Brook Taylor

In 1714 English mathematician **Brook Taylor** (August 18, 1685 – December 29, 1731) published a remarkable solution of the problem of the center of oscillation that led to a translation into mathematical terms of the mechanical principles governing the vibration of a string. The following year his *Methodus incrementorum directa et inversa* (*Methods of direct and inverse incrementation*) appeared. It was the first work to treat a branch of mathematics, the "calculus of finite differences." The most celebrated formula in the *Methodus* has come to be known as Taylor's expansion of a function in terms of an infinite series, which has been used to find polynomial approximations of rational, exponential, logarithmic, trigonometric and hyperbolic functions. James Gregory knew of the formula when Taylor was still a child, but the latter was unaware of Gregory's unpublished result. Lagrange considered Taylor power series so important that he declared the theorem to be "the fundamental principle of differential calculus." Taylor never claimed to have invented the series named for him. What was original with Taylor was his invention of the technique of integration by parts, familiar to calculus students.

Born in Edmonton in Middlesex, Taylor was the son of John Taylor and Olivia Tempest. Up until the time Taylor entered St. John's College, Cambridge, he was educated at home by private tutors. At Cambridge Taylor showed great promise of success in mathematics. By the time he earned his L.L.B. in 1709 he had already written his first important mathematical paper, on the center of oscillation, although it was not published until 1714, the year he received his LL.D. Because of the delay in publication, Taylor became embroiled in an ugly priority dispute with Johann Bernoulli. In the history of mathematics there are many examples of bitter arguments between mathematicians over who had priority of discovery. The Newton-Leibniz controversy is merely the most famous, but not the one of longest duration.

The feud between the families of Taylor and Bernoulli over the center of oscillation was not resolved until July 7, 1990 when François de Montmort hosted a gathering of two descendants of Bernoulli and Taylor: Rene Bernoulli of Basel, Switzerland and Chalmers Trench of Slane, Ireland. After toasting each other the two descendants moved with great dignity to the front lawn of de Montmort's château where together they dug a hole and literally buried a hatchet. It's only fitting that de Montmort was instrumental in bringing the feud to a close. His ancestor, French algebraist Pierre Rémond de Montmort, had unsuccessfully tried to moderate the dispute 275 years earlier.

Shortly after graduation Taylor was elected a Fellow of the Royal Society, and became its secretary. From 1712 on he wrote numerous papers that were published in the *Philosophical Transactions.* Among the most enthusiastic of Newton's admirers, Taylor was appointed to the committee that looked into the claims of Newton and Leibniz as to who had priority in the invention of the calculus. Taylor was unable to be objective in the dispute and in his *Methodus* he failed to mention the work that Leibniz had done on the subject in 1673.

In 1715 Taylor published his treatise, *Linear Perspective*: *or*, *A New Method of Representing Justly all Manner of Objects*, in which he set forth the basic principles of the art in an original and more general form than any of his predecessors. Four years later, his *New Principles of Linear Perspective* gave the earliest general treatment of the principle of vanishing points. Lines in the real world that are parallel to each other but not parallel to a picture frame have images on the picture plane that appear to converge to a single point. Line segments of the same size will appear to be smaller the farther they are from the viewer. The horizon line is at the level of the viewer's eye and vanishing points are on the horizon line.

Railroad tracks that are parallel to each other seem to converge at the vanishing point on the horizon. Figure 8.9 is a schematic representation of this phenomenon.

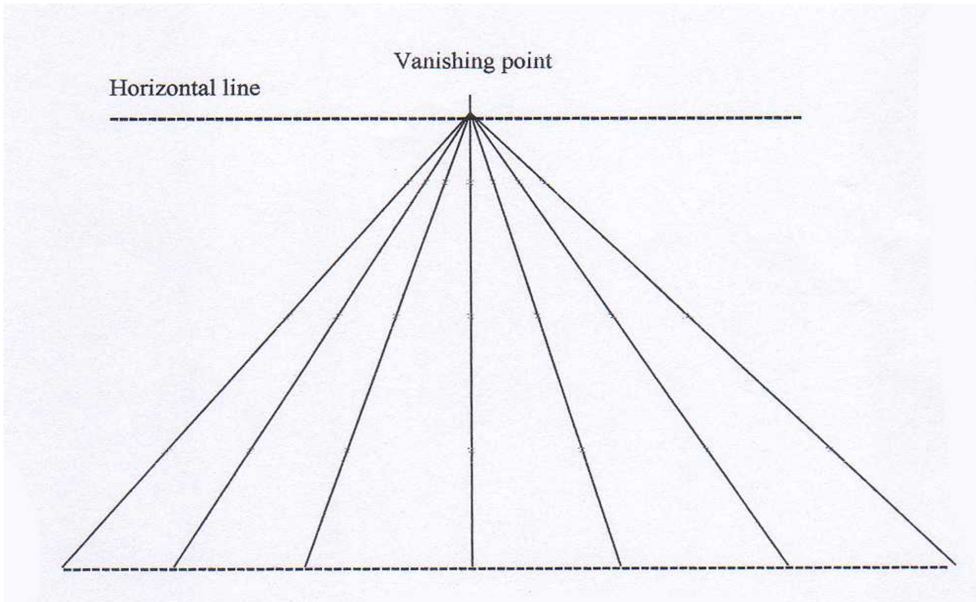

Figure 8.9.

Taylor resigned as Secretary of the Royal Society partly because of ill health but he also wanted to devote himself to writing. He gave an account of an experiment made to discover the law of magnetic attraction, and, in 1717, he contributed an improved method for approximating the roots of an equation by providing a new method for computing logarithms. In 1721 Taylor married a Miss Brydges over the objections of his father. The problem was that although she came from a good family, it had no money, and to Brook's father this was unacceptable. The two men became estranged and were not reconciled until 1723 when Taylor's wife died in childbirth, as did the child. Two years later, Taylor married Sabetta Sawbridge, a woman of whom his father found approved. When Taylor's father died Brook inherited the family's estate of Bifons. Tragedy struck Taylor once again in 1730 when Sabetta also died in childbirth. Taylor's fragile health worsened and he died at the early age of 47 at Somerset House, London on December 29, 1731.

John Barrow in his article “It’s All Platonic Pi in the Sky,” in the May 11, 1993 *Times Educational Supplement*, related a story about Russian mathematical physicist Igor Tamm, the 1958 Nobel Prize winner for Physics. During the Russian Revolution, anti-communist vigilantes seized Tamm near Odessa, suspecting him of being an anti-Ukrainian communist agitator. The group’s leader, who held Tamm’s fate in his hand, asked his captive what he did for a living. When he answered that he was a mathematician, the bandit chief said, “All right, calculate the error when the Taylor series approximation to a function is truncated after *n* terms.” Fearfully Tamm calculated the answer in the dust when his finger. The bandit examined the answer and set Tamm free. He never discovered the identity of his mathematically astute captor.

Quotation of the Day: “No part of mathematics suffers more from the triviality of its initial presentation than the great subject of series…. The general ideas are never disclosed and thus the examples, which exemplify nothing, are reduced to silly trivialities.” – Alfred North Whitehead