Zero: The Biography of a Dangerous Idea

• By **Charles Seife, Viking Penguin, 2000; 248 pp.**

If you think that zero signifies nothing, then you will be surprised how much can come out of "nothing" as you will find out from this book. It traces not only the intellectual benefits arising from such a simple concept but also the destructive trails that follow on the heels of a failure to respect the dangers of the conceptual void.

As with the invention of the wheel, modern science and technology would not be possible without the humble zero. Mathematics would be no more than a book-keeper's art if zero were to be banished to the forbidden zone of the intellect. Although the idea of "nothingness" is fundamental in Buddhist philosophy and its historical antecedents in Indian religious thought, the significance of its numerical equivalent in mathematics was not fully realized and exploited until the 19th century. It is also no surprise that the elevation of zero to the same conceptual status as the whole numbers is generally accepted as an Indian (more specifically, Hindu) achievement. As the book points out, the usefulness of zero as a placeholder in numerical notation was fully understood and implemented by the ancient Babylonian and Mayan civilizations. (There is an omission of historical fact that the ancient Chinese also understood and exploited this usefulness.)

It was the Arabs of the nineteenth century who widely used the Hindu numerals in their mathematical investigations at a time when Europe went through the so-called "Dark Ages". If there was any individual who ignited the spark that brought light into the scientific firmament of Europe, it must have been the Arab mathematician al-Khowarizmi (c. 780 - c. 850) whose treatise on solving elementary equations was translated and adapted by European scholars in the mid-twelfth century. The Hindu numerals together with zero had arrived in the scientific wilderness of Europe and there was no stopping of the fire of the scientific revolution that would sweep through Europe.

The book spins an intriguing story of mathematics and physics around anything and everything that could possibly be interpreted as zero or the void. So you learn about the introduction of a "zero point" into art by the Italian architect and engineer Filippo Brunelleschi (1377 - 1446), thereby heralding the arrival of perspective in art and anticipating the works of the great Leonardo da Vinci (1452 - 1519). You are then taken on a quick scientific tour from Nicholas Copernicus (1473 - 1543) to Albert Einstein (1879 - 1955) with a number of mathematicians appearing as you go along - most of them mathematical household names like Pascal, Descartes, Fermat, Barrow, Newton, Leibniz, Bernoulli, Maclaurin, Taylor, d'Alembert, l'Hopital , Bolzano, Weierstrass, Monge, Poncelet, Desargues, Gauss, Riemann, Cantor and Kronecker.

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You will see that modern mathematics is built on the foundation of so "insignificant" an idea as zero. Calculus is almost literally about zero being divided by zero and its birth was fraught with controversy between philosophers and mathematicians. Geometers are interested in studying so-called "singularities" which are the geometrical equivalents of zero. Set theory constructs mathematically, if not literally, a towering edifice on nothing more than an "empty set", and in the rarefied realms, "infinity" (whatever that is) can behave like zero.

In the real world (of physics and chemistry), the phantom of zero haunts and taunts all those who seek the truth behind the visible and tangible. There is a limit to which you can lower the temperature of anything, and that limit is called "Absolute Zero". Then there are other types of "zero" in nature: the "quantum zero" and the "relativistic zero". Both of these zeros are bizarre and counter-intuitive. The first tells you that a vacuum ("empty space") is not only non-empty but is also "full of force". The other says that the universe as we understand it could be populated by many so-called "black holes" (in mathematical lingo, "singularities") within which the known laws of physics appear to break down. Like dividing by zero, attempts to unveil the mysteries of these physical zeros often bring about what appear to be paradoxes to the finite mind. And then there is the "most tantalizing" and "most unfathomable" zero of all in the universe: the birth of our own universe at the "zeroth" hour of the "Big Bang".

The book keeps mathematics (in fact, only elementary mathematics) to a minimum - right at the end of book in the form of four short appendices. The fifth appendix claims that you can travel back in time if you knew how to build what is called a "wormhole" in physics. There are plenty of ideas in this book to bend and boggle your mind. Some of these ideas have been around for quite some time. If you have not heard of such things, it is time that you pick up a copy of this book, and if your appetite has just been whetted, there is a list of books and articles (and even some web sites) given to lead you onto deeper things.

Reviewed by

Leong Yu Kiang