Mathematicians and Poets

Cai Tianxin, translated by Robert Berold and Gu Ye

Mathematicians and poets exist in our world as uncanny prophets. The difference between them is that poets are thought to be arrogant because they tend to be proud and lonely by nature, while mathematicians are thought to be unapproachable because they exist on a transcendent plane. Thus in art and literary circles poets are often considered to be socially inferior to novelists in the same way that mathematicians are considered socially inferior to physicists in scientific and technological associations. But these things are only superficial.

"I'm a failed poet," the novelist William Faulkner said humbly in his later years. "Maybe every novelist wants to write poetry first, finds he can't and then tries the short story, which is the most demanding form after poetry. And failing at that, only then does he take up novel writing." Physicists, by comparison, are not so modest. Nevertheless, for a physicist every increase in knowledge of physics is always guided in two ways, by mathematical intuition and empirical observation. The art of physics is to design experiments in order to derive the laws of nature. In this process mathematical intuition is indispensable. In fact, it is easy for mathematicians to switch to studying physics, computer science, or economics, just as it is for poets to turn to writing novels, essays, or plays. Of course, there are exceptions.

Mathematics is usually seen as the diametric opposite of poetry, although there are exceptions here, too. Although the opposition is not always true, yet it stands there basically undeniable. Mathematicians work to discover, while poets work to create. The painter Degas occasionally wrote sonnets and once complained to the poet Mallarmé. He said that he had many ideas, in fact too many; he found it difficult to write. Mallarmé replied, "poems are made not with ideas but with words." On the other hand, mathematicians work mainly on concepts, combining concepts of the same kind. In other words, mathematicians think in an abstract way, while poets think in a concrete way. But again this is not always the case.

Both mathematics and poetry are products of imagination. For a pure mathematician, his or her materials are like lacework, leaves on a tree, a patch of grass, or the light and shade on a person's face. In other words, "inspiration", which Plato denounced as "a mania of poets", is equally important to mathematicians. For example, Goethe fancied that he saw a flash of light when he heard of his friend Jerusalem's suicide. He immediately came up with the outline of *The Sorrows of Young Werther*. He recalled that he "seemed to have written the book unconsciously". Another example: Gauss, "the prince of mathematics", wrote to tell a friend, after solving a problem (symbols of Gaussian summation) that had been bothering him for years, "Finally, two days ago, I succeeded—not on account of my hard efforts, but by the grace of the Lord. Like a sudden flash of lightning, the riddle was solved. I am unable to say what the conducting thread was that connected what I previously knew with what made my success possible."

Mathematics often appears to be connected to and interactive with astronomy, physics, and other branches of natural science, but it is a completely self-referential and vast field of knowledge with a reality more enduring than other sciences. It is like a true language, which not only records and expresses ideas and the process of thinking but

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also creates itself through poets and writers. It could be said that mathematics and poetry are the freest intellectual activities of human beings. The Hungarian mathematician Paul Turàn maintained that "Our mathematics is a strong fortress." His words correspond to Faulkner's "People will never be destroyed as long as they yearn for freedom," referring to creative writing.

Through years of study and practice, I have come to believe that the process of mathematical research is more or less an exercise or an appreciation of intelligence. This is perhaps one of the main reasons for its great charm. I fully understand what the philosopher George Santayana said in his later years: "If my teachers had begun by telling me that mathematics was pure play with presuppositions, and wholly in the air, I might have become a good mathematician, because I am happy enough in the realm of essence." Of course, I cannot rule out the possibility that a great thinker can yield to the intellectual fashions of his times as a man or a woman can do to fashions in dress.

Compared with other disciplines, mathematics is often an undertaking for the younger. The Fields Medal, the most renowned mathematical prize, goes only to mathematicians under forty. Riemann died at forty, Pascal at thirty-nine, Ramanujan at thirty-three, Eisenstein at twenty-nine, Abel at twenty-seven, and Galois at twenty; by the time they died they had all left their deep traces on the history of mathematics. Some mathematicians, such as Newton and Gauss, lived long lives, but they completed their major work in their youth. Of course, there are exceptions here, too.

Likewise we can draw up a long list of poets who died young: Pushkin, Lorca, and Apollinaire died at thirty-eight, Rimbaud at thirty-seven, Wilde at thirty-four, Mayakovsky at thirty-two, Plath at thirty-one, Shelley and Yesenin at thirty, Novalis at twenty-nine, Keats and Petofi at twenty-six,[1] and Lautréamont at twenty-four. Whereas if we look at painting, Gauguin, Rousseau, and Kandinsky began their artistic careers after they turned thirty. Thus, more often than other servants of creation, poets and mathematicians tend to burn up the flower of their talent in the midst of their youth. Poets may destroy the shapes common to the forms of their predecessors in order to renew the form and language; mathematicians may be, by the nature of their industry, more prone to continuity. Again, there are exceptions.

[1] *The Hungarian poet Petofi disappeared in a battle against the Russian-Austria alliance in 1849. He was considered to "have died at the points of the lances of Cossack soldiers" until the end of the nineteenth century, when Russian researchers found in archives that he had actually been taken to Siberia as a prisoner of war and died there of tuberculosis in 1856. He would therefore have been thirty-three when he died.*

The language of poets is renowned for its conciseness. Ezra Pound is praised as a master of the concise; no one seems to do better than he in this regard. But the language of mathematicians is also noted for its conciseness. The British writer Jerome K. Jerome gave an example, as follows:

> *When a twelfth-century youth fell in love he did not take three paces backward, gaze into her eyes, and tell her she was too beautiful to live. And if, when he got out, he met a man and broke his head—the other man's head, I mean—then that proved that his—the first fellow's—girl was a pretty girl. But if the other fellow broke his head—not his own, you know, but the other fellow's—the other fellow to the second fellow, that is…*

As he goes on to say, this interminable paragraph would be very succinct if expressed in mathematical symbols, although it would be less amusing:

> *If A broke B's head, then A's girl was a pretty girl; but if B broke A's head, then A's girl wasn't a pretty girl, but B's girl was.*

The language of mathematicians is universal. Goethe joked that mathematicians are like the French, who can translate whatever you say into their own language and turn it immediately into something totally new. We have been taught that a branch of science is truly developed only when it is able to make use of mathematics. In the same way, poetry is a common key factor of all the arts. It can be said that every work of art needs "poetic flavor". Mozart had a reputation as "the poet of music" and Chopin as "the poet of the piano". It's not difficult to imagine the striking symmetry between a beautiful mathematical formula in a scientific paper and several brilliant lines of poetry in an essay or a speech.

Now let's come back to the proposition stated at the beginning of this essay. Freud said, "Everywhere I go, I find that a poet has been there before me." This remark was taken up by Breton, the leader of surrealism, as a golden rule. Novalis asserted, "Poetry is very similar to prophecy in its significance. Generally, poems are like the intuitions of prophets. Poets—prophets—reveal the secrets of a strange and wondrous world with magic lines and images." Therefore a poet of integrity will inevitably violate the interests of those in power. Plato accused poets of being the enemies of truth and their poetry of spreading mental poison.[2] On the other hand, pure mathematics,

[2] *Plato was always precise in his diction. In his last work he described those who ignored the importance of mathematics in the pursuing of ideals as "piggish".*

especially modern mathematics, often develops in advance of its time, even in advance of theoretical physics. It was more than a full century after the invention of Galois's group theory and Hamilton's theory of quaternions that these theories were applied to quantum mechanics. In similar situations, non-Euclidean geometry was used to describe gravitational fields, and complex analysis to describe electrodynamics. The discovery of conic sections, which for over two thousand years was considered no more than "the unprofitable amusement of a speculative brain", ultimately found its application in Newton's equation of motion, theory of projectile motion, and the law of universal gravitation.

However, more often than not, the work that mathematicians do is not understood by the crowd. Some people have rebuked them for indulging in pointless speculation or being silly and useless dreamers. Lamentably, this is the viewpoint of learned scholars. For example, Schopenhauer, a distinguished modern philosopher, acknowledged poetry as the highest art but described arithmetic as the lowest activity of the spirit.[3] Since the beginning of the twentieth century, more and more people have come to realize how our times have benefited from mathematics. To some extent, however, poets and artists are still in the situation they always have been. Perhaps they should console themselves with Picasso's words: "People earn the title of artists only after they have overcome innumerable obstacles. Therefore art should be restricted instead of being encouraged."

By coincidence, mathematicians and poets often walk side by side on the frontiers of human civilization. Euclid's *Elements* and Aristotle's *Poetics*, the two most important academic works of ancient Greece, were written at almost the same time. They both had what one might call a common belief or attitude consisting, one might say, in an accurate "imitation" of the outer world. For Euclid, it was the physical-geometrical form of three-dimensional space; for Aristotle, it was understanding poetics as a description of everyday life. The difference is that the former was an abstract imitation while the latter was a concrete one. Poe and Baudelaire, pioneers of modern art, belonged to the same age as Lobachevsky and Bolyai, founders of non-Euclidean geometry. When a group of poets and painters of great talent gathered in Paris, in the 1930s and 1940s, to launch the radical revolution of surrealism, some other brilliant minds in the world were working hard in their own way to develop topology, a burgeoning branch of mathematics. Here I want to quote an example, often cited by topologists, which uses a parody of The *Song of Hiawatha* by the American poet Longfellow. It tells of an Indian who made fur mittens:

> *He, to get the warm side inside,*
> *Put the inside (skin side) outside;*
> *He, to get the cold side outside,*
> *Put the warm side (fur side) inside…*

Interestingly, the word *topology* first appeared as *Topologie* in German, in the work of a student of Gauss in 1847, when the concept was known to very few mathematicians.

Finally, I'm going to raise the question of whether someone can be a poet and a mathematician at the same time. Pascal assures us at the beginning of his *Pensées*: "As long as geometricians have good insight, they can be sensitive; as long as sensitive people can apply their insight to geometric principles, they can be geometricians too." Despite this, historically only the eighteenth century Italian mathematician Mascheroni and the nineteenth century French mathematician Cauchy could possibly be counted as poets, while the twentieth-century Chilean poet Parra was a professor of mathematics. Perhaps the only one in human history who made great contributions in both fields was Omar Khayyam, the eleventh-century Persian who was born four centuries earlier than the versatile Da Vinci. He made his mark in the history of mathematics for his geometric solution of cubic equations, and he became known to the world as the author of the *Rubáiyát*. When the fourteen-year-old T. S. Eliot came across Edward Fitzgerald's English translation of the *Rubáiyát* at the turn of the twentieth century, he immediately became enthralled. He recalled the splendor of entering the world of this magnificent poem and realized, after reading those lines full of "dazzling, sweet and painful colors", that he wanted to be a poet.

Acknowledgments

The author is grateful for the referees' valuable opinions and suggestions, particularly to Professor Preda Mihailescu for insightful, precious ideas and discussions offered during my visit at the Mathematisches Institut, Universität Göttingen. They all made this paper more readable.

[3] *This viewpoint of Schopenhauer is completely contrary to that of Plato, who proclaimed that he would drive poets out of his ideal city and that "God is a geometrician".*