenix from the ashes; and we may evoke their fate in the words of Emile Verhaeren - the poet, beloved by Vasiliev: "Now comes the time for things / Which seemed a delirium yesterday."

## NOTES

1. Vasiliev N.A. Imaginary logic. Selected papers. Moscow, Nauka, 1989 (in Russian).
2. Bazhanov V.A. Nicolai Alexandrovich Vasiliev (1880 - 1940). Moscow, Nauka, 1988 (in Russian).
3. Carus P. The nature of logical and mathematical thought. - In: MONIST, 1910, vol. 20, p.46.

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