MATHEMATICS | OPINION

The Elusive Origin of Zero

Who decided that nothing should be something?

By Frank Swetz, Shaharir bin Mohamad Zain on July 28, 2022

A number of jewelry relics of Sriwijaya Kingdom are seen after being found by fishermen at Musi River in Palembang, South Sumatera province, Indonesia in November 2021. Credit: Muhammad A.F./Anadolu Agency/Getty Images

Sūnya, *nulla*, *ṣifr*, *zevero*, *zip* and *zilch* are among the many names of the mathematical concept of nothingness. Historians, journalists and others have variously identified the symbol's birthplace as the Andes mountains of South America, the flood plains of the Tigris and Euphrates Rivers, the surface of a calculating board in the Tang dynasty of China, a cast iron column and temple inscriptions in India, and most recently, a stone epigraphic inscription found in Cambodia.

The tracing of zero's heritage has been elusive. For a country to be able to claim the number's origin would provide a sense of ownership and determine a source of great nationalistic pride.

Throughout the 20th century, this ownership rested in India. That's where an inscription was discovered, holding the number "0" in reference to land measurement inside a temple in the central Indian city of Gwalior. In 1883 the renowned German Indologist and philologist, Eugen Julius Theodor Hultzsch copied and translated the inscription into English, dating the

text to the year C.E. 876. And this has been accepted as the oldest known date for the appearance of zero. However, a series of stones in what is now Sumatra, casts India's ownership of nothingness in doubt, and several investigators agree that the first reference of zero was likely on a set of stones found on the island.

In 1891 a French archaeological team uncovered a stone stele near the village of Sambor on the banks of the Mekong River, in what was then French Indochina, later to become Cambodia/Kampuchea. The stone bore a Khmer epigraphic inscription that included the date for the Khmer year 605, reckoned within the Hindu Saka system, a historical calendar based on the rule of the Indian emperor Shalivahana. The calendar's reference year (zero) corresponds to the Julian year 78. Thus, the inscribed date is C.E. 685.

Political upheavals precluded further scholarly examination of this stone, and it would not be until the 20th century that another Western scholar took up this task. Georges Cœdès, a Frenchman, who in 1918 became director of the National Library of Thailand, located the so-called Sambor stone, given the archaeological designation K–127 by the archaeological team that uncovered it. In 1931 Cœdès concluded that the numeration system used in the inscribed date, 605, was decimal in nature and positional in conception and that the central glyph was an empty placeholder, a zero. This assessment meant that 605, referencing a year, singled out the earliest known and documented zero. So, now the preeminent honor of claiming zero, the elusive and mathematically important entity, rested with Cambodia.

The claim earned little attention at the time; thus India maintained its status as the birthplace of zero. In the disruptions of World War II, people forgot about the Sambor stone, which was lost. Almost a century later, a popular science writer, Amir Aczel, tried to find the missing stone and authenticate its existence and significance. He found it in an archaeological warehouse, near the ancient Khmer ruins of Angkor Wat.

Aczel documented his quest and adventures in a book, *Finding Zero*, published in 2015. His testimony affirmed the existence of the zero and endowed its elusive heritage to Cambodia. Aczel's suggestion that he had found the "first zero" was celebrated in the media. But perhaps such euphoria was premature.

Around 1918, Cœdès had postulated the existence of a dominant but previously unknown Old Malay empire in Southeast Asia, one that predated the Khmers. Named Sriwijaya, it was ruled by a maharaja, centered on the island of Sumatra in what is now Indonesia, and flourished in the period C.E. 650 to 1377.

Sriwijaya was a major trading and maritime power controlling the sea lanes from Madagascar, across the Indian ocean, the Straits of Malacca, the whole of the South China Sea and on to the islands of the Philippines. Sriwijaya was also an early center of Buddhist teaching and proselytizing.

Archaeological explorations have uncovered a rich trove of Sriwijayan artifacts and records. Dutch colonial officers discovered three dated ceremonial stones with the historical numerals 605, 606 and 608, marking the years as reckoned from the Hindu Saka–era calendar. Translated into our Common Era chronological systems, those numerals would be: 683, 684 and 686.

The stones are named after the places of their discovery: Keduan Bukit, Talang Tuwo and Kota Kapur. These stones were polished and inscribed and probably intended for use in a

ceremonial ritual, perhaps ablution, suggesting they originated in the seventh century. If correct, the existence of zero in the stones' inscriptions predates the findings of the Gwalior Indian claim by two centuries!

Researchers at the Center for Civilizational Dialogue at the University of Malaya in Kuala Lumpur have been investigating the history of early numeration systems of Southeast Asia. Their findings further strengthened Sumatra's claim, to which we, the authors, agree. Acknowledging this state's strong economic influence and mercantile activities, and the existence of three independent stone glyph inscriptions within its realm bearing a zero, this claim certainly has strong credibility. A 1995 article published in the *Journal of the Malaysian Branch of the Royal Asiatic Society* had also offered this conjecture.

In 1976, while on a research visit to Sumatra to examine the numeration systems of the region, one of us (Swetz) was impressed by the mathematical abilities of the traditional Batak people. In returning to Malaysia, he conveyed his impressions to Malaysian colleagues. A team at the Center for Civilizational Dialogue, headed by the other of us (Zain), then focused their attention on Sumatra and arrived at the conclusion that zero had an early presence in the region.

While the issue requires more deliberation and historical examination, this discovery of a possible nothingness symbol is intriguing. Could zero have been conceptually conceived of and utilized in an ancient and barely known Southeast Asian society? Was the Khmer zero actually influenced by the Sriwijayan culture? Did the use of zero spread from this region westward into India and finally into Europe? Is the credibility of the term "Hindu-Arabic" numerals under serious threat? These questions require further investigation, but, as we see, the history of mathematics offers many mysteries that can puzzle and amaze its disciples.

This is an opinion and analysis article, and the views expressed by the author or authors are not necessarily those of Scientific American.

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