

## COMPLEXITY OF MATHEMATICAL CONCEPTS IN POETIC OPERATION OF ION BARBU (DAN BARBILIAN)

Virginia Popović<sup>1</sup>, Kristijan Cincar<sup>2</sup>

<sup>1</sup> University of Novi Sad - Serbia, Faculty of Philosophy

<sup>2</sup> Department of Computer Science, Faculty of Mathematics and Informatics, West University of Timisoara - Romania

Corresponding Author: Kristijan Cincar

**ABSTRACT:** The Romanian poet Ion Barbu, also known by the nickname Dan Barbilian, was one of the most famous poets and mathematicians of the last century. Ion Barbu states that in poetry, as in geometry, he can see "a different symbol for expressing the possible forms of existence." For him, poetry is "the prolongation of geometry", so "remaining in the field of poetry has never abandoned the divinity of geometry". Dan Barbilian's contribution was to analyze how general this procedure is to build a distance and establish a theory of metric spaces fitted with this distance.

**KEYWORDS:** Romanian poet Ion Barbu, poets, mathematicians, geometry, theory of metric spaces, distance, geometric model.

### 1. INTRODUCTION

The Romanian poet Ion Barbu, also known by the nickname Dan Barbilian, was one of the most famous poets and mathematicians of the last century. He supports his doctoral thesis on the canonical expression of hyperreptile sets in which algebraic and geometric ideas intertwine with mathematical analysis. Therefore, as in a geometry theorem or demonstration, Ion Barbu draws from the first lines the coordinate axes through Kantian principles: time and space. The artistic beauty poet Ion Barbu finds in the interference between Poetry (Poesis) and Mathematics (Mathesis). His way of thinking in the abstract spirit of mathematics has influenced his poetic work, as well as influenced by mythical-biblical language, by which he makes, through Platonic influence, the "transcendence" of the realm of transmutation, a symbolic destruction of the materia by form. Within the symbolic imagery of Barbu we find a geometric imaginary. Art, poetry must reflect the sensory reality, but in the depth of reality we must find the geometric, crystallized, ideal. That's why the poet testified that poetry is a "distracting bypass around a few dome, the narrow polyhedral perfection" ([Ade76]). Ion Barbu states that in poetry, as in geometry, he can see "a different symbol for expressing the possible forms of existence." For him, poetry is "the prolongation of

geometry", so "remaining in the field of poetry has never abandoned the divinity of geometry" ([Ade76]).

### 2. GEOMETRIC MODEL OF POETRY

Ion Barbu finds interpenetration between poetry and mathematics, especially in the third stage of Ion Barbu's hermetic lyricism, which is considered to be the highest point of existence that moves towards the discovery of the latter spiritually and which leads to communication with the revelations world. Mathematical work and the influence of mathematics on his poetry allow for continuous investigation. A significant number of scholars have attempted to demonstrate that some mathematical formulas lead to the creation of verses of Barbu's poems, mathematical symbols were investigated in parallel with their equivalents in the symbols found in some poems, as well as the influence of Romanian and foreign mathematicians on his work scientific. As a result of the research on the influence of mathematics on Ion Barbu's poetic work, he has come to different interpretations of his work, approaching the seemingly untouched mystery of the "second game" poetry cycle. There is also a strange moment of geometry, because "where geometry becomes rigid and resilient, poetry opens up a horizon of knowledge and imagination" ([Bar70]). Ion Barbu's poetry also reflects the specificity of his biography: the poet (Ion Barbu) had to prove his professional education, the mathematician (Dan Barbilian). The answer can be found in two additional solutions: the first solution is to translate mathematical science into poetic space, taking an absolute, mitizing form; the second solution is to prevent the mathematical poetry approaching. Until the advent of his work, a great number of literary mathematicians and critics have dealt with the themes of influences on Barbu's poetry and have come up with interesting solutions. The poet himself, when he realized that "for him all the games were consumed," renounces poetry,

pointing, as he himself said, to the final "white sphere" of his life, "marking the ending, ie fulfillment" ([Bar70]).

The mathematical report - poetry was written by the Hungarian mathematician Mandics György, whose exegesis is among the very few attempts that go from the concept of canon to approach the barbian work. The problem debated by György Mandics is proven in synchronicity with Solomon Marcus, as early as 1973, when Marcus published the study of Poetic Mathematics. For this, Barbian Hermetism has as an axiomatic model and the canon of mathematics. Canonic barbian hermetism "installs quality instead of quantity," which some critics of the interwar period (such as Ovid S. Crohmallniceanu) were forced to recognize in the analysis pages of the Second Game Lyrics. The geometric model is asserted by Ion Barbu in Felix Aderca's interview: "I will continue with each piece to propose substantially indefinite existence": disturbing deviations around a few dome - "the narrow polyhedral perfection" ([Ade76]). The geometric model is present in the entire barbian universe, from the first to the last verse of the second volume volume - and in the poem From the clock, deduced ... At the same time, the nadir symbol, which means an inverse point to zenith, suggests a center of consciousness, that is, the spirit that generates the universe. By translation, the point generates right: "Dream of the Simple Straight!", Conclusion; then the triangle ("eye in the virgin triangle", Grup), then the square ("Souls in the square of the day conjugate", the gate), the prism ("High in the prism organ weigh", Dioptrie) cubes", Romantic Parallel), Spiral ("Ordered Spiral", Uvedenrode), heptagon ("Eptagon with Star Peaks", Conclusion). These symbols have the role of suggesting "polyhedral perfections": the cube (representation of the earth principle), the tetrahedron (representation of the fire principle), the octahedron (representation of the principle of air), the icosahedron (representation of the water principle), the dodecahedron of the ether or apeiron principle). All these perfect polyhedrons are patterns expressing the constant or number of gold, the form of the law of harmony and balance.

### 3. BARBILIAN SPACES

For many, the way to mathematician Dan Barbilian's knowledge is long and not always fulfilled. Thanks to admiring the poet, I understand Barbilian's pride for what he did in mathematics. His lasting work, and without claiming to the popularity acquired in the other genre in which Barbilian has expressed, gives us a deep inspiration for one of Romania's greatest mathematicians. The second game volume

was published following a bet with Tudor Vianu, that he can write poetry (other sources tell about an understanding: if Barbu managed to publish poems, Vianu had to critically analyze his creation). Ion Barbu taught, as a university professor, until the end of his life, only special courses from the last years of the faculty, attended by a small number of very good students. After his death, much of the mathematical work and didactic work was published in volumes. These manuscripts are scattered through notebooks, separate sheets or on the edges of many Numbers in the Mathematical Gazette of the years before World War I. He was considered a mathematician of European reputation, imposing, in geometry, the term "Barbilian spaces". Dan Barbilian's contribution was to analyze how general this procedure is to build a distance and establish a theory of metric spaces fitted with this distance. In his work in 1934, he defined a metric within a certain planetary region, generalizing the idea of the Poincaré model, which is defined only within the drive disk. With that metric, the interior of the crowd became a non-Euclidean geometry model. In one of the works of 1959, Barbilian suggests the name of Apollinian metrics for what Blumenthal and Kelly proposed to be called "Barbilian spaces." Thus, we can say that the idea of 1934 proved a remarkable durability. In 1981, P.J. Kelly published a non-Euclidean geometry textbook with Springer-Verlag along with G. Matthews (from the State University of California), volume ending with a chapter devoted to "Barbilian spaces".

This chapter is of remarkable clarity and demonstrates that, in the hand of a skilled educator, "Barbilian spaces" can become a useful teaching tool in illustrating non-Euclidean geometries. The 1934 work has returned to the attention of researchers in recent years, especially since, in 1995, Alan F. Beardon (from Cambridge University) succeeded in generalizing it (the paper was published in 1998). In 1998, F.W. Gehring (from Michigan University, Ann Arbor) and K. Hag (from the Norwegian University of Science and Technology) continued Beardon's idea, reading as a starting point the construction of Barbilian in 1934 (their work appeared in 2000). Since then, Barbilian's work in Prague has been quoted by Peter Hästö (from Helsinki University) and by Zair Ibragimov (one of the citations of this author is in his Ph.D. thesis at the University of Michigan, Ann Arbor, 2002; is currently at the University of Cincinnati) in their study of Apollinian metrics. These are significant citations in important scientific impact journals. A more comprehensive monograph on the subject, hyperbolic geometry and Barbilian spaces, appeared in 1996 under the signature of Wladimir G. Boskoff, at Istituto per la Ricerca di Base, Hardronic Press.

There are other recent contributions to this issue. The idea of "Barbilian space," as well as the interest in the Barbilian geometry area from 1934-1939 and 1959-1961, continues to this day.

About these "Barbilian spaces" an interesting article was written by Wladimir Boskoff and Bogdan Suceava in the „Observator Cultural magazine“ in issue 286 of September 2005: The story of "Barbilian spaces" or what happened after the *Second Game*. Until now, he is valued at his true value both as a mathematician and as a poet. "Barbian poetry falls on the psychologically sophisticated and sophisticated paste of avant-garde Romanian inter-war literature. The absolute lyricism of his creation, of an exuberant wealth of games of ideas and feelings in an overflowing metaphor, is a symbol of symbolic value and salvation, the supreme tribute to the poetic contemplation of Creation ... As an austere thinker, Ion Barbu is an adept convinced of determinism and ordering, modern realistic aesthetics, his essayistic creation being a prose of ideas (theoretical considerations of criticism and literary history, receptions and references in the philosophy of science, portraits, etc.), in which the avalanche of concepts and assumptions, dressed in Augustan expressions, charming as sublime discourse, is conquering through purity and detachment" ([Col06]). Knowing the Barbique work, perceiving the wide universe of significance expressed in a solemnly developed system of signs is a difficult process for the modern lecturer. "Geometry of the poetic space, spiritualization of the mathematical one; the essence of lyrical perception, the individualization of algebraic discourse - these are the coordinates that axiomatically fix in barbaric work the transcendence of the real in the space of Pure Knowledge. Both mathematical and poetic discourse lends itself to the unique beauty of the Higher Knowledge. Styling a poetic image as well as a mathematical demonstration until they come to express The idea in its purest form, the most abstract and closest to the essence of knowledge, is the "sign" to which the creation of the barbi (li) is. Gnostic aspiration brings him closer to the great thinkers of the nineteenth century" ([Ser07]). Creation, poetics or mathematics draws the marks of a unique destiny, not only in the space of Romanian culture, but also in the universal one. Ion Barbu "is the most difficult poet not only in Romanian literature" ([Man84]), his difficulty is "in the existence of a univocally imagined, but unspoken object, only circumscribed by a mathematician's own methodology" ([Man84]). The literary critic, Eugen Lovinescu, tells Barbu that he has enriched literature with a new talent through geometric vigor and the novelty of conception

because Ion Barbu opted for "cryptic poetry, essentialized, mysterious, initiatory" ([Ruj08]).

Geometry, therefore, is more than a branch of science in Barbaric work, it is a concept, a principle, a way of perceiving the world, a stylistic category. The poet and mathematician proposes an original formula of this new humanism: what distinguishes classical humanism from modernism is precisely the emphasis on "mathematical formation" ([Bar67]). Having as a starting point the geometric vision, as an expression of the essence intuition circumscribed to a unique synthesizer principle, Barbian humanism proposes a configuration of possible worlds. The fundamental axis of this new humanism: openness to innovation, to likely interpretations: "In the new humanism, the probability, as a dialectical opening in the method, becomes fundamental to the hieratism of Greek geometry transformed into a philosophical dogma" ([Min90]). Barbu talks about the connection of mathematical conception with his poetry in: "We are Einstein's contemporaries who compete on Euclid in the imagination of abstract universes, and we have to make new demiurg's competition in the image of probable worlds" ([Bar68]).

The originality of Barbilian's mathematical idea consists in the re-examination of the Poincaré model of Lobachevski's non-Euclidean geometry. This pattern naturally generates a distance that can be represented as logarithmic oscillation. Dan Barbilian's contribution was to analyze how general this procedure is to build a distance and establish a theory of metric spaces fitted with this distance. In the 1934 paper, he defined a metric within a certain planar region, generalizing the idea of the Poincaré model, which is defined only within the drive disk. With that metric, the interior of the crowd became a non-Euclidean geometry model. These results have been cited and used over the years by many mathematicians, including (in the chronological order of contributions) Leopold M. Blumenthal, PJ Kelly, Wladimir G. Boskoff, Alan E. Beardon, FW Gehring, K. Hag , Peter A. Hasto, Zair Ibragimov, H. Linden, P. Sousa, S. Ponnusamy, SA Sahoo, MG Ciucă, Bogdan Suceava. In an interview before the release of the Second World War (1930) and much more before the publication of his major mathematical contributions of considerable value (Der Riemansche Raum kubisher Binarforngen, 1938, known as Barbilian Spaces / Group, Axiomatic Classical Mechanics, 1945), Barbilian said in an interview: "I am more than a mathematician and little as a poet, and only as poetry reminds of geometry. No matter how contradictory these two terms seem, at first glance, there is somewhere, in the high field of geometry, a luminous place where he meets poetry." ([Val27]).

At the mathematical congress in Prague, he drew the attention of L. M. Blumenthal, one of the most important geometers, who published in 1938 a paragraph dedicated to "Barbilian spaces". The dramatic history of the East by imposing the Iron Curtain has led to the violent and total separation of the Western world. In 1954, American mathematicians were interested in Barbilian's theory in 1934. Paul Joseph Kelly, a mathematician with old literary and linguistic preoccupations, became a professor at the University of California Santa Barbara after the war. He published in 1954 an article in a mathematical journal, where he prefers Barbilian's approach to the theme at the expense of the Poincaré model, Barbilian's approach "having the advantage of simplicity and generality." The Montly Mathematics Magazine in which this article appeared was and has remained one of the most important publications in the world. L. Blumenthal was to review Kelly's article in "Mathematical Reviews". Ion Barbu finds out in this magazine about Kelly's "Montly" article when he thought he was no longer interested in any of his pre-war research. This success encourages him to return to the geometry studies and to carry out the research that began sometime. Thus, towards the end of his life, he will conceive four works of geometry on the theme of the known subject. The 1934 theory again comes to the attention of the Americans with the publication in 1981 by Kelly of a non-Euclidean geometry manual with G. Mathews;

#### 4. MATHEMATIC MORPHOLOGY

For Barbilian, mathematics is a world in which the freedom and the perspective of ideas, the rigor of mathematical demonstration, and the solemnity of the mathematical sign configures an art of higher thought: "Mathematicians are not that monotonous construction, the reflection of an identical spirit to itself [...]. This widespread opinion among the profane is wrong" ([Bar68]). Mathematics is a sacred science, a "immersion of the research spirit in its raw and living springs: in the simple data of intuition" ([Bar68]). "Mathematical Morphology" ([Bar68]) also implies "an algebra and a theory of numbers as free as servitudes of calculus in which formulas reduced to a minimum have somehow the role of geometric figures: to fix ideas without participating essential to the inner fabric of reasoning" - as in the mathematics of Gauss and Galois ([Bar68]).

Well-known in specialist circles around the world through his important algebra results, and through his name-bearing spaces, he creates his algebraic work at a time when, after a long process of accumulation of numerous particular facts, there was

a need for a organization of this material, its hierarchy, by the separation of some general structures. Dan Barbilian's creative activity has been manifested in this algebra, the so-called non-algorithmic, activity that replicates, on another plane and by other means, the tendency towards abstract, essence extraction.

#### 5. MATHEMATICS ABOUT RELATIONSHIP BETWEEN MATHEMATICS ART / POETRY

Its mathematical texts, though abounding in metaphorical terms, retain their clarity and precision. According to Dan Barbilian, "mathematics, like other human activities, raises style problems that can not be indifferent to the philosophers of culture" (Numerus vol.10, 1943, p. 65). Mathematics and Poetry were an essential part of his spirit, a way to live, to contemplate the world. He understood the essential meanings of the coexistence of several geometries. Non-Euclidean Geometry, born to Lobachevski and Bolyai in 1840, though quickly started to make fruit through Gauss, Riemann, Lagrange, Poincaré, was legalized by Hilbert and Klein, continued to make fruit through Einstein, Cartan and Finsler, but penetrated in the Romanian society since 1934 thanks to Dan Barbilian who brought new presentations. At the congress of Slavic mathematicians in Prague, Dan Barbilian presented a communication whose abstract (in German) contains two pages. Very quickly, the US Geometry, L. M. Blumenthal, in its Distance Geometry monograph, establishes a "Barbilian Spaces" paragraph of these ideas. Direction is associated with P. J. Kelly, Wilhem Blashke and then many others. Currently, the international index of geometry includes Hjemslaev, Barbilian, etc. Perhaps nothing better illustrates reciprocal resonances between a mathematician, a poet and a philosopher than how he comments on his mathematical discoveries and others. In the opinion of Solomon Marcus, Dan Barbilian appears to be the first to observe in 1943 "at Hilbert stands out, overwhelming by its originality, an insoluble idea, such as the assertion of the ring structure of language in relation to the operations of the syntax." Solomon Marcus has set the exact measure of things and people, and even his polemic poetry texts impress with the impeccable accuracy of accent placement. An example in this respect is the chapter Dan Barbilian - Ion Barbu. With full faith, with the seriousness and lack of moral involvement of a scientist, Solomon Marcus examines the personality of the poet's mathematician in all its aspects. Reluctantly praising the poetic work and mathematical work, by properly examining the work of Dan Barbilian's professor, Solomon Marcus does not silence any less episodic

episodes in his life. The mathematician who researched the influence of mathematical symbols on Ion Barbu's poetic creation is Mandics György. Ion Barbu's book in 10 poems appeared in print in 2001, re-published in 2003, at the Dacia Publishing House in Cluj-Napoca. This book is divided into four chapters where the mathematician, through an original research, discovers the hidden mathematical symbols in Ion Barbu's three cycles of poetry.

## CONCLUSIONS

Poetry and mathematics can be met, therefore, they can develop correspondences, both of which assume a particularly elevated spiritual level. That's why it's also very difficult for the same person to go both ways. This difficulty was felt by Ion Barbu. Considering that he failed to attain that ideal convergence, the poet retired in the field of mathematics, yet without ever escaping the nostalgia of complementarity. Looking at the detachment and clarity that the passage of time articulates, we can say that in Barbu's person these contradictions melted away because the mathematician and the poet of genius did not cease to coexist in him. His works are of great scientific importance and they combine a wonderful computing skill, a deep, safe logic and a rich intuition because Ion Barbu puts the most varied and interesting problems he treats with ingenuity and pursues them in the farthest their consequences. The originality of his mathematical thinking has been recognized abroad, and his work is still a subject of study. Creator of meaningful and rigorous demonstrations, Ion Barbu proposes his own hermeneutics, the barbi (li) annotation, "whether it is mathematical or poetic, is a noble game of spirit meant to express maximum meanings in the minimum of signs" ([Ser07]).

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