Ancient Indian Method for Divine Links to The Invention of Zero

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ABSTRACT - **In this paper firstly we have tried our best to make attempts to extend divine links to the invention of zero.**

I. INTRODUCTION

The purpose of introducing this Section is to give Spiritual background regarding invention of zero and place-value system in India on which not only Mathematics but also other branches of Modern Science depend.

BRAHMA, THE CREATOR OF THE UNIVERSE

Sunya or zero or null or void or nothing – a mark of absence of everything, identifies itself with blackness, the Colour of Goddess Kali or Lord Krsna, the absence of all colours; with Nirguna Brahma, the absence of all qualities. The Blackness in the colour of Goddess Kali or no quality in Brahma represents the fact that She (or He) is not guided by any of the qualities, Sattva, Raja or Tama but at the Same time it symbolises Her (or His) pervading nature and connotates the conception that She (or He) is the source of all qualities, energy, power and strength which sublimate every living and non-living thing in the world and which guide not only this world but the whole Universe and Cosmos. i.e. according to the Vedas, Brahma is the minutest of the minute and the greatest of the great. In a similar way Sunya or Zero itself Signifies nothing but it pervades the entire Mathematical and Scientific field of the whole world since its very inception. It leads to a place Value System on which all the basic laws and operations of arithmetic depend and without its help the present arithmetic, algebra, Calculus, Statistics, Economics and all other branches of Mathematics and science would have not been flourished today.

REFERENCES TO OTHER EFFORTS

Here, we are producing some references from other works showing the Spiritual Strength of Sunya and Mathematics.

(i) In the Preface to the Commentary on the treatise Ganita-Sara-Samgraha written by the great Mathematician Mahaviracarya professor Rangacarya writes that in Jainism, Mathematics was taken as a necessary ingredient for the "attainment of the Salvation of Soul-liberation known as moksa."

Zero has been used as a Symbol for one-sensed soul, two-sensed soul, etc denoted by 0, 00, etc. This has been symbolically represented in the Jain work, Dhavala of Virasena.

(ii) The great Mathematician Mahaviracarya has used the word 'Pudgala' for an atom. The meaning of this word is also 'Soul' ir 'epithet of Shiva'. Atom presents the idea of infinitesimal. Thus, Mahaviracarya has presented 'Shiva' or 'Soul' in the form of Zero as in infinitesimal.

(iii) In Buddhism or Buddhist Philosphy, Sunyata (Zeroism) plays a very important role. T.R.V. Murti in his treatise "The central philosophy of Buddhism" has given the following remarks while referring to Nagarjuna's interpretation of Buddist philosophy.

(a) "The Absolute is very aptly termed Sunya." – Murti, T.R.V.,

"The central philosophy of Buddism, P. 229"

(b) "The Absolute (Sunya) is the norm of all things."

Ibid. P. 231.

(c) "Absolute (Sunya) is prajna – it is that intuition itself

Ibid. P. 236.

(d) "Sunyata is Absolutism, not nihilism or positivism."

Ibid. P. 329.

(iv) Brahma represents the unknown and zero has been used as a symbol to represent unknown quantities in Atharvaveda, Bakhshali manuscript and in the works of Hindu Mathematicians like Sridhara, Bhaskaracarya II and others.

Thus, the above references lead us to conclude that from the time of Vedas Indians have been worshipping Sunya in the form of God. These traditions continued even when Buddhism and Jainism thrived in India. All the worshippings for nearly twelve thousand years have brought the dawn of Sunya in the vicinity of 3500 B.C. It is known to us that Jesus Christ came with his banner of faith and devotion in the beginning of the Christian era and Hazarat Mohammad, the messenger of the Islamic religion

came long after him. Hence there was a vacuum of religious thoughts and spiritual consciousness in the western front and in the Middle East, when India was completely infused with religious environment from the time of Vedas, which accounts for the failure of the great mathematicians of antiquity (Greece) and success of the Indian Mathematicians.

OPINIONS OF DIFFERENT SCHOLARS

(1)   Laplace: Laplace was a brilliant mathematical astronomer and revolutionary thinker. He told Napolean that God is not a necessary hypothesis in natural Science. Hogben refers to Laplace in his Book Mathematics for the Million at the page 284. Dantzig quotes Laplace "It is India that gave us the ingenious method of expressing all numbers by means of ten Symbols, each symbol receiving a value of position as well as an absolute Value; a profound and important idea which appears so Simple to us now that we ignore its true merit; but its very Simplicity, the great ease which it has lent to all Computations, puts our arithmetic in the first rank of useful inventions and we shall appreciate the grandeur of this achievement when we remember that it escaped the genius of Archimedes and Apollonius, two of the greatest men produced by antiquity."1

(2)   Dantzig: Dantzig in his admirable book Number writes: This long period of nearly five thousand years saw the rise and fall of many a Civilization, each leaving behind it a heritage of literature, art, philosophy and religion. But, what was the net achievement in the field of reckoning; the earliest art practiced by man? An inflexible numerations so crude as to make progress well nigh impossible, and a calculating device so limited in scope that even elementary calculations called for the services of an expert Men used their devices for thousands of years without making a single worthwhile improvement in the instrument, without contributing a single important idea to the SystemEven when compared with the slow growth of ideas during the dark ages, the history of reckoning presents a peculiar picture of desolate Stagnation. When viewed in this light, the achievement of the unknown Hindus, who sometime in the first Centuries of our era discovered the principle of position, assumes the proportion of world event."

He further comments by saying, "Particularly puzzling to us is the fact that the great Mathematicians of Greece did not stumble on it. Is it that the Greeks had such a marked contempt for applied science, leaving even the instruction of their children to Slaves ?"

(3)   Hogben: Hogben gives his own opinion on the issue "Greeks inherited a Social Culture which forced them to use a number Script evolved before the need for elaborate calculations with large numbers was keenly felt. In such a situation advance could only come from a less sophisticated people, who did not begin to write numbers until large numbers were being used freely the difficulty of understanding why it should have been the Hindus who took this step and why it was not taken by the great Mathematician of antiquity is insuperable if we see for the explanations of intellectual progress in the genius of a few gifted individuals, instead of in the whole social frame work. At a certain stage in the history of culture the eruption of a less sophisticated community proves to be a turning point recognize that every culture contains within itself its own doom, unless it pays much attention to the education of the mass".

II. CONTEMPLATION

Suppose one agrees with many of the views expressed by the above Scholars. But, objections may be raised on the statements given by Dantzig and Hogben. What Dantzig actually meant by "leaving even the instruction of their children to slaves". If he meant that the Greek Invasion in the fourth century B.C. made slaves of the Indians who were pioneers in the development of new symbols in Mathematics, his expression is unwarranted and baseless. History shows that at the time of invention of Zero and place – value system India was not under the domination of Greece rather India was an independent country. Hogben comments "Indians did not begin to write numbers until large numbers were used freely" giving rather a left handed compliment to the Indians. But, Indians wrote down numbers long long before Greeks wrote them or even Greek civilization existed, as would be apparent from the inscriptions on the coins found by excavations at Harappa and Mohen-jo-daro which throw light on Indus Valley Civilization, which existed sometime in the vicinity of 3500 B.C.

The above comments by the scholars of the west show that they were puzzled to find that India gave birth to Zero, the most important discovery in the field of Mathematics and baffled by the fact that the giant Mathematicians of Greece did not stumble at the idea of Zero. Mathematicians of the caliber of Pythagoras, Euclid, Archemedes and Apollonius could not get away from the clumsy instrument of the counting frame in the field of reckoning when India made a landmark in the history of the world while expressing all numbers by means of ten symbols by inventing Zero and decimal system of numeration.

The reason seems simple enough. India is the land of Yogins where Yoga had been practised from the time of Vedic ages. Yoga means a methodised efforts towards self-perfection by the expression of the potentialities latent in the being and an union of the human individual with the Universal and Transcendental Existence, which means Meditation or Dhyana or Contemplation is a concentration of the mind on a single train of ideas which works out a single subject. Mathematics is nothing but a method to find order in chaos, to arrange ideas in logical chains to find fundamental principles. Hence, Mathematics identifies itself with meditation or concentration on Brahma meaning

fixing up one's mind on "om" or "Sunya" or "o" which reprents the cosmos, God in all, all in God and all as God. Now, this word "om" has the sound of an "anusvara" . The ancient Hindu Mathematicians were so much impressed by the need of Yoga that they even set problems dealing with Yoga in their books on Mathematics. For example – the great Mathematician Mahaviracarya of the ninth century A.D. in his treatise Ganita-Sara-Samgraha presents a problem on Mathematics in which Yogins were brought in.

In a garden beautified by groves of various kinds of trees, in a place free from all living animals, many ascetics were seated. Of them the number equivalent to the square root of the whole collection were practising Yoga at the feet of the trees.

Hence, it can safely be assumed that Yoga or Meditation on a particular point is that secret seat of cypher. Sir John woodroffe rightly comments in the preface of the book Kama-Kala-Vilasa that "point or Bindu" called Sarvanandmaya is the supreme "Siva-sakti" in the centre. He further opines "where does the extended Universe go at the great Dissolution i,e. Maha Pralaya ? It collapses so to speak into a point. This point may be regarded as a Mathematical point".

III. RGVEDA

Numbers are essentially of Indian Origin and in the present case we shall see how the idea of numerals basically came from the Vedas. The first chapter, which has been regarded as Mandalam of the Rgveda opens with prayers to different Gods like Indra, Agni, Varuna, Vayu etc. Here, Indra has been regarded as a God with thousand eyes and also with powers related to thousands. The whole of Rgveda consists of numbers of tens, hundreds, thousands and ten thousands.

IV. YAJURVEDA

Here, the following numbers have been presented:
Eka (1)
Dasa (10)
Sata (100)
Sahasra (1000)
Ayuta (10,000)
Niyuta (100,000)
Prayuta (1,000,000)
Arbuda (10,000,000)
Nyarbuda (100,000,000)
Samudra (1,000,000,000)
Madhya (10,000,000,000)
Anta (100,000,000,000)
Parardha (1,000,000,000,000)

These hymns present the idea of numbers in terms of tens till 1012. There is also a conception of G.P. with common ratio 10.

V. KRSNA YAJURVEDA (TAITTIRIYA SAMHITA)

Here, we have a list of numbers from 100 to 1,000,000,000,000.

'kr	100
lgl~j	1000
v;qr	10000
fu;qr	100000
iz;qr	1000000
vcqZn	10000000
U;cqZn	100000000
leqæ	1000000000
eè;	10000000000
vUr	100000000000
ijkn~/Z	1000000000000

The writing of the above expressions usa, vyasta, esa, loka after the numbers in decimal system of notation, points to one important and certain fact that there is a single guiding factor which has created all the separate numbers written above and above which is responsible for the dawn of consciousness in the realm of Mankind and that definitely can not be anything by Sunya or Zero i.e. zero prompts the movement of all the numbers from 10, 100, 1000 to 1,000,000,000,000.

VI. ATHARVAVEDA

In the Atharvaveda there is a hymn which goes by the name Atharvanah and Atharvan is the Rsi associated with this hymn. The numerals are enumerated as follows:
We know that Ksudra is a synonym for zero. Here, starting with 0 (Ksudra) the numbers are moving serially
1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20 and 0 at the end.

Here, writing 0 at the end gives an indication that zero is the guiding factor.

The important idea here to be noted is the plural sense (H;%) at the end of all the numbers giving an indication that the particular number has to come again and again and has to occupy different places in decimal system of numeration.

Besides this there is also an idea of continuity of numbers starting with zero and adding up one in each step and thus getting all the natural numbers. Thus, the dual conception of Mathematical zero-absence in the term Ksudra and fullness in helping the numbers to move serially was present in the Atharvaveda.

VII. KASHMIRIAN ATHARVAVEDA

In Kashmirian Atharvaveda reproduced by chromophotography from the manuscript in the University Library at Tubingen, Bloomfield and Garbe-1901 the following evidences of zero and decimal place-value have been found:

(a)	Zero symbol has been found both as a dot and as a small circle.

-- Ibid., P.312 & 323

(b)	In decimal place-value Numeral Symbols for 1,2,3,4,5,6,7,8,9,10 are presented in the text.

-- Ibid., P.312.

(c)	There are numbers with zero in decimal place-value in marginal notes in different pages of the book.

-- Ibid.,P.192,194,310 etc

(d)	Zero symbol has also been used to denote blank space at the end of the page 323 of the book.

VIII. CONCLUSIONS

To conclude this section, in a nutshell, the following facts have been observed regarding the conceptions of zero and decimal system of numbers in Indus Valley and Vedic civilizations:

(i)	Zero in its double interpretations had a spiritual projection from the time of Vedas and it has been worshipped from very early times.

(ii)	The double meaning of Sunya (Zero) was obvious in the words used as synonyms for zero in the vedas.

(a) The synonyms used for zero to represent absence of number were fjDr] rqPN] {kqæ] jU/z etc. Just as a particle of water is too small and its occupying space is negligible and so to say it resembles tuchha Randhra resembles hollowness. The zero also contains a sort of enclosed hollowness. It is plausible, therefore, to assume that the other name of the zero is Randhra. Similarly, for other names.

(b) The names used for zero to represent it as a guide in decimal place-value system were æfo.ka] cya] vuUr] iw.kZ etc. The word 'kqU; itself has both the meanings-absence and fullness.

(iii)	There have been found numbers till four decimal places in Indus Valley civilization and numbers in multiples of ten till 1,000,000,000,000 in Vedic civilization while in Egypt they could go up to 10,000 and in Greece till Myriad i.e. 10,000.

(iv)	In Indus valley civilization, Yajurveda and Artharvaveda calculations of numbers and to bring them in terms of progressions-Arithmetic and Geometric-are found.

(v)	In Artharvaveda, numbers start with zero and move on continuously up to thousands with a plural sense, meaning that a particular number is to come again and again is to be used at different places i.e. unit, tenth, hundredth and so on.

For example- The number 1, when placed at the tenth, hundredth, thousandth places respectively and so on, becomes 10,100,1000 and so on. The number 1111 shows that 1 has been used in all the four places, unit, tenth, hundredth and thousandth. Similarly, the number 5 when placed at the tenth, hundredth and thousandth places and so on becomes 50,500,5000 and so on. The example 5555 shows that 5 has been placed at all the four places.

(vi)	In the word i`Fkd~lgl~jkH;ka ¸ in the Atharvaveda there is an indication that numbers are to move to 10n, n being a multiple of 3.

(vii)	In the Atharvaveda, zero has been represented both as an absence and as an aid to decimal place-value as the word has been written in the beginning and also at the end after enumerating numbers.

(viii)	Zero has been represented by a dot (.) as well as by a small circle (o) in the Kashmirian Atharvaveda. These forms of zero are suggested by the word Ksudra in the Atharvaveda and they are physically placed in Kashmirian Atharvaveda while writing numbers in decimal system and in denoting blank spaces.

Thus, it is a certainty that the invention of zero both as an absence and as a guide to decimal system of numeration was made some time when the vedic civilization and Indus valley civilization thrived in India. Thus, considering all the facts at disposal, the views and ideas and also the spiritual background, it can safely be concluded that the invention of zero with conception of absence and fullness in guiding numbers in decimal place-value, could not have been made after 3000 B.C. a time when both Indus-valley and vedic civilization simultaneously thrived.

REFERENCES

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[2] Ibid. P., 61.

[3] Swāmī Srī Bhāratī Krsna Tīrthajī Mahārāja, Sankarācārya of Govardhana Matha, Puri, "Vedic Mathematics", P. 16.

[4] Ibid. P., 23.