

# Is Father of Arithmetic is a Sri Lankan?

Essay by

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## Can Origin of Modern Arithmetic Be Traced To Sri Lanka?

Today all toddlers from all ethnic groups are taught numbers from 1 to 10 along with their mother tongues. Where did these numbers come from? In this paper it will be established that arithmetic based on modern numbers originated in Sri Lanka.

Medieval Europe was conducting arithmetic using Roman numerals till 12<sup>th</sup> century. Arithmetic based on Modern numerals appeared in Europe during early part of the 12<sup>th</sup> century. Leonardo of Pisa of Italy was considered to be the very first European to write a book about the modern arithmetic. The new technique was called “*Modus Indorum*” or the method of the Indians. It should be mentioned here that Leonardo of Pisa was also known as Fibonacci and has no relationship to famous Leonardo Davinci. Leonardo of Pisa’s book was known as *Liber Abaci* and was written in 1,202 AD. *Liber Abaci* was translated to English by Sigler and Grimm.

In the preface of the book Leonardo of Pisa says the following.

“After my father's appointment by his homeland as state official in the customs house of Bugia for the Pisan merchants who thronged to it, he took charge; and in view of its future usefulness and convenience, had me in my boyhood come to him and there wanted me to devote myself to and be instructed in the study of calculation for some days.

There, following my introduction, as a consequence of marvelous instruction in the art, to the nine digits of the Hindus, the knowledge of the art very much appealed to me before all others, and for it I realized that all its aspects were studied in Egypt, Syria, Greece, Sicily, and Provence, with their varying methods; and at these places thereafter, while on business.

I pursued my study in depth and learned the give-and-take of disputation. But all this even, and the algorism, as well as the art of Pythagoras, I considered as almost a mistake in respect to the method of the Hindus. (*Modus Indorum*). Therefore, embracing more stringently that method of the Hindus, and taking stricter pains in its study, while adding certain things from my own understanding and inserting also certain things from the niceties of Euclid's geometric art. I have striven to compose this book in its entirety as understandably as I could, dividing it into fifteen chapters.

Almost everything which I have introduced I have displayed with exact proof, in order that those further seeking this knowledge, with its pre-eminent method, might be instructed, and further, in order that the Latin people might not be

discovered to be without it, as they have been up to now. If I have perchance omitted anything more or less proper or necessary, I beg indulgence, since there is no one who is blameless and utterly provident in all things.

“The nine Indian figures are:

9 8 7 6 5 4 3 2 1

With these nine figures, and with the sign 0 ... any number may be written”.

*Reference: Sigler, L., “Fibonacci’s Liber Abaci”, Springer, 2003.*

One could see that Fibonacci was bubbling with enthusiasm of this new method that he stumbled upon, which he calls “The method of the Hindus” (*Modus Indorum*). His goal was to have all common people learn this method. This dream of Leonardo had come true. Today all literate people learn the nine figures and zero and computations with it while they are children.

Leonardo did not accept zero as a true number. He says “Nine Indian figures with symbol zero, any number can be represented”.

Leonardo of Pisa did not learn of the new method from Indians. It was the Arabs who introduced him to this new science.

Today our numbers are known as “Hindu Arabic” or “Indian” numbers.

Copernicus was one of the first European astronomers to use the new arithmetic. In his famous book *De Revolutionibus Orbium Coelestium* Copernicus says the following.

*“Indian numerical notation certainly surpasses others, whether Greek or Latin in lending itself to computations with exceptional speed”.*

Reference: Nicholas Copernicus (1473 AD – 1543 AD)

*De Revolutionibus Orbium Coelestium*

Nicholas Copernicus on Revolutions, Translated by Edward Rosen 1978.

### **Al Khwarizmi:**

Very first Arabic mathematician to translate the Indian arithmetic was Al Khwarizmi. Al Khwarizmi wrote a book known as *Kitab al-Jama wal-Tafreeq Bil Hisab Al-Hind*. This book was translated to Latin as *Algorismi De Numero Indorum* meaning “Al Khwarizmi concerning Hindu Art of Reckoning”. (Here reckoning means computing). (Ref. *Encyclopedia Britanica, 2000*).

Al Khwarizmi was not the first Arab to translate the so called method of the Indians.

Some other Arab mathematicians who wrote about the Indian arithmetic are given below.

**Abu l'Hasan Al Uqlidisi (950 AD):** He wrote a book on Indian number system known as *Kitab al fusal fil hisab al Hindi*.

**Abu'l Hasan al-Qifti (900 AD)** Arab scholar and author of Chronology of the Scholars, speaks of Arab admiration for Indian place-value system and methods of calculation.

“Among those parts of Indian sciences which came to us, the numerical calculation....it is the swiftest and most complete method of calculation, the easiest to understand and the simplest to learn; it bears witness to the Indians' piercing intellect, fine creativity and their superior understanding and inventive genius.”

(source: The Universal History of Numbers - By Georges Ifrah p. 511 - 589).

### **Al Kindi- (830 AD)**

Arab mathematician Al-Kindi wrote a book known as *Ketab fi Isti'mal al-'Adad al-Hindi* translated as "On the Use of the Indian Numerals" about 830 AD.

**Nasir-ud-din Toosi,** A great intellectual scholar of Islam wrote *Oawaid-ul-Hindasiya*.

**Abul Wafa Al-Buzjani, (940--997, 998 A. D.)** He is the author of *Kitab al-Hindusa* (Science of the Indians) which was rendered into Persian and Hebrew.

### **AL-NASAWI**

Al Nasawi wrote a book known as (*al-muqni fi-l-hisab al hindi*) "Satisfying (or Convincing) on Hindu Calculation" was also translated to number of middle eastern languages including Hebrew and Persian.

Reference: *Die Mathematiker und Astronomen der Araber (96, 1900) Uber das Rechenbuch des Ali ben Ahmed el-Nasawi (Bibliotheca Mathematica, vol. 7, 113-119, 1906).*

**Kushyer Ibn Labban: (971 AD):** Earliest existing Arabic book on Indian arithmetic is "*Kitab Fi Usual Hisab Al Hind*", by Kushyar Ibn Labban, who lived

from 971 AD to 1021 AD. This book was translated to English by Martin Levey and Marvin Petruck of University of Wisconsin.

**Indian Number System Arrive Spain: (976 AD):** Spaniards due to their trade with Arabs probably the first Europeans to get the Indian number system. I should also mention here that Italians were also had contact with Arabs during this time. Spanish book was written on the Indian number system on 976 AD.

“Item de figures arithmetice. Scire debemus indos subtilissimum ingenium habere et ceteras gentes eis in arithmetica et geometria...”

**Very First English Book with Indian Arithmetic: (1,240 AD)**

Very first book in English with Indian arithmetic appears in the year of 1,240 AD. Alexander De Ville Dei, a priest, wrote a book named “*Carmen de Algorismo*”. There he says in 12<sup>th</sup> century English in the chapter known as “*The craft of nombryng*”;

“*This boke is called the boke of algorm or augrym after lewder use. And this boke tretys of the craft of nombryng, the quych crafte is called also algorym. Ther was kind of Inde the quich heytch algo and he made this craft.....Algorisms in the quych we use teen figurys of Inde*”

The way it seems, he was trying to say that the ten figures he uses in the book are from India. This book is available in London museum.

Villa Dei, Alexander de wrote a book known as *Carmen de Algorismo* in poems explaining Indian arithmetic

*Hinc incipit algorismus.  
Haec algorismus ars praesens dicitur in qua  
talibus indorum fruimur bis quinque figuris  
0 9 8 7 6 5 4 3 2 1,*

Here begins the algorismus.  
This new art is called the algorismus, in which  
out of these twice five figures  
0 9 8 7 6 5 4 3 2 1,  
of the Indians we derive such benefit

**1546 AD** – Cataneo of France wrote a book known as “*Le Nove Fisure Degli Indian*”.

## Indian Numbers in China:

### **Buddhist Monks Takes Indian Numbers to China:**

Numbers were taken to China by Buddhist monks of India. A Buddhist monk known as Chuthan His Ta, edited an astronomical compendium known as Khai Yuan ChanChing (718 AD), where the author says,

*"Nine numbers were used and whenever it reaches 10, an empty space was left. Whenever there is an empty space, a dot is placed"*

Ref: Georges Ifrah; From One to Zero, Universal History of Numbers, 1985, Page 440.

As you could see zero was a dot before it became a circle.

### **Syriac Nestorian Bishop's Attempt To Introduce Indian Numbers to Europe Before Arabs:**

Before Arabs, a Syriac Nestorian bishop known as Severus Sebokt (662 AD) tried to introduce the Indian arithmetic to Europe. Apparently he was angered by some Greek scholars.

"I shall not speak here of the science of the Hindus, who are not even Syrians, and not of their subtle discoveries in astronomy that are more inventive than those of the Greeks and of the Babylonians; not of their eloquent ways of counting nor of their art of calculation, which cannot be described in words - I only want to mention those calculations that are done with nine numerals. If those who believe, because they speak Greek, that they have arrived at the limits of science, would read the Indian texts, they would be convinced, even if a little late in the day, that there are others who know something of value.

Reference: Nau, F. (1910) Notes d'astronomie indienne. *Journal Asiatique* **10 Ser. 16**, 209 - 228.

### **Campaign Against Indian Numbers Due to Zero:**

In Medieval Europe some communities banned the zero based Indian positional number system. The bankers of Florence, for example, were forbidden, in 1299, to use Hindu-Arabic numerals. Instead they had to use Roman numerals. Thus the more convenient Hindu-Arabic numbers had to be used secretly. As a result "ciphra" came to mean a secret code, a usage that continues in English. The resolution of a code is of course "deciphering"--a very popular word in modern English.

Some who resisted trading in their counting boards for the new numerals regarded them as the work of the devil, while others had a field day ridiculing them. Menninger lists several examples of how the zero turned up in literature:

- "Just as the rag doll wanted to be an eagle, the donkey a lion, and the monkey a queen, the 'cifra' put on airs and pretended to be a digit," wrote a 15th-century French man.
- Another French source said that calling somebody a person who used the "ciphery" system (rather than counting boards) was equivalent to calling that person a blockhead. Even as late as the mid-20th century, French had a term, "faire par algorisme [the modern system of numerals]," meaning "to miscalculate."
- Shakespeare had King Lear's Fool point out the king's abandonment thusly: "Now thou art an 0 without a figure. I am better than thou art now. I am a fool, thou art nothing."

Did anyone but a few monastic eggheads love the unlovely zero when it first appeared in Europe?

Yes, says Menninger:

The astrologers. They gladly adopted the new numerals, including the dark and mysterious zero, because "like every form of secret writing, [the numerals] helped to raise their status."

### ***Now turning to the main theme of this paper, did arithmetic originate in India or Sri Lanka?***

So far we saw all early Europeans and Arabs give ample credit to Indians for arithmetic. Sri Lanka being a small country which is under the cultural sphere of India it is reasonable for Arabs and European scholars to give credit to India.

#### The Men Who Built Arithmetic:

Modern arithmetic is due to the labors of number of mathematicians.

Aryabhata - 496 AD - 550 AD

Brahmagupta - 626 AD

Mahavira - 800 AD

Bhaskara - 1050 AD

The earliest of all the Indian mathematicians, who used the modern arithmetic was Aryabhata. Here it will be shown that Aryabhata, the father of arithmetic could be a Sri Lankan.

Aryabhata wrote two books. After nearly 1,500 years later only one book is in existence today. This book is known as *Aryabhatiyam* and here I would show that Aryabhata was a Sri Lankan using internal evidence available in *Aryabhatiyam*.

Here I would use *Aryabhatiyam* translated by a Harvard University Professor Walter Eugene Clarke.

Aryabhata in lemma 19 says the following:

**Lemma 19:** “The circle which intersects the east and west points and the two points in the meridian which are above and below the horizon by the amount of the observer’s latitude called the horizon of Lanka, on it the increase and decrease of day and night are measured.”

Here Aryabhata uses horizon of Lanka as his reference to measure the apogee and situate himself in the celestial sphere. Now the question is, if Aryabhata is an Indian, why would he use Lanka as the point of measurement?

In Lemma 18, he says the following?

**Lemma 18:** “As a man in a boat going forward sees a stationary object moving backward so at Lanka, a man sees the stationary asterisms moving backward in a straight line”.

Again, the movement of the celestial sphere or in this case the rotation of the earth that causes the diurnal motion is obtained using Lanka as a reference point. Aryabhata has to be stationed in Lanka for this statement to be true.

In Lemma 10, he says the following?

**Lemma 10:** “The cause of their rising and setting is due to the fact the circle of the asterisms together with the planets driven by the provector wind, constantly moves westwards at Lanka”

This phrase was shown by some Indian scholars as non Sri Lankan origin of Aryabhata. Here Aryabhata indicates the wind is flowing towards Lanka due to the setting and rising of asterisms. If he was stationed in Lanka why would he say the wind is moving towards Lanka? This lemma indicates non Sri Lankan reference of Aryabhata.

Brahmagupta, the staunch critic of Aryabhata who lived nearly 200 years after Aryabhata criticises Aryabhata for using Lanka as his reference. In *Panchasiddhantika* Brahmagupta says the following.

“Aryabhata maintains that the beginning of the day is to be reckoned from midnight of Lanka. The same teacher says that the day begins at sunrise of Lanka”

It is not clear what Brahmagupta had in mind. But as per Brahmagupta, it is very clear that Aryabhata had two systems for the measurement of the rotation of the celestial sphere. Either way using two systems for the measurements of the celestial sphere is been criticized. Could it be that Aryabhata used one system while he was in Lanka and the other one after he came to India?

### **Indian Numbers Based on Brahmi Characters:**

1	2	3	4	5	6	7	8	9	0
१	२	३	४	५	६	७	८	९	०
Nagari numerals around 11th century A.D.									

Above is the numbers of India dated to 11<sup>th</sup> century based on Brahmi characters. Brahmi characters came to southern India from Sri Lanka. (Reference: *John Keay, India History*)

It could be established that based on internal evidence in Aryabhatiyam, the foremost of the Indian mathematician who was responsible for developing the modern arithmetic could be a Sri Lankan.

### **Time Period of Aryabhata:**

It is established that Aryabhata lived from 476 AD to 520 AD.

King Kassapa ruled in Sri Lanka from 478 to 495 AD. Moggallana from 495 to 515 AD and Kumara Dhatusena from 515 to 523 AD.

This was an interesting time period. Bhuddhagosha arrived in 430 AD from Bodhi Gaya. Aryabhata lived in Pataliputra which was walking distance from Bodhi Gaya. Mahavamsa says that Kalidasa, the great poet of India came to Sri Lanka and died here during King Kumara Dhatusena's time. Kalidasa was a great friend of Kumara Dhatusena and as per Mahavamsa, Kumara Dhatusena jumped into the funeral pyre of Kalidasa.

These events show us that there was great communication between India and Sri Lanka at that time.

Above information show us that there is a very good possibility that Aryabhata was a Sri Lankan.