Poets and Mathematicians
数学家与诗人

蔡天新 / 文　　Robert Berold, Gu Ye / 译

数学家和诗人都是作为先知先觉的预言家存在我们的世界上。只不过诗人由于天性孤傲被认为狂妄自大，而数学家由于超凡脱俗为人们敬而远之。因此在文学艺术团体里诗人往往受制于小说家，正如在科学技术协会里物理学家领导数学家一样。但这只是表面现象。

"我做不了诗人"，晚年的威廉·福克纳彬彬有礼地承认，"或许每一位长篇小说家最初都想写诗，发觉自己写不来，就尝试写短篇小说，这是除诗以外要求最高的艺术形式。再写不成的话，只有写长篇小说了。"相比之下，物理学家并不那么谦虚，但无论如何，对每一个物理学家来说，物理认识的增长总是受到数学直觉和经验观察的双重指导。物理学家的艺术就是选择他的材料并用来为自然规划一幅蓝图，在这个过程中，数学直觉是不可或缺的。一个不争的事实是，数学家改行搞物理学，计算机或经济学，就像诗人转而写小说，随笔或剧本一样相对容易。

数学通常被认为是与诗歌绝对相反的，这一点并不完全正确，可是无可否认，它有这种倾向。数学家的工作是发现，而诗人的工作是创造。画家德加有时也写十四行诗，有一次他和诗人马拉美谈话时诉苦说，他发现写作很难，

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

数学之桥，相传牛顿设计，剑桥皇后学院（蔡天新 摄）

尽管他有许多概念，实际上是概念过剩。马拉美回答：诗是词的产物，而不是概念的产物。另一方面，数学家主要搞概念，即把一定类型的概念组合起来。换句话说，数学家运用了抽象的思维，而诗人的思维方式较为形象，但这同样不是绝对的。

数学和诗歌都是想象的产物。对一位纯粹数学家来说，他面临的材料好像是花边，好像是一棵树的叶子，好像是一片青草地或一个人脸上的明暗变化。也就是说，被柏拉图斥为"诗人的狂热"的"灵感"对数学家一样的重要。举例来说，当歌德听到耶路撒冷自杀的消息时，仿佛突然间见到一道光在眼前闪过，立刻他就把《少年维特之烦恼》一书的纲要想好，他回忆说："这部小册子好像是在无意识中写成的。"而当"数学王子"高斯解决了一个困扰他多年的问题（高斯和符号）之后写信给友人说："最后只是几

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) which 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 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", when he talks about 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

牛顿的苹果树，剑桥三一学院 (蔡天新 摄)

天以前，成功了（我想说，不是由于我苦苦的探索，而是由于上帝的恩惠），就像是闪电轰击的一刹那，这个谜解开了；我以前的知识，我最后一次尝试的方法以及成功的原因，这三者究竟是如何联系起来的，我自己也未能理出头绪来。"

数学虽然经常以与天文、物理及其它自然科学分支相互联系、相互作用的方式出现。但从本质上说，它是一个完全自成体系的（对它本身来说又是极为宽广的）、最具有真实性的知识领域。这一点正如真正的文字语言，它不仅用来记载和表达思想及思维过程，并且反过来（通过诗人和文学家）又把它们创造出来。可以说数学和诗歌是人类最自由的智力活动。匈牙利数学家保尔•图拉认为：数学是一座坚固的堡垒。这应验了福克纳的话：人只要有向往自由的意志，就不会被毁灭。

高斯出生的房子，不伦瑞克（蔡天新 摄）

哥廷根的高斯饭店（蔡天新 摄）

通过多年的研究实践，我认为数学研究的过程或多或少是一种智力的锤炼和欣赏的过程，这或许是数学研究之所以有如此吸引力的一个重要原因。我非常能够理解哲学家乔治·桑塔耶纳晚年说过的一席话："如果我的老师们真的曾在当初就告诉我，数学是一种摆弄假设的纯粹游戏，并且是完全悬在空中的，我倒可能已经成为优秀的数学家了。因为我在本质王国里感到十分幸福。"当然，在此我不能排除伟大的思想家追求时代智力风尚，就如同妇女在服饰上赶时髦一样。

与任何其它学科相比，数学更加是年轻人的事业。最著名的数学奖——菲尔兹奖是专门奖给四十岁以下的数学家的。黎曼死于 40 岁，帕斯卡尔死于 39 岁，拉曼纽扬死于 33 岁，艾森斯坦死于 29 岁，阿贝尔死于 27 岁，伽罗华死于 20 岁，而他们作为伟大数学家的地位却已经奠定。有些数学家虽然长寿，但他们的主要工作大多是在青年时代完成的，例如牛顿和高斯。另一方面，我们可以开列一长串早逝的诗人名单：普希金、洛尔迦和阿波利奈尔死于 38 岁，兰波死于 37 岁，王尔德死于 34 岁，马雅可夫斯基死于 32 岁，普拉斯死于 31 岁，雪莱和叶塞宁死于 30 岁，诺瓦利斯死于 29 岁，济慈和裴多菲死于 26 岁 [注 1]，洛特雷阿蒙死于 24 岁。而以绘画为例，高更、卢梭和康定斯基都是三十岁以后才开始艺术生涯的。因此，我们有理由认为，在科学、艺术领域里，数学家和诗人是最需要天才的。不同的是，对诗人来说，一代人要推倒另一代人所修筑的东西。而对数学家来说，

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 , 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 the 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.

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 him 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

歌德塑像

歌德咖啡馆，法兰克福机场（蔡天新 摄）

每一代人都能在旧建筑上增添一层楼。由于这一原因，诗人比数学家更容易出现或消失。

诗人的语言以简练著称，埃兹拉·庞德被誉为"简练的大师"。这方面似乎没有人做得更好，殊不知数学家的语言也是如此，英国作家 J·K·杰罗姆曾举过一个例子，有这样一段描写：

当一个十二世纪的小伙子坠入情网时，他不会后退三步，看着心爱的姑娘的眼睛，他说她是世界上最漂亮的人儿。如果他在外面碰上一个人，并且打破了他的脑袋——我指的是另一个人的脑袋——那就证明了他的——前面那个小伙子的——姑娘是个漂亮的姑娘。如果是另外一个人打破了他的脑袋——不是他自己的，你知道，而是另外那个人的——对后面那个小伙子来说的另外一个——那就说明了……

倘若我们把这段没完没了的叙述借助数学家的符号表达出来，就变得非常简洁明了了：

如果 A 打破了 B 的脑袋，那么 A 的姑娘是个漂亮的姑娘。但如果 B 打破了 A 的头，那么 A 的姑娘就不是个漂亮的姑娘，而 B 的姑娘就是一个漂亮的姑娘。

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.

Of course, it would have been less amusing. 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 'the poet

兰波的城市：夏洛维尔（蔡天新 摄）

诗人们在兰波墓地，夏洛维尔（蔡天新 摄）

不仅如此，数学家的语言还是一种万能的语言，歌德曾逗趣说：数学家就像法国人一样，无论你说什么，他们都能把它翻译成自己的语言，并且立刻成为全新的东西。马克思更是教导我们：一门科学只有当它达到了能够运用数学时，才算真正发展了。与此相应，诗是一切艺术的共同要素，可以说每一件艺术品都需要有"诗意"。因此，莫扎特才有"音乐家诗人"的美誉，而肖邦也被称为"钢琴诗人"。不难想象，在一篇科学论文中出现一个优美的数学公式和在一篇文章或谈话中间摘引几行漂亮的诗句，两者有一种惊人的对称。

现在让我们回到本文开头提出的命题。弗洛伊德认为："诗人在心灵的认知方面是我们的大师。"这句话曾被超现实主义领袖布勒东奉为圭臬。诺瓦利斯声称："诗歌的意义和预言十分相似，一般来说，和先知的直觉差不多。诗人——预言家通过有魔力的词句和形象使人得以触及一个陌生而神奇的世界的奥秘。"因此，一个正直的诗人难免会冒犯统治阶级的利益。柏拉图历数诗人的两大罪状：艺术不真实，不能给人真理；艺术伤风败俗，惑乱人心。[注2] 另一方面，纯粹数学尤其是现代数学的发展往往是超越时代的，甚至是超越理论物理学的。例如，伽罗华群和哈密尔顿四元数的理论在建立一个多世纪以后才开始应用于量子力学；非欧几何学被用来描述引力场、复分析在电气动力学中的应用也有类似的情况；而圆锥曲线自被发现二千多年来，一直被认为不过是富于思辨头脑中的无利可图的娱乐，可是最终它却在近代天文学、仿射运动理论和万有引力定律中发挥了作用。

然而，更多的时候，数学家的工作仍不被人们理解。有这样的指责，认为数学家喜欢沉湎于毫无意义的臆测，或者认为数学家们是笨拙和毫无用处的梦想家。可悲的是，

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. On the other hand, pure mathematics, 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 raised from 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 viewpoint of these learned scholars.

达芬奇是意大利文艺复兴时期的著名画家，也是
建筑师、解剖学者、工程师、数学家和发明家

皮亚特·海恩（Piet Hein，1905-1996）是丹麦科学家、数学家、发明家、诗人和作家，
笔名"Kumbel"（意即"墓碑"）

这些饱学之士的观点还得到某些权威的支持。圣奥古斯丁一面攻击荷马的虚构败坏人心，"把人间的罪行移到神的身上"，"我们不得不踏着诗的虚构的足迹走入迷途"，一面又叫嚷道："好的基督徒应该提防数学家和那些空头许诺的人，这样的危险业已存在，数学家们已经与魔鬼签订了协约，要使精神进入黑暗，把人投入地狱。"古罗马法官则裁决"对于作恶者、数学家诸如此类的人"，禁止他们"学习几何技艺和参加当众运算数学这样可恶的学问"。叔本华，一位在现代哲学史上占有重要地位的哲学家，一方面视诗歌为最高艺术，另一方面却把算术看成是最低级的精神活动。[注3] 进入二十世纪以来，越来越多的人认识到了，我们这个时代是如何受惠于数学的，至少奥古斯丁那样的权威人士销声匿迹了。但是诗人和艺术家的境况在某种意义上依然如故，或许他们应该用毕加索的话来聊以自慰：人们只有越过无数障碍之后，才能得以登上艺术家的宝座。因而对艺术非但不该加以鼓励，相反应压抑它。

　　数学家和诗人常常是不约而同地走在人类文明的前沿。古希腊最重要的两部学术著作——欧几里得的《原本》和亚里士多德的《诗学》几乎诞生在同一时代，并且都是建立在对三维空间摹仿的基础上。只不过前者是抽象的摹仿，后者是形象的摹仿。现代艺术的先驱爱伦·坡、波德莱尔与非欧几何学的创始人罗巴切夫斯基、鲍耶也属于同

For example Schopenhauer, a distinguished modern philosopher, acknowledged poetry as the highest art but described arithmetic as the lowest activity of the spirit. 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. The first leading in For Euclid, it was the physical-geometrical form to Euclid of three-dimensional space, the second be for Aristotle's understanding of it was poetics as a description of every day's life. The difference is that the former was an abstract imitation while the latter was a concrete one. Allan Poe and Baudelaire, pioneers of modern art, belonged to the same age as Lobachevsky and Bolyai, founders of non-Euclidean geometry.

波斯诗人数学家
欧玛尔·海亚姆
（1048-1122）

海亚姆雕像，罗马尼亚布加勒斯特

海亚姆陵墓，伊朗马什哈德

一时代。本世纪三、四十年代，当一批才华横溢的诗人、画家聚集巴黎，发动一场载歌载舞的超现实主义革命时，这个世界上另一些聪明绝顶的头脑正各自为营，致力于发展新兴的数学分支——拓扑学。这里我想引用一个拓扑学家经常引用的例子，美国诗人朗费罗的长篇叙事诗《海华沙之歌》（作于 1855 年，德沃夏克的《自新大陆交响曲》即受其影响写成）中有一段故事，讲到一个做毛皮手套的印第安人：

他把晒暖的一侧弄到里面，把里面的皮翻到外面；把冷冰冰的一侧翻到外面，把晒暖的一侧弄到里面……

在手套的翻进翻出过程中，这个印第安人实际上是在做一个拓扑动作。有趣的是，拓扑这个词最早是以德文的形式 (Topologie) 出现在 1847 年高斯的一个学生写的著作里，在那个年代拓扑概念只存在极少数几个数学家的头脑里。

最后我要谈到的是，一个人能不能既成为诗人又成为数学家呢？帕斯卡尔在《思想录》开头差不多这样轻松地写道：凡是几何学家只要有良好的洞见力，就会是敏感的；而敏感的人若能把自己的洞见力运用到几何学原则上去，也会成为几何学家。虽然如此，从历史上看，只有十八世纪意大利数学家马斯凯罗尼和十九世纪法国数学家柯西勉

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 18th century Italian mathematician Mascheroni and the 19th century French mathematician Cauchy could possibly be counted as

历史上仅有的几位诗人兼数学家：意大利的马斯凯罗尼（左），法国的柯西（中），智利的帕拉（右）。

强算得上诗人，二十世纪智利诗人帕拉也曾做过数学教授。而人类历史上惟一能够在两方面都有杰出贡献的或许惟有欧玛尔·海亚姆了，这位十一世纪的波斯人比多才多艺的达·芬奇还早出生四百年，他的名字不仅因给出三次方程的几何解载入数学史册，同时又作为《鲁拜集》一书的作者闻名于世。上个世纪初，十四岁的 T·S·艾略特偶然读到爱德华·菲尔茨杰拉德的英译本《鲁拜集》，立刻就被迷住了。他后来回忆说，当他进入到这光辉灿烂的诗歌之中，那情形"简直美极了"，自从读了这些充满"璀璨、甜蜜、痛苦色彩的"诗行以后，便明白了自己要成为一名诗人。

poets, while the 20th 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 11th 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 20th 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.

注 释

1. 1849 年，匈牙利诗人裴多菲在反抗俄奥联军的一次战斗中失踪，此后的一个多世纪里，他一直被认为是"死在哥萨克士兵的矛尖上"。直到不久以前，俄罗斯研究人员才找到档案，揭示他作为战俘被押送到西伯利亚，并于 1856 年死于肺结核。因此他去世时应为 33 岁。

2. 柏拉图先生的用词向来较有特色，在他的最后一篇著作里，他把那些无视数学对于探求理想的重要性的人形容为"猪一般"。

3. 叔本华的这个观点正好与柏拉图唱反调，柏拉图声言要把诗人赶出他的"理想国"，同时又称"上帝是位几何学家"。