

C.S. PEIRCE'S INFLUENCE ON THE LOGICAL WORK OF N.A.VASILIEV

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**Abstract.** We deal with the heuristic influence of C.S. Peirce's logical ideas on the creation of imaginary, non-Aristotelian logic (logic free of the laws of contradiction and excluded middle) by Nikolai Aleksandrovich Vasil'ev (Vasiliev) in 1910-13 and with the circumstances that attended and made easier the creation of imaginary logic.

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How do radically new revolutionary ideas in science emerge? What can we say about the nutrient medium favouring the birth of such ideas? What are the mechanisms of their maturation? These questions belong mainly to the psychology of scientific research and may be treated only on the basis of a large amount of empirical data from various fields of research. The new "lunatic" ideas that these data suggest become, either immediately or eventually, the cornerstones of original academic conceptions, theories, or directions of research.

The important ingredients of creativity are "prompts" of one kind or another that make the creative process easier; they make it possible to seek and find new approaches, encouraging the scholar to complete the task and overcome handicaps on the way to the discovery. Heuristic prompts may be of unexpected origin and nature, coming from unexpected areas of life and knowledge. These prompts may be vague "sensations" of some kind that are temporarily implicit, as yet unarticulated ideas, indeterminate anticipations, in lucky combinations and circumstances that become the catalysts of fruitful new approaches and outstanding discoveries.

As André Weil stated in "From Metaphysics to Mathematics" [Weil 1980, 408]: every mathematician is aware that there is nothing in the way of heuristic influence that is more fruitful than some vague similarities, dim glimmers of one theory to another, which are

like “furtive endearments and inexplicable disagreements” (“*ces furtives caresses, ces brouilleries inexplicables*”). Yu.I. Manin, citing this thought, reminds us of “the metaphysics of infinitesimals – the system of vague and hardly formulated analogies, which nevertheless played a crucial role in scientific discovery” [Manin 1984, 47].

N.A.Vasiliev’s work is the forerunner of modern non-classical logics. What vague similarities, uncertain and barely formulated analogies, fed his work? To my mind they can be specified: (a) Charles Peirce’s logic of relatives, which Vasiliev learned about when he was only seventeen years old; (b) the symbolist poetry that paid a great deal of attention to the subject of another world; (c) the special psychological standpoint, used for the critical analysis of Aristotelian logic; and (d) Charles Darwin’s ideas on the evolution of life.

The present article deals only with the prompts that Vasiliev received from Peirce’s ideas, though the other streams of heuristic influence are both worthy of study and also quite instructive [Bazhanov 1990a].

Nikolai Aleksandrovich Vasiliev (29 June 1880 – 31 December 1940) was Professor of Philosophy at Kazan University. As early as 1910, in his “imaginary logic,” he abandoned the law of contradiction and constructed a logic without this law. For this reason he deserves to be recognized as the founder of paraconsistent logic. Strictly speaking, it was precisely in paraconsistent logic that the idea of NON-Aristotelian logic was formally first incarnated. The idea had excited the minds of scholars from the end of the nineteenth to the beginning of the twentieth centuries. Vasiliev’s severe criticism and ultimate rejection of the law of excluded middle makes him the forerunner as well of another alternative to classical logic, namely of intuitionistic logic. Due to his introduction of new classes of judgements (and truth values), Vasiliev may also be considered to be a founder as well of multi-valued logics which expanded the possibilities of classical logic [Bazhanov 1988; 1990].

Vasiliev’s imaginary logic became the precursor of modern non-classical logic. His path to imaginary logic was steep and toilsome. The starting point of his path is to be found in the youthful animations and in the “vague sensations” of the future scholar. The first heuristic prompts were received by seventeen-year old Vasiliev due to summarizing Peirce’s work on logic of relatives [Peirce 1897]. The point is that young Vasiliev was deeply interested in psychology and logic. In his surprisingly serious diary, young Vasiliev paid much attention to making summaries of specific logical works.

Almost all of the work in logic to which the young Vasiliev had access was carried out within the context of the Aristotelian tradition. Peirce’s work, written in different style, stands out against a background of papers written in the Aristotelian mold. Taking a survey of the logic of his time, Vasiliev noticed that in Aristotelian logic, the theory of judgements implies the existence of the subject, predicate, and copula that are part of the judgement, while in the logic of relatives the theory of judgements is not exhausted by predicates belonging to subjects, but is based on far wider understanding of relations

among things. In the logic of relatives we have not two terms of judgments, as in Aristotelian logic, but at least three terms.

We may argue that Vasiliev perceived in Peirce's logic of relatives evidence of the imperfection of Aristotelian logic and the narrowness of the traditional theory of judgements and its terms, as a result of which he realized the important possibility of different modes of logical reasoning, of the non-absolute character of classical logic and its basic laws.

Here is found an example of that "obscure opposition" to traditional theory of judgements, an opposition which encouraged Vasiliev to create a radically novel classification of judgements which served as the foundation for imaginary logic and led to rejection of some central principles of traditional (classical) logic. Vasiliev's acquaintance with the ideas in Peirce's work that go beyond Aristotelian logic provided the specific kind of "imprinting" (to use the biological term) in Vasiliev's mind that later facilitated the origination of the ideas of imaginary logic. Suffice it to say that it was not by accident that the first steps toward the creation of a novel logic were his critique of the traditional classification of judgements and his proposal to attempt an original method for the classification and comprehension of propositions.

It is probable that Peirce's work was first noticed by Nikolai Vasiliev's father Aleksandr V. Vasiliev. Aleksandr Vasiliev was a prominent mathematician and social figure. In 1894 he published a brief study of the life and work of N.I. Lobachevsky. (A.V. Vasiliev worked on the book constantly until his death, expanding it in the light of new historical data; in 1927 his book, then nearly 700 pages, was published, but all copies were totally destroyed; only in 1992 will we at last see the book published again). In [1895], Peirce wrote a review of G.B. Halsted's [1894] English translation of A.V. Vasiliev's book. This review was known to A.V. Vasiliev; he also knew of Peirce's work and activity, which he highly appreciated and to which he paid special attention.<sup>1</sup>

It is worth noting that ideas in the logic of relatives were vigorously developed in Russia by Moscow University professor Nikolai Yakovlevich Grot (1852-1899) in the late nineteenth century. In his book *On the Reform of Logic*, published in [1882], Grot presented ideas consistent with Peirce's ideas (with the reservation that Grot and Peirce belonged to different paradigms). Grot's style of constructing the logic of relatives was rather close to Vasiliev's ideology and ideas. Both scholars shared the psychologist's standpoint (platform) in logic, for Grot was the chief editor of the journal *Voprosy filosofii i psikhologii* ("Problems in Philosophy and Psychology"), which Vasiliev read regularly. Moreover Vasiliev reported in his 1908 account (see [1989, 143]) that he was familiar with Grot's ideas.

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<sup>1</sup>A review by Duffy [1990; see especially pp. 75-81] of the author's biography of N.A. Vasiliev ([Bazhanov 1988]) takes particular note of the connections inherent in the analogy between Lobachevsky's "imaginary" non-Euclidean geometry and N.A. Vasiliev's "imaginary" non-Aristotelian logic.

Most supporters of psychologism were opposed to the mathematization of logic. Vasiliev, however, declared that this process makes it possible to open new horizons for the development of logic. Though he did not use the methods of mathematical logic (being acquainted with them only in the most general terms), his psychologism helped him to propose radically new, essentially non-classical, systems formalization by means of mathematical logic. Coincidentally, in 1909 Peirce accused himself of psychologism.<sup>2</sup>

Vasiliev's second "confrontational" contact with Peirce's ideas took place in 1908 at Third International Philosophical Congress. A third "confrontation" was fixed in history as occurring in 1910. Vasiliev concentrated on the idea of non-Aristotelian logic. This idea was brought to his attention by the article of Paul Carus [Carus 1910] containing long quotations from Peirce's letters. Vasiliev's copy of the 1910 issue of *The Monist* containing Carus's paper (kept in the present author's archives of the Vasiliev family's library) is filled with Vasiliev's annotations.

The notion of non-Aristotelian logic was still rather general at the turn of the twentieth century; it contained only the idea of an abstract possibility of its construction. Aristotelian logic is incomplete and ineffective, though as yet no mistakes have been found in it, Carus [1910, 44] declared, expressing thereby the opinion of a member of the scientific community radically disposed against Aristotelian logic.<sup>3</sup> In support of his position, Carus cited Peirce's letters dealing with the question at issue. Before starting his studies of the algebra of relatives, Peirce, according to one letter (to Francis C. Russell, quoted by [Carus 1910, 45]), "made some investigation" into the consequences of the hypothesis that logical laws might differ from those that were known at the end of nineteenth century (though Peirce unfortunately failed to clarify the details, vital in the case given). Acceptance of such hypotheses lead to some sort of non-Aristotelian logic. Some aspects of the study seemed "interesting" to him, but not important enough for publication. In the letter (as quoted by [Carus 1910, 45]), Peirce wrote:

Before I took up the general study of relatives, I made some investigation into the consequences of supposing the laws of logic to be

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<sup>2</sup> Editor's note: In the circa 1911 manuscript "A Sketch of Logical Critics" (Robin Catalogue number 675) in which he enumerates some of his earlier philosophical mistakes regarding the relationship of understanding and belief to logic specifically and the nature of reasoning generally, and separates the psychological from the logical aspects of reasoning, Peirce wrote that "there is no worse fallacy than to think that logic is a study of the human understanding." But even as early as [1865], Peirce argued strongly against the neo-Kantian inclusion of theory of knowledge and psychology of reasoning as part of logic. Searches of material held by the Peirce Edition Project by the Project's historian of logic Nathan Houser failed to locate a reference from 1909 to the self-criticism.

<sup>3</sup> Carus [1910, 44] wrote: "Aristotelian logic is incomplete and insufficient. It treats only the most simple relations and does not cover the more complicated cases of thinking, but so far as it goes it is without fault."

different from what they are. It was a sort of non-Aristotelian logic, in the sense in which we speak on non-Euclidean geometry. Some of the developments were somewhat interesting, but not sufficiently so to induce me to publish them. The general idea was, of course, obvious to anybody of sufficient grasp of logical analysis to see that logic reposes upon certain positive facts, and is not mere formalism. Another writer afterward suggested such a false logic, as if it were the wildest lunacy, instead of being a plain and natural hypothesis worth looking into [notwithstanding its falsity].

Thus, Peirce was categorically opposed to those scholars who rejected the possibility of non-Aristotelian logic beforehand as false, as "lunacy" instead of considering this quite natural hypothesis as worthy of investigation, regardless of its truthfulness.

In another letter, complementary to the previous letter just mentioned and providing an explanation of his comment on non-Aristotelian logic, Peirce explained that he never excluded the worth of a continuation of previous studies of non-Aristotelian logic. They might at least reveal features of logic which for the moment remained hidden from sight. But he had decided at that time that this direction of research was not very important. In a follow-up letter to Carus, explaining the ideas of non-Aristotelian logic found in the letter to Russell, Peirce wrote (as quoted in Carus [1910, 158]):

It does not seem to me to have been a lunatic study. On the contrary, perhaps if I had pursued it further, it might have drawn my attention to features of logic that had been overlooked. However, I came to the conclusion that it was not worth my while to pursue that line of thought further. In order to show what sort of false hypotheses they were that I traced out to their consequences, I will mention that one of them was that instead of the form of necessary inference being, as it is, from  $A$  being in a certain relation to  $B$ , and  $B$  in the same relation to  $C$ , it necessarily that  $A$  is in the same relation to  $C$ , I supposed, in one case, that the nature of Reason were such that the fundamental inference was  $A$  in a certain relation to  $B$  and  $B$  in the same relation to  $C$ , whence it necessarily that  $C$  is in the same relation to  $A$ ; and I followed out various other similar modifications of logic.

The follow-up letter quoted in [Carus 1910, 158] clearly shows then that Peirce tied construction of non-Aristotelian logic to a modification of the law of transitivity.<sup>4</sup> Carus

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<sup>4</sup>Note that in his explanatory letter ([Carus 1910, 158]), Peirce gives modification of the law of transitivity as an *example* of the sort of false hypotheses he considered. A thorough search of Peirce's

disagreed with Peirce's approach to the nature of non-Aristotelian logic and method of construction. He stressed that Peirce's treatment of Aristotelian (and non-Aristotelian) logic factually presupposes a different, rather than the commonly accepted, understanding of logic and of the nature of non-classical logic.

Moreover, the law of transitivity had never been included in the list of basic laws of Aristotelian logic and thus was far from being one of its central principles. That is why Carus's account of the modification (or even abandonment) of the law of transitivity cannot be considered as the starting point of the building of non-Aristotelian logic.

Vasiliev apparently had his attention fixed on this article by Carus containing excerpts from Peirce's letters when, in May 1910, at an inaugural lecture he proposed a novel non-Aristotelian logic system based on a new classification of judgements. In October of the same year, the lecture was published in the form of a brochure.

Vasiliev's article "Logic and Metalogic" [1912-13] was crucial for imaginary, non-Aristotelian logic. In this article, Vasiliev noted that he is unfortunately forced to withhold his assessment of the ideas of various prominent logicians, Peirce's among them (see [Vasil'ev 1989, 122]).

Peirce and Vasiliev were thinking along the same lines, by which we mean thinking of the creation of non-classical logic. Conjectures of the non-universal character of the laws of (non)-contradiction and excluded middle probably struck Peirce's mind at the end of the nineteenth century. From the beginning of the twentieth century, Peirce not only expressed his doubts about the universality of these laws, but made attempts to construct systems of multi-valued logics, limiting the scope of the law of excluded middle. I am, however, unaware of a desire on Peirce's part to also build a logic allowing contradiction, though he was "suspicious" of the law of (non)-contradiction.

Thus Vasiliev from the very outset of his conscious life, that is even long before the start of his academic life, had in a sense known Peirce's logical achievements as sorts of heuristic prompts that made it easier to find new types of non-Aristotelian, imaginary logic. They were among the building blocks of novel logical constructions.

The other heuristic prompts, as I have had already mentioned, were symbolist-style poetry, the peculiar psychological treatment of logical realities (for details see [Bazhanov 1988]), and Darwin's theory of evolution (see [Bazhanov 1990a; 1990b]).

Thus we can more clearly imagine what "vague analogies and sensations" followed Vasiliev on his way to imaginary, non-Aristotelian logic, what implicit ideas and similarities fitted his work.

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*Nachlaß* would be required to determine whether Peirce indeed considered other possibilities as well, and if so, what they were.

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