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CONCEPT OF ZERO IN THE INDIAN TRADITION: THE CONTRIBUTION OF INDIA IN MATHS & SCIENCE

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ABSTRACT

Zero is the most important number in the present number system, without this (zero) no calculation can be done in either discipline of modern Maths and Science. It has been well argued and accepted by the various scholars that it was discovered in India and then migrated to the Western world through Arabian traders. Not only the idea of zero evolved in India but the other nine digits are also the product of ancient Indian minds. Though the Western world calls them the Arabic numbers but the contribution of the great Indian mathematicians can never be neglected and ignored at any point in time. This paper would be an attempt to explore and identify the very beginning of the number system in India particularly in the context of Zero. The historical and philosophical dimensions behind the evolution of Zero in India would also be a matter of serious inquiry in this paper. It would also be an attempt to uncover the politics behind the naming of Indian number systems as Arabic numbers in the post-colonial scientific world.

KEYWORDS: *Zero, Indian Numbers, Maths, Science, Arabic Numbers, Western Science, History, Philosophy*

INTRODUCTION

The human mind is considered the best among the creatures on the earth because it can calculate, predict and process the available information for its use and benefit. We can also argue that humans are pattern-seeking beings, trying to understand & interpret the world around us, and in this process, Maths has given us the ability to do so. The development of the number system can be traced to various primitive civilizations like Egyptians, Babylonians, Maya, Chinese and

Indian. All these civilizations had an idea about the conceptualization of numbers but the idea of zero has been found in only a few civilizations.

Ancient Egyptians were using numerals with the base of 10 they used hieroglyphs for the digits but they didn't have the place value system. The Babylonians had an advanced positional and number system but it was lack of a positional value or place holder. The Mesopotamians had a numeral system with base 20, but the idea of zero was not evolved to them also. The ancient Greeks had no symbol for zero and did not use a digit placeholder for it. They seemed unsure about the status of zero as a number. They asked themselves, "How can nothing be something?"

Despite all these, various scholars (particularly western) have argued that the discovery of zero was done by the people of the Maya civilization. The Maya civilization which has a history dating back to about 1500 BC reached its peak between 300 BC and 900 BC and the most important achievements of the Maya civilization are their perfect calendar, knowledge of mathematics, hieroglyphic writing, and use of paper. The Mayan year consisted of 365 days, as in a solar calendar. There were 18 months in a year, each month of 20 days. Here it seems that the Mayans were having great calculation ability which exhibits in their formulation in the calendar and this might be a reason for the various scholars to believe that they had the idea of zero as a number and as a place holder.

In India, the zero as a concept probably predated zero as a number. The Sanskrit word for zero, *shunya*, meant "void or empty" The word is probably derived from *shun* which is the past participle of *svi*, "to grow". In one of the early Veda, Rgveda occurs another meaning: the sense of "lack or deficiency". It is possible that the two different words were fused to give *shunya* a single sense of "absence or emptiness" with the potential of growth.¹

Scholars like Robert Logan² have argued that Zero was an invention of the Hindu mathematicians, working more than 2000 years ago. Their discovery of zero led them to positional numbers, simpler arithmetic calculations, negative numbers, and algebra with a symbolic notion. It has always been a source of mystery and surprise to the historians of mathematics that the germinal idea of zero was a discovery of Hindus and not the Greeks. The great mathematician of the eighteenth century, Laplace, wrote:

"It is India that gave us the ingenious method of expressing all numbers using ten symbols, each symbol receiving a value position as well as an absolute value."³

There are also scholars like Robert Kaplan who have argued in his book "The Nothing that is: A Natural History of Zero"⁴ that the discovery of Zero is not an original discovery by the Hindus instead the idea of zero was reincarnated in India through Greeks possibly after the invasion of Alexander around 326 BC.

History of Zero from India

The symbol for zero was first used by Pingala (before 200 BC) in his *Chandah Sutra* while the use of zero in calculation appears in the Bakhshali manuscript which is dated around 200 AD, where the use of place values is found. The treatment of zero as a number, with equal status to others such as one or two, is found in the text *Panchsiddhantika*⁵.

The name for zero used in this text and later texts is *shunya*, which means "empty space" or "blank". Zero was first symbolized as dots in the Bakhshali manuscript, and later as a small

circle or o. The use of dots to represent zero is used as a metaphor in the text of Vasavadatta of Subandhu.

All kinds of calculations in respect to zero like addition and subtraction with zero first appears in 505 AD., in the *Panchsiddhantika* of Varahmihir, while Brahmagupta in 628 AD formulated the definition of zero as $a-a = 0$. Sanskrit texts on astronomy from the time of Brahmagupta usually contain a portion called *shunya-gatika* or computations involving zero.

The earliest inscription in India about the numeral system is found in an inscription from Gwalior dated 876 AD. The expansion of this number system towards the western world is an interesting story. First, the Indian number reached Baghdad in around 773 AD, and al-Khwarizmi wrote his famous Arithmetic in about 820 in Arabic to deal with the new numbers. The text contains a detailed exposition of numbers and their uses.

In the transmission of Indian numbers to Europe via the Islamic world, Spain and Sicily also played an important role as intermediaries. *Liber Abaci*, written by Fibonacci who learned to work with Indian numbers during his extensive travels in North Africa, Egypt, Syria, and Sicily. Since these Indian numbers migrated to the west via the Islamic world they were started to be called Arabic numbers.

Philosophical dimensions for the evolution of Zero

As we have discussed in the introduction part that various civilizations were aware of the need for a universal base system for the calculation as well as an expression for “nothing” in mathematics but most of these civilizations were failed to deal with the presence of this idea of “nothing”.

As Robert Kaplan in his book has argued that the Idea of zero is not an original discovery of Hindus instead it was done by the early Greeks and then the Idea was migrated at the time of Alexander. When we critically inquire about Kaplan’s argument with the ideas of ancient Greek philosophy it seems that Kaplan’s theory is just an assumption as great discoveries are only being done by western minds.

It has been well argued by Logan in his “*The Mystery of the Discovery of Zero*” according to Logan the climate of Greek thought was as unfavorable as possible to the formulation of zero, particularly zero as something to be manipulated mathematically as a number. The Indians on the other hand were used to deal with the notion of non-Being.

In Buddhism, negativity and non-being are positive and good because the Buddhists take their point of departure in the negative side of life and the world. For them the being of existence is a ‘nothing’, likewise, non-being is the negation of something negative and is, therefore something positive.⁶ For Both the Hindu and the Buddhist, the notion of non-being was a state that they sought in their attempt to achieve Nirvana. Non-being was something a state that could be discussed. The concept of zero as a concrete state was totally consistent with this aspect of Hindu Philosophy, and hence presented no problems with Hindu mathematicians. The Hindus did not have any logical obstacles to overcome in this regard, like the Greeks. Nothing stood in the way of their formulation of zero. The Hindu believes systems encouraged this theoretical & symbolic development of zero.

Here it is important to mention that the idea of liberation in Hinduism or the concepts like *Brahmand* and *Nasadiya sukta* of Rigveda could also be seen as some primordial reasons behind the developments of concepts like:

1. Zero
2. Negative numbers
3. Arithmetic computational methods
4. Algebra with symbolic notions
5. Infinity

Nasadiya sukta is an interesting departure point in the development of philosophical ideation of zero. Within the Rgveda this *Nasadiya sukta* is the earliest attempt by the human mind to know the beginning of mind and beginning of this universe. It has been argued that there is no difference between “infinite” and “nothing” because both are endless, this same intuition has appeared in the questions of *Nasadiya sukta*, therefore the point of inquiry from “nothing” has always been easy for Indians as well to conceptualize infinite and negative numbers.

Colonization of Indian Maths & Science

Colonization was not only a political phenomenon where socio-political and economical exploitation was being done instead it was a process through which local and indigenous maths and science were also subsumed and unrecognized by the western world. The emergence of modern science along with its industrial and commercial applications coincided with colonial explorations and understandings this was no coincidence. Both had an intimate complex cause-and-effect relationship⁷

It is obvious that the colonial masters were not ready to accept and acknowledged any scientific discovery or mathematical formulation beyond the realm of European land and that is why they suppressed the Indian knowledge system by using the English language western education system in India. Indian metallurgies, Indian surgery, Indian Maths, and Indian astronomy were some of the greatest discoveries by Indian minds but they were never accepted among westerners as original Indian discoveries instead they projected them as myths only.

CONCLUSION

There is no doubt that zero was discovered by Indians and not only zero but the ideas of negative numbers and infinite numbers were also the product of Indian minds. There are various ideas and formulations which originated in India and migrated to the western world through the Islamic world in which zero is just a single example. The due respect and regards to the great Indian minds are unrecognized and ignored as well as the Indian Ideas have been painted as Arabic/Western products. Still, Western minds do not accept that zero is an Indian Intellectual product which shows that even after the end of political colonialism still we are being regulated and governed by cultural colonialism by the West.

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