Dissenting Knowledges Pamphlet Series (no. 8)

Is Science Western in Origin?

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Multiversity

Citizens International

Foreword to the

Dissenting Knowledges Pamphlet Series

Vinay Lal, Founding Editor

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In his densely argued essay, Raju makes mincemeat of the received view of the Greek origins of science. He speaks of three different phases through which the received narrative was constructed, though his argument is peppered with a great many other critical observations. The story of the Greek origins of science, Raju argues, can nowhere be found 'from the beginning of the Christian Dark Age to the beginning of the Crusades'. The Greeks had a primitive system of numeration; similarly, since much has been made of the great library of Alexandria, it is imperative to recognize that people other than Greeks produced its books. Raju has elsewhere, in a forthcoming work on Euclid, detailed what exactly it is that we know about Euclid, and what might be the sources of our knowledge about Euclid; and he surprises us with the observation that the sum total of any credible knowledge about someone called 'Euclid' is zero. This is the same 'Euclid' who had become such a globalized and universal figure that even someone like Mohandas Gandhi could effortlessly allude to him in his own quest for truth and precision: as he was to explain to the passengers on board a ship on 25 December 1931, 'It is a self-evident axiom, like the axioms of Euclid, that one cannot have peace unless there is in one an intense longing for peace all round.' Speaking of zero, however, it is well known

that the idea of zero (sunya) came to the West from India, mediated by the Arabs; but astronomy and trigonometry also traveled in that direction, even if the West has long persisted in the fiction that these sciences were transmitted to India from the West.

Having established that the story of the transmission of astronomy and geometry from the Greeks to, in effect, the rest of the world during the Crusades cannot be given any credence, Raju argues that, in the period of the Inquisition, a concerted attempt was made to suggest that Europeans independently rediscovered the scientific knowledge. Raju sees in the much-celebrated account of the supposed Copernican revolution, which takes us from a geocentric view of the universe to a heliocentric view, evidence only of a sustained and pernicious hellenocentrism. Though Copernicus used Islamic sources to reach his conclusions, he failed to acknowledge them. In the final phase of the Western appropriation of scientific knowledge, which continues down to the present day, the entire apparatus of imperialist power was marshaled to press forth the case that accurate scientific knowledge had always been the monopoly of the Europe. Indeed, though Raju does not go so far, this view was bound to prevail in Europe considering that most 'natives' were held to be altogether devoid of the faculty of reasoning. Raju's intent here is also to question the supposition that knowledge in the West has a secular cast. 'Note how theology has crept in', he avers: 'we are asked to believe that science is about deducing the consequences of some "laws" instituted by a god who created the cosmos, as has been made out in the West since Newton.'

Raju's pamphlet, then, takes its place along others in this series that have probed the assumptions underlying the disciplines of economics and anthropology. This pamphlet series, as I noted at the outset, is one of many enterprises to have emerged out of the desire of some scholars, academics, activists, and public intellectuals, who first convened together in Penang, Malaysia in early 2002, to create a new forum, which has been termed "Multiversity", that will at once enable a wholesale but rigorous and searching critique of the frameworks of modern knowledge as well as more ecumenical political and cultural futures. Multiversity's members are committed to the proposition that there needs to be less conversation with the West and more conversation between peoples of the South. Long before India, China, Southeast Asia, and Africa interacted with Europe, they interacted with each other; indeed, the Indian Ocean was a global world, a crossroads, but part of the effect of colonialism has been to obscure these earlier histories. The conception of what constitutes the "world" has narrowed so considerably that everywhere outside Europe it means knowledge only of one's own country and of the Euro-American world. These, apparently, are the borders of our supposed cosmopolitanism.

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Readers are invited to learn more about the pamphlet series and Multiversity by accessing http://www.multiworld.org and http://vlal.bol.ucla. edu/multiversity/.

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Is Science Western in Origin?

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Science is a creation of the West—or so the story goes. On this creation story, science began in Hellenic (Greek) culture, and developed in post-renaissance Europe. The rest of the world had no clue.

A typical account is in the "classic" history of mathematics by Rouse Ball:

> The history of mathematics cannot with certainty be traced back to any school or period before...the...Greeks...though all early **races**... knew something of numeration...and...the elements of land-surveying, yet the rules which they possessed were...founded only on... observation and experiment, and were neither deduced from nor did they

form part of any science.[1]

He presupposes that (a) deduction is more important to science than observation or experiment (which leads to mere "rules"), and that (b) only the Greek "race" had deduction. Needham avoids the racist part of the explanation; but lapses into an otherwise similar view about Chinese "land-surveying" versus Euclidean geometry.[2]

Unlike political history, it is hard to counter or even *explain* the biases in the history of science. "Information poverty" is a consequence of industrial capitalism—even otherwise-educated people are often scientifically illiterate. Like other illiterates, they uncritically accept and repeat stories from socially "authoritative" sources. Scientists, too, may not be knowledgeable enough, for in practice they rely heavily on authority (again because industrial capitalism breeds excessive specialization). Moreover, scientists focus on technique, and carelessly propagate *any* given history. Consequently, very few can put science together with its history and philosophy and build a counter-story. India is a particularly pathetic case: it has no university department of history and philosophy of science, even 60 years after independence. No wonder, the same old story is perpetuated by current Indian school texts,[3] which mention many Greek names as the originators of mathematics and science. These Greek names are accompanied by images of Caucasian stereotypes. Children get the underlying racist message!

This history was contested during the NDA-led regime,[4] but with such extreme counter-biases that there was a storm of

protest. Newspapers then highlighted the "saffronization of history", suggesting that religious fanaticism leads to concocted history as a means of glorification. Certainly this is true, and certainly this needs to be highlighted. But doesn't this apply to *all* situations where religion is mixed with state power? The Crusades and the Inquisition were periods of marked religious fanaticism in Europe. Did that influence the Western history of science? Singularly enough, the role of religious fanaticism in shaping *this* story seems never to have been assessed. Let us do so here.

The Crusades and the story of the 'Greek' origin of science

The story of the Greek origin of science postdates the Crusades.

Before the Crusades, Christendom was in its "Dark Age". In the 4th c., state and church came together in the Roman empire. The subsequent book-burning edicts of Roman Christian emperors,[5] the burning down of the Great Library of Alexandria by a Christian mob,[6] and the closure of all philosophical schools by Justinian in 529 CE, created a vacuum of secular knowledge in Christendom. Such secular knowledge as existed, prior to the Crusades, was pitiful. The outstanding mathematician of the time was Gerbert of Aurillac (Pope Sylvester II), who wrote a learned tome on the abacus (the kindergarten toy of today). So, it would be fair to say that the abacus represented the acme of mathematical knowledge in pre-Crusade Christendom.

Ironically, this Christian Dark Age coincided with the

Islamic Golden Age. In sharp contrast to the book-burning traditions of Christendom, the Abbasid Caliphate had set up the Baghdad House of Wisdom by the early 9th c. CE. This led to such an explosion in the demand for books that, along the lines of the *hadith* to seek knowledge even from China, paper-making techniques were imported from China to set up a paper factory in Baghdad, which had a flourishing book bazaar. Libraries proliferated across the Islamic world, and the 10th c. Umayyad Caliphate in Cordoba had a library, catalogued in 44 volumes, of over 600,000 tomes.[7]

Quite naturally, prior to the Crusades, Europeans regarded the Arabs as knowledgeable. To learn mathematics, Gerbert turned to the Islamic Arabs in Cordoba, not to Greek Christian sources in Byzantium. (Hence, the numerals he imported are today known as "Arabic numerals".) So, the story of the Greek origins of all science did not exist in Europe prior to the Crusades.

The Crusades as "barbarian incursions"

How did this story emerge during the Crusades?

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Ever since state and church first came together, at the time of Constantine, Eusebius, a church historian, had initiated the program of distorting history to promote church interests. His successor Orosius, in his *History Against the Pagans*, made it amply clear that history was just another tool of soft power in the church's armory. This technology of falsehood was now applied to "manage" common perceptions. The story-line was simple: it was the Greeks who did it. On this

story, during the 600 years of the Christian Dark Age, all that the Arabs did was to preserve Greek works, the rightful inheritors of which were the chosen people, the Christians of Europe.

It was this fantastic justification—characterizing Arabs as mere carriers of knowledge, and Greeks as the creative fount—which made the ("Greek") knowledge in Arabic books theologically acceptable in Europe, and enabled the translated Arabic books to be used as university texts for centuries in Europe.

Arabs did not quite accept this story. In the 9th c., when the Arabs built the Bayt al Hikma (House of Wisdom) in Baghdad, they gathered knowledge from all over the world, including India, Persia and China. They certainly did *not* restrict themselves to Greek sources. The actions speak for themselves: the Arabs did not then think that science was primarily a Greek invention.

Greek and Roman difficulties with elementary arithmetic

The non-textual evidence provides a good reason for this. More than deduction, science is based on quantitative *calculation*. But the Greeks lacked basic arithmetic skills needed for calculation. The early Greek (Attic) system of representing numbers was worse even than Roman numerals. (We will use Roman numerals in the following examples, since they are better known.) Greek/Roman numerals are inefficient for two reasons. First they are clumsy: the small number 1788 requires 12 symbols, and is written as MDCCLXXXVIII.

This system is hopeless for large numbers, such as 10^{53}, which the Buddha was asked to name (by an opponent, who sought to test his knowledge). The world might come to an end before one finishes writing down this number in Roman numerals!

The unavoidable inference is this: the Greeks and Romans used this primitive system of numeration just because they never encountered large numbers, and never did the complex calculations required for astronomy and science. Conversely, when the need for such complex calculations arose in Europe, first among the Florentine merchants, and then among European navigators, Roman numerals were abandoned in favour of "Arabic numerals".

Can one get around this inefficiency by inventing names for larger numbers? No. Roman numerals are *structurally* inefficient: even the simplest sum needs an abacus. Try XIV + XVIII! To add two numbers, say 1788 + 1832, one would first represent these numbers on the Roman abacus, using counters.

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Multiplication is more difficult. Shakespeare's clown knows that 11 sheep give 28 pounds of wool which sells for a guinea. How much would he get for the wool from 1500 sheep? He "cannot do't without counters".[9] (We leave out subtraction and division as too difficult to explain!) The Greeks obviously could not have done science without properly knowing how to add and multiply.

The Baghdad House of Wisdom and transmission TO Greek texts

Therefore, while the Arabs valued the "theology of Aristotle",[10] for arithmetic, they turned to India, not to Greece. Arabs imported various Indian arithmetic texts, notably those of Aryabhata, Brahmagupta and Mahavira. These were digested and transcreated in the Bayt al Hikma, by al Khwarizmi, and became famous as Algorismus after his Latinized name. These "Arabic numerals" use the place-value system. That makes it easy to represent large numbers. It also makes arithmetic very easy through "algorithms"—the elementary techniques of addition, subtraction, multiplication, and division that everyone today learns in school.

Although the Baghdad House of Wisdom was a landmark, it only accelerated a well-established tradition. From the very beginning of the Abbasid Caliphate, the legendary Barmakids (from barmak = *pramukh*) of Persian-Buddhist origin, who were *vazir*-s to the Abbasid Khalifa-s, had already instituted this system of importing knowledge from Persia and India.

The Barmakids, in turn, were only continuing the earlier Persian tradition of gathering knowledge, and translating it into Persian (Pahlavi). This continuity is manifest through texts, such as the Indian *Pancatantra*, which were translated into Arabic not from Sanskrit but from Pahlavi, along with other Persian books, such as the "Arabian Nights" and the astronomy text called the *Almagest*. Noticeably, the *Almagest* came to Baghdad from Persia, not Byzantium. Had this text

then existed in Byzantium, it could easily have been sourced from there, for Byzantium was then an abject tributary of Baghdad.

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Euclid: Geometry and Mathematics

We saw that even Needham thought that real mathematics and science began with deduction, a tradition supposedly started by Euclid.

But what exactly do we know about Euclid? One authority, the late David Fowler, gave a succinct answer: "Nothing".[20] However, other historians insist that the right answer is "almost nothing". Let us decide between these two possibilities!

Euclid supposedly wrote a key geometry text called the *Elements*. Naturally, people suppose (on the strength of the story) that the name "Euclid" is found in front of manuscripts of the *Elements*. But that is not true.

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At about this point, many people jump up to say that they don't really care about the person Euclid, and it is the book called the *Elements* which ultimately matters. This is a facile escape route.

If Euclid is a concoction, the *Elements* might have had a non-Hellenic origin in the mystery geometry of pre-Alexandrian Egypt. In that case, it could be better understood as *contrary* to post-Crusade Christian rational theology. The same conclusion applies even if we accept seriously the

Neoplatonic philosophy of geometry, as articulated by Plato or by Proclus in his *Commentary on the Elements*. So, accepting Euclid as a concoction also entails a different understanding of the *Elements*, and amounts to denying the appropriation of reason by the church.[25] Such a denial would alter the present-day philosophy of mathematics,[26] and the idea of deduction as fundamental to science.

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Citizens International (CITIZENS) is a global peoples network based in Penang, Malaysia which works on issues of peace, antimilitarism, cultural co-operation, environmental protection, sustainable development and traditional knowledge systems.

CITIZENS believes that peoples activism on these issues globally is essential to arrest the world's rapid slide towards increased militarisation of land, seas, space; wasteful production of armaments; irreparable destruction of our environment and ecology; war, poverty and pestilence for the global majority.

CITIZENS is managed by a Board of Trustees of experienced NGO activists. The Chairman of the Board is S.M. Mohamed Idris, the President of Consumers Association of Penang (CAP) and Sahabat Alam Malaysia (Friends of the Earth, Malaysia) (SAM) and Co-ordinator of Third World Network (TWN).

On stock Western history, science originated among the Greeks, and then developed in post-renaissance Europe. This story was fabricated in three phases.

First, during the Crusades, scientific knowledge from across the world, in captured Arabic books, was given a theologically-correct origin by claiming it was all transmitted from the Greeks. The key cases of Euclid (geometry) and Claudius Ptolemy (astronomy)—both concocted figures—are used to illustrate this process.

Second, during the Inquisition, world scientific knowledge was again assigned a theologically-correct origin by claiming it was *not* transmitted from others, but was "independently rediscovered" by Europeans. The cases of Copernicus and Newton (calculus) illustrate this process of "revolution by rediscovery".

Third, the appropriated knowledge was reinterpreted and aligned to post-Crusade theology. Colonial and racist historians exploited this, arguing that the (theologically) "correct" version of scientific knowledge (geometry, calculus, etc.) existed only in Europe. These processes of appropriation continue to this day.

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