FEATURE ARTICLE

Blind Mathematicians

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The only thing worse than being blind is having sight but no vision.

-Helen Keller, American author, political activist, and lecturer.

DESPITE the fact that they were blind physically, they acquired qualities to look at the beauty of the "Queen of all Sciences". Although blind musicians, writers, politicians, and philanthropists are most well known, there were some renowned blind Mathematicians who had great vision and also made great contributions to Mathematics. Let's take a look at some of these great mathematicians.


Nicholas Saunderson

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Renowned English Scientist, Mathematician and sensible Newtonian was born in the small village of Thurlstone, Yorkshire, in January 1682 to an exciseman who was a government officer and collected taxes imposed on goods. He may have been the earliest discoverer of Bayes theorem which was named after Thomas Bayes (1701-April 7, 1761).

Unfortunately, when about a year old he lost his sight as well as eyes to smallpox; but this tragedy did not prevent him from acquiring a remarkably good education and studying mathematics. He learnt to read by tracing the engravings on tombstones around St. John the Baptist Church in Penistone with his fingers.

His early education was at Penistone Grammar School. In 1707, he arrived in Cambridge, staying with his friend Joshua Dunn. With the permission of the 3rd Lucasian professor of Mathematics who succeeded Isaac Newton, William Whiston, Saunderson was allowed to teach, lecturing on mathematics, astronomy and optics. Whiston was expelled from his chair on 30 October 1710. Queen Anne awarded Saunderson a Master of Arts degree on 19 November 1711 so that he would be eligible to succeed Whiston as Lucasian professor. He was chosen as the 4th Lucasian professor (1711-1739) the next day.

Saunderson was elected a Fellow of the Royal Society (FRS) on 6 November 1718. He was awarded doctor of laws in 1728 by the command of George II (King of Great Britain and Ireland). He died of scurvy on 19 April 1739 and was buried in the chancel of the parish church at Boxworth near Cambridge.

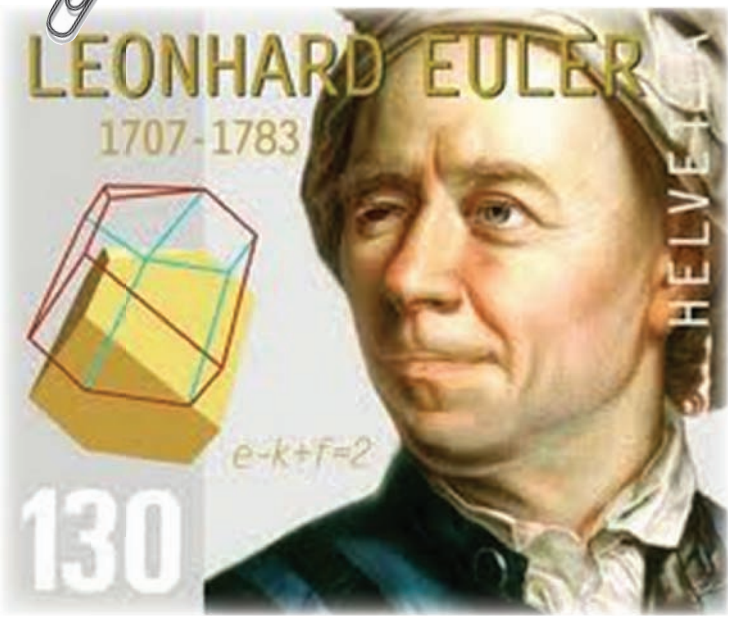
Saunderson possessed the friendship of many eminent mathematicians of the time, such as Sir Isaac Newton, Edmund Halley, Abraham De Moivre and Roger Cotes. He devised a calculating machine or abacus, by which he could perform arithmetical and algebraic operations by the sense of touch; this method is sometimes termed his palpable arithmetic, an account of which is given in his elaborate Elements of Algebra.

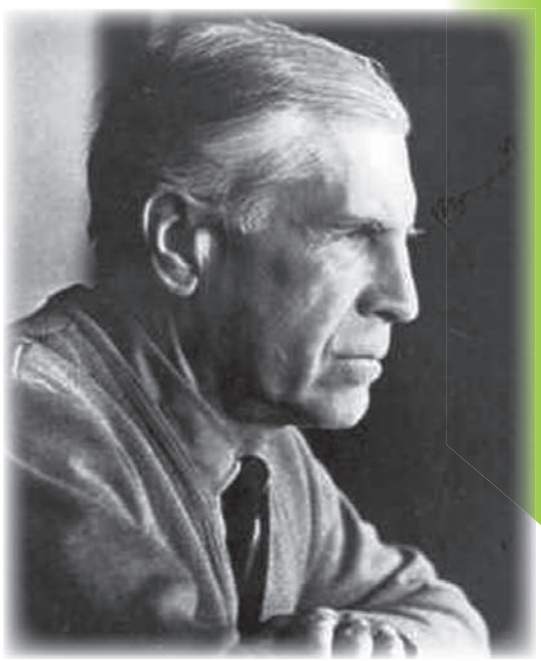
Leonhard Euler

Euler was born on 15 April 1707, in Basel to Paul Euler and Marguerite Brucker. His left eye became blind from cataract and suffered from eyestrain caused by a near-fatal fever in 1735.

Leonhard Euler was a pioneering Swiss mathematician and physicist of the 18th century who spent most of his life in Russia and Germany and made discoveries in fields as diverse as infinitesimal calculus and graph theory. He also introduced much of the modern mathematical terminology and notation for mathematical analysis, such as the notion of a mathematical function f(x). He is also renowned for his work in mechanics, fluid dynamics, optics, and astronomy. A statement attributed to Pierre-Simon Laplace expresses Euler's influence on mathematics: "Read Euler, read Euler, he is the master of us all."

His early education started in Basel, where he was sent to live with his maternal grandmother. At the age of 13 he enrolled at the University of Basel, and in 1723, received his Master of Philosophy





Leonhard Euler (left).
Lev Pontryagin (right)

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with a dissertation that compared the philosophies of Descartes and Newton. At this time, he was receiving Saturday afternoon lessons from Johann Bernoulli, who quickly discovered his new pupil's incredible talent for mathematics. In 1727, he entered the Paris Academy Prize Problem competition, where the problem that year was to find the best way to place the masts on a ship. He won second place, losing only to Pierre Bouguer who was known as "the father of naval architecture". Euler subsequently won this coveted annual prize twelve times in his career.

Euler worked in almost all areas of mathematics: geometry, infinitesimal calculus, trigonometry, algebra, and number theory, as well as continuum physics, lunar theory and other areas of physics. Euler is the only mathematician to have two numbers named after him: the immensely important Euler's Number in calculus, 'e' approximately equal to 2.71828, and the Euler-Mascheroni Constant γ (gamma) sometimes referred just as "Euler's constant", approximately equal to 0.57721. It is not known whether γ is rational or irrational.

He also introduced 'e' for the base of the natural logarithm, the Greek letter γ for summations and the letter i (iota) to denote the imaginary unit. The use of the Greek letter γ to denote the ratio of a circle's circumference to its diameter was also popularized by Euler. In 1772, Euler had proved that 2^31 1 = 2,147,483,647 is a Mersenne prime. It may have remained the largest known prime until 1867.

The city of Königsberg, Prussia was set on the Pregel River and included two large islands which were connected to each other and the mainland by seven bridges. The problem was to decide whether it is possible to follow a path that crosses each bridge exactly once and returns to the starting point. In 1736, Euler solved the problem known as the Seven Bridges of Königsberg. It is not possible: there is no Eulerian circuit. This solution is considered to be the first theorem of graph theory. He also discovered the formula V-E + F = 2

Lev Pontryagin

A Soviet mathematician who was born on 3 September 1908 in Moscow and suffered an accident at the age of 14 – an explosion that left him blind. His father, Semen Akimovich Pontryagin was a civil servant. Despite his pitiable condition, Pontryagin was able to become a titan of mathematics of the 20th century and that was possible with the help of his mother Tatyana Andreevna who read mathematical books and papers (notably those of Heinz Hopf, J.H.C. Whitehead and Hassler Whitney) to him.

Pontryagin entered the University of Moscow in 1925 and it quickly became apparent to his lecturers that he was an exceptional student. He made major discoveries in algebraic topology and differential topology. Pontryagin worked on duality theory for homology while still a student. He went on to lay the foundations for the abstract theory of the Fourier transform, now called Pontryagin duality. In topology, he posed the basic problem of cobordism theory. This led to the introduction around 1940 of a theory of certain characteristic classes, now called Pontryagin classes, designed to vanish on a manifold that is a boundary.

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In 1942, he introduced the cohomology operations now called Pontryagin squares. Moreover, in operator theory there are specific instances of Krein spaces called Pontryagin spaces. Later in his career he worked in optimal control theory. His maximum principle is fundamental to the modern theory of optimization. He also introduced there the idea of a bang-bang principle, to describe situations where either the maximum 'steer' should be applied to a system, or none.

Pontryagin authored several influential monographs as well as popular textbooks in mathematics. He was accused of anti-Semitism on several occasions. Antisemitism is prejudice, hatred of, or discrimination against Jews for reasons connected to their Jewish heritage. For example, he attacked Nathan Jacobson for being a "mediocre scientist" representing the "Zionism movement", while both men were vice-presidents of the International Mathematical Union (IMU).

Abraham Nemeth (extreme left)
Bernard Morin (left)

Bernard also discovered the Morin surface, a half-way model for the sphere eversion, and used it to prove a lower bound on the number of steps needed to turn a sphere inside out.

Majored in psychology at Brooklyn College, Abraham earned MA in Psychology from the Columbia University and studied mathematics and physics at Brooklyn College.

Abraham Nemeth

American mathematician and inventor, Abraham was born congenitally blind on 16 October 1918 in New York City on the Lower East Side of Manhattan into a large family of Hungarian Jewish immigrants who spoke Yiddish (High German language of Ashkenazi Jewish origin). He attended regular public schools at first but did most of his primary and secondary education at the Jewish Guild for the Blind school in Yonkers. Majored in psychology at Brooklyn College, he earned MA in Psychology from the Columbia University and studied mathematics and physics at Brooklyn College.

Abraham needed a Braille code that would more effectively handle the kinds of math and science material and so developed the Nemeth Code for Mathematics and Science Notation in 1952. Nemeth Code has gone through four revisions since its initial development and continues in wide use today. He is also responsible for the rules of MathSpeak, a system for orally communicating mathematical text.

Amazingly, his obituary was prematurely published twice in Jewish and blindness-related magazines, when in fact his brother and wife had actually died. Nemeth was a member of the United States Democratic Party but was appointed by a Republican governor of Michigan as chairman of the state commission for the blind, a position he served for two years (1991-1993).

Bernard Morin

Pioneering mathematician, specifically a topologist, born in Shanghai, China in 1931. His father was a French citizen who worked for a bank in Shanghai. He was blind since age six due to glaucoma and was taken to France for medical treatment. He returned to Shanghai, but suffered detached retinas and became totally blind.

Morin returned to France and educated in schools for the blind until age fifteen, when he went into the regular education system. He studied philosophy for a few years before switching to Mathematics. His blindness did not prevent him from having a successful career in mathematics.

In 1957, he began his career as a researcher at the Centre National de la Recherche Scientifique (The National Centre for Scientific Research). He earned his PhD in 1972 and spent most of his career teaching at the University of Strasbourg and retired in 1999. Morin also worked at the Institute for Advanced Study in Princeton.

Morin was a part of a group that first demonstrated an eversion of the sphere, i.e. a homotopy (topological metamorphosis) which starts with a sphere and ends with the same sphere but turned inside-out. He also discovered the Morin surface, a half-way model for the sphere eversion, and used it to prove a lower bound on the number of steps needed to turn a sphere inside out.

He discovered the first parametrization of Boy's surface (named after German Mathematician Werner Boy in 1978). His graduate student François Apéry later discovered (in 1986) another parametrization of Boy's surface, which conforms to the general method for parametrizing non-orientable surfaces.

"Our spatial imagination is formed by manipulating objects, you act on objects with your hands not your eyes," said Morin while discussing his work.

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