Extended abstract
The Saraswati Sangam Project, Eminent Scholar Award
Zoom meeting: 26 March 2022

Western appropriations of Indian ganita: contemporary consequences

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Extended Abstract

About 30 years ago, a group of influential intellectuals in India decided: let us tell our own stories. The West has been telling our stories for us for far too long. I participated in the initial discussions, and in the resulting Project of History of Indian Science, Philosophy and Culture, and eventually authored one of its over 100 volumes.[2]

Indian origin of calculus. My PHISPC volume documented how the calculus originated in India, with the 5th c. Aryabhata, in connection with the two key sources of Indian wealth: agriculture, and overseas trade. Agriculture, which is still monsoon-driven in India, required a good calendar which could correctly identify the rainy season, not just summer and winter. Overseas trade required celestial navigation. Both calendar and celestial navigation require good astronomy, *and precise "trigonometric" values.* Aryabhata invented the "Euler" method to solve finite difference equations to derive precise sine values, precise to the first sexagesimal minute. By the 14th c., in India, this accuracy had been extended to the third sexagesimal minute or about nine decimal places by his disciples in Kerala.

Why Europeans stole it. Ganita and astronomy texts containing these precise trigonometric values, derived using the Indian calculus were translated by Jesuits in their Cochin college, in the 16th c., and taken to Europe. Why? Because astronomy, and precise trigonometric values were *critically important* for the European navigational problem, of determining latitude, longitude and loxodromes at seas. The navigational problem was then the foremost scientific challenge facing Europe until the end of the 18th c. European governments offered large prizes for its solution from the 16th to the 18th c. (British longitude prize, 1712) since European dreams of wealth all rested overseas.

The discovery doctrine and its use for false history. However, the origin of this Indian calculus was all falsely attributed to Europeans, Cavalieri, Newton. Leibniz, Fermat, Euler etc., using the "Doctrine of Christian discovery" (still a US and British law[3]) to appropriate all knowledge (like all land in the US) to Christians. This doctrine[4] asserts that all land (or knowledge) is "owned" by the first Christian to spot it, called its "discoverer", like Columbus "discovered" America, or Vasco "discovered" India (with the help of an Indian navigator!).

The standard of evidence for proof of theft. Evidence in history is normally assessed on balance of probabilities, as in civil law. However, to establish that calculus was stolen from India, I used the higher standard of evidence, as in criminal law for serious crimes like murder:[5] examining the evidence for calculus transmission from India to Europe, based on opportunity (Cochin college), motivation (European navigational problem), circumstantial evidence (e.g. Fermat's challenge problem[6]) and documentary evidence (e.g. Matteo Ricci's letter[7]).

The Western response. Was that standard of evidence enough? Was the Western theft of calculus from India now acknowledged? No! Instead *the very thesis of theft of calculus was itself almost immediately stolen!*[8] The West is very sure that if Indians allowed credit grab and theft of knowledge for so many centuries, they will allow it forever. It has 1700-year long tradition of benefiting from history as propaganda, and seems largely unconcerned about evidence or truth in history.

The epistemic test. Faced with this experience of "perpetual theft" of knowledge by the West, my PHISPC volume emphasized a novel standard of evidence which I used as a teacher to catch students who cheat. This is my **epistemic test**: those who copy, like students who cheat in an exam, often fail to *fully* understand what they copy. **Therefore, in a situation where transmission (copying) is very possible, failure to understand is *proof* of copying**. This test helps unmask knowledge-thieves whether ancient or modern.

West did NOT fully understand calculus. Though the West stole calculus and claimed credit for it, Newton, Leibniz etc. didn't *fully* understand the calculus. That is, they understood how to apply the calculus to practical problems of navigation and physics, but e.g., they did NOT know how to sum its infinite series.[9] (Nilakanth, in the15th c., gave the first documented sum of the *infinite* geometric series.[10]) The Western metaphysics of "real" numbers and limits was invented to overcome that self-acknowledged lack of understanding of infinite sums. Thus, calculus was self-acknowledgedly not fully understood in the West until the 1930's, when axiomatic set theory was invented to justify

real numbers. Real numbers only provided a layer of *metaphysics*, over Indian calculus, which added nothing to the practical (or epistemic) value of calculus (but enormously to its difficulty).[11]

Most current school math of Indian origin. Indeed, not calculus alone, but most of present-day *useful* school mathematics, arithmetic,[12] algebra,[13] trigonometry and calculus,[14] probability and statistics,[15] was transmitted to Europe from India in pre-colonial times.[16] Three different models of false history were used to appropriate it; all deny credit to Indians. The first was the pre-Crusading, non-malicious model of simple misattribution to Arabs: as in "Arabic numerals", or "algebra". The second was the Crusading model of deliberately false history: attributing all knowledge in captured Arabic texts (including Indian knowledge in them) to Greeks, as in attributing trigonometry from Arabic or later (derived) Byzantine Greek texts to early Greeks.[17] In a scriptural tradition, and in times of intense fanaticism, no one bothered that this was contrary to *all non-textual evidence* that early Greeks were arithmetically challenged and lacked even a systematic notation for fractions, hence lacked a half-way decent calendar. The third model of false history, the Christian Discovery model, was used to appropriate calculus and probability, as in attributing "discovery" of calculus to Newton and Leibniz.

The Western distortion of math. In each case, my crucial epistemic test exposes the theft. Initial European lack of understanding of Indian arithmetic is clear from the very term "Arabic numerals" which exposes lack of understanding of the efficient arithmetic of "algorithms", and the resulting comparative advantage for commerce (and the subsequent distrust of the change, as in the Florentine law against zero).[18] The lack of understanding of trigonometry is clear from its very name: it was always about "circlemetry", or measuring the circle not just triangles. This is a misunderstanding like the very name sine, which originates from the Latin sinus, a misreading of the Indian jiva, as the Arabic jaib, written as the consonantal skeleton "jb". These misunderstandings did not seriously affect the subject. But there was lack of understanding also of algebra: the "non-Archimedean" arithmetic of Brahmagupta's *avyakta ganita* (algebra) of polynomials, since al Khwarizmi's translation was restricted to linear and quadratic equations. Similarly, Egyptian mystery geometry was stolen from Arabs during the Crusades, and attributed to an unknown early Greek, "Euclid", and used in support of the Crusading church theology of axiomatic reasoning.[19] All this resulted in the fundamental Western misunderstanding of the calculus stolen from India, especially the lack of understanding of the Indian way of summing infinite series.[20]

Formal math adds useless metaphysics to pre-existing normal math. The subsequent misguided Western attempt to understand Indian ganita in Western ethnomathematical terms, resulted in practical Indian ganita being coated with a superficial layer of useless metaphysics, and being recast as an *exact* (and axiomatic) metaphysics of infinity.[21] This resulted not only in metaphysical (=unreal) "real" numbers, but also in the measure-theoretic definition of probability which cannot be clearly related to any empirical basis. But ganita is *not* (formal) mathematics, it is superior normal mathematics.[22] What "works" in math is normal math; the credit is appropriated to formal math, just as Black slaves worked, and the White masters grabbed the benefit.

False history of math results in its bad philosophy and the difficulty of math. In short, the *false history* of math resulted in lack of understanding, hence a *bad philosophy* of math. The need to correct the faulty Western understanding of math (which persists e.g. in calculus, and probability) results in the *contemporary value* of this revised history. While the West has glorified itself with 1700 years of systematically false history, the false history of math[23] cannot escape the epistemic test: the lack of full understanding of the stolen Indian calculus led the West to evolve a bad philosophical way to understand the calculus. This has made calculus so difficult (without adding to its practical value) that the California new math framework[24] now seeks to effectively "cancel" the calculus[25] in favour of statistics and data science. But statistics is risky if done without calculus.

The advantages and disadvantages of false history. The lies of false history of math/science have greatly financially benefited the West in the past centuries, also enabling it to claim "intellectual superiority" and "morally" justify slavery, racism, and colonialism.[26] But the false history of math also created a bad understanding of math, hence the current difficulty in math-teaching, needed for technology development. The only solution to this impediment in the way of future technological development of the West[27] is to do reparation for past injustice by acknowledging and correcting the centuries of false history, and the related bad philosophy of math. Unfortunately, so far, the West has only tried to censor and suppress the critique of its false history, and bad philosophy, and effectively support racism.[28]

The future. If reparations are done, that would also help improve the teaching of statistics and data science.[29] But, if reparations are not done that would eventually result in poetic justice, with others forging ahead of the West in technology due to a better understanding of mathematics.

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