Decolonising math and science education

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Math and science are believed to be universal, so is there anything to decolonise in math and science education? Indeed there is. The wrong *belief* that math and science are universal but developed mainly in the west played a key role in colonisation. In nineteenth century India, the belief was bought by the gullible 50%, including Raja Ramamohun Roy,[1] who hence advocated imitation of the West. That gullible but influential 50% enabled Macaulay to push in western-style university education, so critical to colonisation.[2] Despite 175 years of experience to the contrary, that imitation can *never* be used to catch up, people still claim that western education helps India to 'progress', and the prescription to imitate the West, especially in math and science, is again being used today to recolonise India by promoting western education and through it dependence on the west. The same 175 year old rotten carrot of 'catching up' with the west is involved in the present-day ranking of universities. This led to the demand for 'ISI publications,' introduced by the Organization of Islamic Conference in 2007,[3] which forcibly brings all university scientists in the Muslim world under the total control and intellectual domination of the West.

Since so much power continues to flow from the claim that 'math and science are universal but they originated in the west' we ought to examine it carefully. The claim is not only false, but the merest inspection shows it is absurd and contrary to commonsense: if math and science are indeed universal they should have sprung up the same everywhere. So we must abandon either the belief (a) that math and science are universal, or the belief (b) that they originated (mainly) in the west, or (c) both. Either way, this would have a major impact on university and school curricula.

Mathematics

It is very easy to see why present-day university mathematics is not universal, and never can be. The philosophy of present-day mathematics, known as formalism, due to Russell and Hilbert, reduces mathematics to metaphysics, and it is commonsense that metaphysics can never be universal. Far from being universal, the metaphysics underlying formal university mathematics is, in fact, *contrary* to *all* Indian systems of philosophy (including Nyaya, Advaita Vedanta, Samkhya-Yoga, Buddhist, Jain and Lokayata) and to Islamic beliefs. This again is rather obvious. *All* Indian systems of philosophy, without exception, accept the empirically manifest (*pratyaksa*) as the first means of proof (*pramana*). But present-day mathematics rejects empirical proofs.[4] Indeed, the substance of Russell's and Hilbert's analyses of the foundations of geometry[5] (which preceded and led to formalism) was to eliminate the empirical proofs found in the *Elements* (in the proof of the side-angle-side theorem or proposition 4, in proposition 1, etc.).[6]

Note that we are not referring only to philosophies classified as 'religious'. The Indian Lokayata system is profoundly anti-religious and materialist. Nevertheless, Lokayata accepts only empirical

proofs, and rejects inference as an unreliable means of proof, *exactly contrary* to present-day mathematics which accepts inference as the sole reliable means of proof and rejects the empirical.

Further, racist western scholars who have extolled deduction, made a naïve mistake in assuming deduction to be universal. Thus, deduction is based on logic, mistakenly assumed to be universal by western philosophers since the Crusades.[7] However, the Buddhist logic of *catuskoti* and the Jain logic of *syadavada* is different[8] from the 2-valued logic declared to be universal by the west and used to prove the theorems of present-day mathematics.[9] The use of such logics (note how the plural logics is considered a grammatical error in English) for deduction would lead, like quantum logic,[10] to a different class of mathematical theorems, and invalidate numerous existing mathematical proofs based on proof by contradiction. Thus, present-day mathematics is specially biased against Buddhism, Jainism and Lokayata, the three *nastika* ('atheistic') Indian philosophies.

This does not bring formal math any closer to the Indian *astika* ('theistic') philosophies, for formal mathematics is also especially biased against Advaita Vedanta, for example, since it rejects the Egyptian/Platonic idea of mathesis. That belief about mathesis and reincarnation involved beliefs about the soul very close to those in the Upanishads, Advaita Vedanta, and sufi beliefs.[11] This difference over the notion of the soul was, as we know, at the heart of the rejection of mathematics and philosophy by the post-Nicene church,[12] and the quarrel it had with the philosophers ('pagans').[13]

Though the above argument about the religious bias of formal mathematics (as taught in present-day universities) is conclusive, there is more to the matter. Though the philosophy of formal mathematics accepts in theory that the postulates of a mathematical theory are arbitrary and *not* universal, there is no objective way to decide the worth of a formal mathematical theory. Consequently, the worth of a mathematical theory is decided solely through western endorsement. This makes all mathematicians dependent upon western endorsement. This dependence has similar consequences to dependence on drugs, and makes non-western mathematicians beg and crave for western endorsement. As a further consequence, the postulates of a mathematical theory are decided, in practice, by western mathematicians, and students throughout the world are wrongly taught that other ways of doing things, like computer arithmetic, for example, are erroneous, though all practical mathematics can be and is done today using a computer. Apart from biases against practical ways of doing things, those postulates laid down by western mathematicians may and do involve biases against Islamic thought, for example. As I have explained elsewhere,[14] the atomistic beliefs of the followers of al Ashari are compatible with computer arithmetic.

Present-day mathematics is also against various other systems of belief. It is in recognition of these differences that western historians refer to 'Hindu mathematics,' 'Egyptian mathematics,' ethnomathematics, etc., as kinds of mathematics different from present-day 'universal' mathematics, better called university mathematics! Note how professional mathematicians in the west avoid the phrase 'Christian mathematics,' which is not found in texts on the history of mathematics.

Setting aside this play on words (to which we will return later), the differences between the various kinds of mathematics become especially clear when we examine cases of transmission of mathematics. western historians have done their utmost to hide cases of mathematics being transmitted to the West from the non-West (barring the pre-Crusade case of 'Arabic' numerals). Nevertheless, as I pointed out and established a few years ago,[15] calculus developed in India and was transmitted to Europe. Since Indians were the first to invent the calculus, that is certainly a matter of pride for Indians, but we should not lose sight of the key points on that account. The key points are, firstly, that western historians are an utterly dishonest lot, who cannot be trusted since they deliberately lied about this to belittle others and

glorify their own selves. Secondly, and more importantly for the present paper, the way the calculus actually developed in India provides a concrete example of how mathematics was and can still be done differently.

The history of the transmission of the calculus makes clear this clash of philosophies, or math war as I have called it. In the 16th c. CE, Jesuits based in Cochin, stole the calculus from India. (I say 'stole' since they did it without acknowledgment; and this lack of acknowledgment was systemic, not accidental.[16]) The reason for the theft was the great practical value of the calculus. This practical value arose since the calculus was used by Indians to derive precise trigonometric values (precise to the 9th decimal place). Those precise trigonometric values were badly needed in the 16th c. to solve the problems of (and specific to) European navigation. Navigation was the key scientific problem in Europe at that time, since Europe was very poor then, and its dreams of wealth rested on overseas trade with India and China. This required an accurate system of navigation which Europe did not then have. Accordingly, various European governments offered large prizes for the solution of the (European) navigational problem, while the Royal Society and the French Royal Academy, etc., were set up with the solution of the navigational problem as a key objective. While recent histories have dwelt on the problem of determining longitude at sea, they have neglected to mention that the major problem in the 16th c. was to determine latitude at sea and loxodromes.[17] (western histories do not mention this, since it makes their star navigators like Columbus and Vasco da Gama look foolish and ignorant, as in Vasco da Gama's remark that his Indian navigator was telling the distance by his teeth, or in Columbus' remark that he mistook Cuba for Cathay because his sextant was broken.[18]) The precise trigonometric values taken from India were used then by Europeans to solve their problems of determining latitude and loxodromes.

The practical value of the calculus was immediately accepted in Europe and incorporated, for example, in the Mercator chart ('map of the world,' which mapped loxodromes to straight lines using precise trigonometric values, or tables of secants). While western histories with their typical dishonesty extol Regiomontanus and Clavius, the fact is that western mathematicians (including Clavius) were too deficient to understand the high-school problem of how to use precise trigonometric values to determine the size of the earth, something which they determined only as late as 1672, over a thousand years behind the Indians[19] and some 850 years after al Mamun. The size of the earth was a critical parameter in Indo-Arabic navigation techniques, and Europeans lacked a clear value of this parameter. (And in 1672 it was not clear to practical navigators that they had managed to fix its value.) *Hence,* European navigational theorists were unable to solve the longitude problem mathematically,[20] and developed a separate mechanical instrument, the chronometer, for that purpose. This part of history was never told by western historians.

With this level of understanding of the math they imported from India, Europeans naturally failed to understand the philosophy underlying the calculus. Clavius, Tycho Brahe, Kepler, Galileo, Descartes and Newton all struggled with and failed to understanding how infinite series were summed in India to derive those precise trigonometric values. Granting that Europeans then were especially backward in mathematics, in my opinion this particular lack of understanding (as distinct from the failure to determine the size of the earth using trigonometry) was a characteristic of the clash of philosophies arising from imported knowledge. Europe had experienced similar epistemological difficulties in the preceding 500 years in understanding and accepting elementary arithmetic and especially zero (also imported from India via Arabs), because of philosophical differences about the nature of number. I have called that the first math war.[21] (That European difficulty in understanding zero is clear from its very name, for zero derives from the Arabic *sifr* through zephyr or cipher, and cipher, as we all know, means a hard to understand code.) To understand these philosophical differences we need to clarify the

nature of western academic activity, at the fundamental level.

The origin of the western university system

Now, it seems to have gone unnoticed that the beginning of the western university system coincides with the Crusades and the consequent influx of non-Christian knowledge into Europe: the first western university in Bologna commenced in 1088 *after* the fall of Toledo in 1085, when its large Arabic library came under Christian control.[22] As is well known, the Arabic books in this library were mass translated into Latin, starting ca. 1125 to provide the first books in Europe (apart from the Bible and related religious literature). Ever since it burnt down the Great Library of Alexandria,[23] the church had for centuries carefully excluded non-Christian knowledge, with a policy to kill or exile heretics rather than debate with them. Consequently, the influx of non-Christian knowledge threatened church doctrine and its insecure dominance based on absurd lies and myths. That is, *from its inception, the western university was conceived as an institution to absorb incoming knowledge after ensuring it was theologically correct.*

This relationship of western academics with Christian theology was further cemented by the fact that for centuries the church was the key consumer for the products of the western university system. In fact, the graduates were required to swear their loyalty to the church. (This applied also to Protestant countries like Britain. For example, though Newton himself managed to get a dispensation to avoid swearing allegiance to the church, as all graduates of Cambridge were then required to do, the continuing dominance of the church is clear from the fact that he felt compelled to hide his true masterpiece – the history of the church – which remains hidden and unpublished to this day.[24]) These products of western (theological) education made knowledge theologically correct by following a stock procedure.

The first step of this stock procedure was to falsify history by simply denying all theologically-incorrect sources of knowledge. In this step, all knowledge was attributed either to theologically correct sources such as 'friendly' early 'Greeks' (concocted where necessary, like 'Euclid'[25]), or directly to contemporary Christians (like Copernicus), by claiming 'independent rediscovery.' Note that contrary to the myths spun by western historians, Copernicus was not the revolutionary scientist he is made out to be, but a priest who merely translated and transliterated the works of Ibn Shatir of Damscus, and the Margheh school of Nasiruddin Tusi, from Greek to Latin. (The book of Ibn Shatir had already been translated from Syriac to Greek, and was available in the Vatican, while Europeans widely studied Maragheh text directly in Arabic, but Harvard historians still insist that Copernicus discovered the identical system independently,[26] just as Western historians say Vasco da Gama discovered India (or 'independently rediscovered' the sea route to India with the help of his Indian navigator, Kanha). This system of claiming dependent discovery in the non-West and 'independent rediscovery' in the West is a stock aspect of jaundiced western history which continues to this day.

For example, a former President of the Royal Society claimed to have independently rediscovered my published work[27] about a paradigm shift in physics, from ten years earlier. He was immediately informed about my work. Nevertheless, a year on, it got mysteriously named after him, as 'Atiyah's hypothesis,' in a prominent article published in consultation with him. When I objected, a post-facto acknowledgment to my work was published patronisingly.[28] I wrote a letter clarifying that this was the *second* time Atiyah had claimed credit for my work, and this second case occurred *after* he was explicitly informed of my work, and had acknowledged that communication. The letter also clarified that the term 'hypothesis' involved another mistake, in that no hypothesis was needed. The editor A.

Magid refused to publish this letter. He deliberately allowed the mistake in his journal to stand. This action of retaining mistakes had the full support of the American Mathematical Society.

This is not an isolated case: in cultural matters, western institutions are still proceeding with their unethical agenda of colonial appropriation. Western pirates since Francis Drake have known they will receive the fullest institutional support. This appropriation agenda was aided by the Church methodology of excluding, suppressing, and brutally killing, all those who differed – hence Mercator feared to acknowledge his non-Christian sources. Even Newton was compelled to hide his history of the church. This enabled the late Newton scholar Whiteside to continue to lie about it in this century, when I pointed out that a 'cartload' of Newton's works had been suppressed. Whiteside tried to *suggest* to the contrary that none of Newton manuscripts were unpublished, and turned abusive when contradicted.[29] These are only some quick examples of how people at the highest level in western academics see it as their trade to try and preserve falsehoods. Even with the reduced power of the church, they systematically verbally abuse, misrepresent, and malign those who want to bring out the truth. The point is that they still see the western university as an institution which helps to carry forward the false history initiated by the post-Crusade church and pursued by later-day racist and colonial historians.

The second part of this system of making the incoming knowledge theologically correct is less understood. This was to make the knowledge itself (not merely its source) theologically correct by 'reinterpreting' it to bring it in line with church theology. Accordingly, western thinkers tried to fit the calculus and infinite series within the frame of what they knew – the notion of infinity/eternity familiar to them from Christian theology. I have explained some of these issues elsewhere, and will not again go into them here. Suffice it to say that set theory and formalism – on which present-day university mathematics is founded – are a direct outgrowth of this western misunderstanding of the calculus while trying to appropriate it and make it theologically correct. (Recall that Russell and Hilbert's agenda in their respective tracts on the foundations of geometry was to restore the supremacy of metaphysics by eliminating the empirical from the *Elements*.)

Making numbers theologically correct

At this stage someone or the other (usually a non-mathematician) is bound to pop up with what seems (to them) an absolutely irrefutable objection. Isn't 2+2 = 4 a universal truth? The simple answer is no. I am tired of explaining this repeatedly, but here goes once again. How much do 2 big fish + 2 small fish make? 3 big fish or 5 small fish? If I have two stones, and you give me two stones, but I break one of them, how many stones do I have? Various sorts of 'deviant' arithmetics are eminently practical: a single chip on a computer implements the arithmetic of 1+1 = 0 (exclusive or gate) or 1 + 1 = 1 (inclusive or gate) millions of time. We count days of the week using modular arithmetic where 4 (Thursday)+5 (days) = 2 (Tuesday), and so on.

The next layer of misunderstanding through simplistification is to imagine that I am suggesting modular arithmetic or some variant of it as a fundamental counter-example to integer arithmetic. The argument actually is this: in view of these different types of arithmetic that are prevalent, to say that 2+2=4 we must first *specify* that we are dealing with integers, and not with some other form of arithmetic. The real catch is this: though not obvious, on formalist philosophy, some notion of infinity/eternity creeps in the process of such specification of integers. The simplest way to understand this is to observe that a computer can *never* do Peano arithmetic and a Java program for adding integers will give 2000000000 + 2000000000 = -294967296. If we try to get around this difficulty by using

floating point numbers instead, other less-obvious difficulties will manifest themselves: the associative 'law' for addition would fail, and so on.

Let me explain this last point. Everyone understands the difference between a big fish and a small fish, and one will typically not swap one for the other any more than one will swap a heavier gold bar for a lighter one. One will, for example, *weigh* the two fish. This involves using fractions so that 2 big fish + 2 small fish may turn out to be 3.2 big fish. This is perfectly satisfactory so far as fish are concerned, but one may well demand a higher precision for gold coins, for one may want to discriminate between 3.180 kg of gold, and 3.453 kg, for the difference of 273 grams may be worth a lot of money. Perhaps one may be satisfied with milligrams where gold is concerned, which when measured in kg amounts to identifying numbers which differ in the 7^{th} decimal place. But that is still not quite the 'perfect' mathematics that formalism constructs. With floating point numbers on a computer one stops discriminating after the 7^{th} decimal place, and this results in the arithmetic where (-1+1) + 0.0000001 = 0.000001. However 1+0.0000001 = 1 so that -1 + (1+0.0000001) = 0. This arithmetic is different from the one taught to school children, under the western education system, which teaches that numbers obey the (god given?) associative law. If we want that 'law', we must first be able to *specify* a number to an infinite number of decimal places. That is physically impossible. Of course, it can be declared possible metaphysically, and in the human imagination, according to the postulates of formalism and set theory, but that argument fails with machines like computers which cannot be persuaded about the metaphysics of infinity.

Since western philosophy was all done by priests until rather recently, this notion of infinity had to be theologically correct on Christian theology. And that is really what formalism is all about (making infinity theologically correct) even if some of those who implemented the formalist program were non-believers. (Russell is not a solitary example of a non-believer falling victim to church propaganda; even ardent opponents of the church like Newton and Nietzsche fell into Augustine's trap of a dichotomy between 'linear' and 'cyclic' time, as I have explained elsewhere.)

How all of math was made theologically correct is actually a long story which begins with the Crusades. I have explained this in a series of publications over the last decade, including *Cultural Foundations of Mathematics* (Pearson Longman, 2007). I have also explained how post-Nicene and post-Crusade Christian theology (and mythology) has deeply influenced the philosophy of present-day university mathematics. An explanation for the complete layperson is in my forthcoming book *Euclid and Jesus: How the church changed mathematics and its history across two religious wars*. The following quote is from its back cover.

> The mystery geometry of black Egypt aimed to arouse the soul, and prove equity, as in Plato's story of Socrates and the slave boy. Early Christians had similar beliefs about the soul, but the church changed Christian doctrine to enable its priests to rule. When 'pagans' resisted, the church retaliated with a religious war: it cursed the early beliefs about the soul, and banned philosophy. This plunged Christendom into its Dark Age, but catalysed the Islamic Golden Age. The contrast fanned envy, and the church incited the Crusades, hoping to grab Muslim wealth – but the Crusades failed beyond Spain. To convert Muslims, who accepted reason, the church now sought mathematics, connecting it to Christian doctrine by changing both. The myth of Euclid helped the church claim ownership of reason, and belittle both Muslims and early Egyptians. Was the real author of the *Elements* a woman, Hypatia? Was she black?
>
> Mathematics is promoted as universal truth, and the *Elements* as its role model. Strangely,

> both harmonize with (post-Crusade) church doctrine. So, should people abandon all other religions and philosophies? This book argues that a web of myths and lies is being used to trap and enslave the human mind, and only true knowledge can set it free.

Instead of reproducing the full story, and forcibly compressing those books into this paper, I would invite people to read the books and papers unabridged. Since the notion of infinity potentially lurks behind the simplest propositions of mathematics, the western solution was to make math metaphysical. But other solutions are possible, for example the realistic solution provided by zeroism, which accepts that it is impossible to specify a thing (anything) exactly. However, there is no room for students to question the philosophy with which mathematics is taught to them, and there is no forum where this philosophy can be fundamentally questioned without monitoring and petty falsehoods introduced by western gatekeepers.[30]

Changing the math curriculum

I hope I have said enough to make the point that formal mathematics, as taught in universities today, is not universal by any stretch of the imagination, but it has been forcibly made universal. Though no longer explicitly religious, the philosophy of mathematics remains rooted in post-Crusade Christian theology, and contrary to all other religious beliefs. The harmony of present-day mathematics (and its 'history') with post-Crusade theology, together with the illiterate superstition about its universality, makes it an excellent tool for propaganda. Imitating those techniques of mathematics creates a discord within the student's mind for it implants a bias against all other religious beliefs and philosophies.

Ironically, though the mathematics imported by the west was specifically Christianised, no western academic is honest enough to admit it. They insist that what they have done is 'universal,' and though others did mathematics differently, they keep insisting it was because those others had no understanding of what is universal! It is time now to reject this proposition, and to go instead with the claim that it was the west which got mathematics wrong (among other things) because it is a society dominated for so long by a terrible institution – the church – which propagates superstitions as a means of mind control.

This western mathematics (perhaps better called Christian ethnomathematics) is taught in universities today in blind imitation of the things western. (Remember we are trying to catch up for the last 175 years?) It is based on premises and false history never critically examined in the non-west. To change the university curriculum in mathematics we need to challenge those absurdities. But they are *de facto* hard to challenge because the system is fortified: decisions regarding education are taken by politically powerful but ignorant people, too ignorant to understand the criticism. For example, the Indian Knowledge Commission was headed by someone politically powerful but not knowledgeable. These people who seek to control the knowledgeable, lack knowledge even about who the real experts are, for their simple-minded process is to select as experts those endorsed by the west. These 'experts' and their graduate students can be readily observed wagging their tails before westerners so as to fetch that endorsement.

These may occasionally be misguided people, but often enough there are also traitors who well understand that western endorsement is a source of profit and are out to profit by betraying their people and culture (that is how colonisation functioned). I will not name names, though there are plenty to choose from. However, one point must be mentioned. Despite my personal regard for Sam Pitroda, I

must say that even a mediocre manager can see that taking decisions about knowledge by relying on western-approved 'Indian' experts can only lead to more aping of the west, which benefits the west and not India. This reliance on western endorsement to decide experts (and hence the kind of mathematics to teach) is a natural outcome of the colonial educational system which ensures that most people remain scientifically illiterate and learn to trust only the west, as in the ISI norm introduced by the OIC.

Now, the point of this paper is not to complain about western dominance, but to understand and expose the tricks used to bring it about and to maintain it, so that an alternative mathematics curriculum can be actually implemented, and adopted in our universities, despite those tricks. Changing the math curriculum, and discarding the belief in the universality of formal math and its western origin as a false and absurd myth, is necessary in order to decolonise our universities. In my opinion, if we follow Macaulay's logic, changing the math curriculum will be far far more potent than revising the curriculum in all the social sciences put together.

However, we must also understand that western-endorsed experts, the comprador elements in our universities, will oppose any curriculum change tooth and nail just because they were brought up in the western system, and changing it would make valueless their own work in mathematics. Of course, that work, especially in pure mathematics, is anyway utterly useless to people in the non-west – the vast majority of the mathematical theorems they have proved are as worthless as propositions about the number of angels dancing on a pin. Nevertheless, western endorsement being the sole criteria by which colonised societies judge scientific achievements, this endorsement fetches the experts numerous financial benefits. While there are honest persons who would be willing to forego those financial benefits, there are also many who would put their financial self-interest first and the larger needs of society later.

The thinking behind the suggested change in the math curriculum is simple. Why do math? In the non-west the key reason to do math is for its *practical* application to science and technology. That practical application, then, should be the goal of our revised curriculum. To avoid the danger of simplistification, let me clarify that I am not merely advocating applied math over pure math. I am advocating a different epistemology, called zeroism, which rejects formal math as altogether worthless, and based on an erroneous epistemology. The new epistemology, called zeroism, is a realistic philosophy. This means, for example, that we accept the reality that a number can be specified only to a finite number of decimal places. That again means, for example, that the limits taught in a calculus course are not only worthless but an *erroneous* western understanding of non-western mathematics, and should be abandoned.

I have argued out this particular case of calculus in some detail. The 450 years of confusion about the calculus in Europe has failed to resolve even the most elementary epistemological problems. Thus consider the question, 'Is a discontinuous function differentiable?' According to elementary calculus, as taught at the first year level in the university, the answer is 'no'; one can easily use limits to formally prove that a differentiable function must be continuous. On the other hand, at an advanced level, we have several formal theories, such as the Schwartz theory of distributions or Mikusinski's operational calculus, which do allow a discontinuous function to be differentiated: it is well known even to physicists that the derivative of the discontinuous Heaviside function is the Dirac delta function. (Curiously, the first such theory of Sobolev was put forward even before set theory was formalised to put real numbers and limits on a firm formal footing.) That is, while the answer to our question is 'no' on elementary mathematics, the answer is 'yes' on advanced mathematics. This is the way of metaphysics, one can juggle around and select whatever answer one wants for the time being! Though the critics who opposed the constructivist changes in the US math curriculum (during the Carter

regime) seem unaware of it, formalism is the best route to no-correct-answer math!

However, if the aim of mathematics is to do physics one cannot have two answers. The more serious difficulty is that one has no answer at all, for one cannot accept *either* answer provided by formal math! Thus, what should one believe about the differential equations of physics? Do they or do they not admit discontinuous solutions? On elementary mathematics they clearly do not. The advanced mathematics of the Schwartz theory too does not work for the equations of physics are nonlinear and the Schwartz theory is not, so that Schwartz distributions cannot be multiplied. However, the *observation* is that a shock wave or blast wave leads to a discontinuity. In classical physics one can pretend that this discontinuity is not real by going over to statistical mechanics. However, this artifice is not available in the general theory of relativity since there is no relativistic statistical mechanics to connect the continuum to a particulate distribution of matter: accordingly, relativistic shocks must be regarded as real hypersurfaces of discontinuity.

To complete this account of the total mess in formal mathematics on this elementary issue in the calculus, since mathematics goes with western authority rather than commonsense, the 'accepted' theory of multiplying Schwartz distributions is that of Colombeau which is a rather bad theory since it can be used to derive any conclusion one wants[31] and hence cannot lead to any refutable results. The correct solution to the problem, using zeroism, is explained in the appendix to my book *Cultural Foundations of Mathematics.* It leads to new (and empirically refutable) conditions for shock waves. In fact, this philosophy changes mathematics from metaphysics to an auxiliary physical theory. There are similar issues about infinity in quantum field theory (renormalization problem) and Maxwell's equations (runaway solutions), and the same procedure can be and has been applied there as well, but I will not go into that here. The point is that the theory of limits does not help the practical applications of the calculus which can be better done by abandoning limits. (I should add that this is especially helpful in resolving the long-standing problem with the frequentist interpretation of probability.[32])

Incidentally, contrary to what western mathematicians repeatedly say, the calculus as it historically developed in India did sum infinite series in a completely rigorous way by discarding infinitesimals. However, even after 450 years, this simple point still remains beyond the comprehension of western mathematicians who are obsessed with their own sense of authority, and with the compatibility of notions of eternity/infinity with Christian theology, and can only understand things explained in those terms. In fact, even in those terms, the matter is quite easy to understand: formally speaking, Indian mathematicians worked with rational functions, which are like rational numbers except that they form what is today called a 'non-Archimedean' field. Discarding infinitesimals in such a field is equivalent to limits by order counting which is the exact procedure followed in Indian texts to sum infinite series, as I have explained.

With a view to establish an alternative mathematics curriculum, I have taught calculus without limits to 6 batches of students until now. Three batches consisted of non-math students and three batches of math students. The course involved 5-7 lectures and practicals in a computer lab, which were integrated with the course in some cases. At the end of the course the students were able to (a) understand the core concepts of the calculus, (b) use a computer program to calculate symbolic integrals and derivatives, and (c) use a computer program to numerically solve ordinary differential equations and analyse the solution qualitatively.

Advantages and disadvantages

The disadvantages of the existing (calculus with limits) curriculum are the following. First, limits cannot really be taught correctly even according to formalism, since that would involve teaching formal real numbers and axiomatic set theory. These are regarded as advanced topics, and most students of science and engineering are not exposed to them. While formal real numbers are taught in advanced courses on mathematical analysis, axiomatic set theory is not taught even to mathematicians, except to specialists in logic. Hence, even professors of mathematics in IITs are not familiar with it. The assumption is that some confused and naïve ideas about set theory and real numbers are adequate for most people. On this same assumption, naïve set theory is taught to school children with all sorts of wrong definitions, and that confusion persists with most people for the rest of their lives. One completely fails to see why students should be taught limits in a naïve and confused way when the objective of limits is purportedly to eliminate naivete and confusion! Apparently, this is intended to teach some sort of ritual obeisance to the confusion implanted into the calculus by the west.

Secondly, most engineering students learn the formulae of calculus by rote. That is, everyone can write down the derivative of the exponential function, say, but few can provide the definition of the exponential function.

Thirdly, the other thing that students take away from existing calculus courses is the ability to use tricks to 'solve' integrals symbolically in terms of elementary functions. This is a dead skill for a computer can perform the task easily.

Fourthly, students are taught to prove theorems. First, as pointed out above, theorems have lost their *raison d'etre* since due to cultural variations in logic, mathematical theorems provide no epistemological security. Second, proofs are by design something that can be checked mechanically. Further, despite Godel's theorem, there is no guarantee at all that the class of theorems proved by human beings is any evidence of human creativity for Godel's theorem says nothing at all about human creativity: the entire class of theorems proved by humans and most future theorems that humans are capable of proving may soon be readily proved using computers. Third, computers can prove theorems (like the four-colour theorem) too complex for humans to understand, so if complexity is a measure of the value of proofs, then theorem proving is a task best left to computers. Indeed, theorem-proving mathematicians are perpetually under the thumb of western authority: that is all that theorem-proving achieves. Lastly, many mathematicians desperate to defend themselves, often jump to the old and rejected mathesis idea of mathematics as an art form. This is a specious defence, for if they are serious, they ought to go back also to the mathesis notion of soul, and reject the post-Nicene modifications to Christianity. In any case, if mathematics is primarily an art form, it should be taught only to students of arts, and not to students of science, and there too only to those who want to specialise in western arts, western music, etc.

In contrast, the course on calculus *without* limits has clear-cut advantages. As briefly described in my blog: it makes math easy, by eliminating the religious bias in it, and gives a better math, physics and history. This can be expanded as follows.

First, it does away with the existing religious bias, for mathematics is being done for its practical value in a religiously neutral way. This is big gain for the non-west.

The second advantage is that of conceptual clarity. Limits cannot be taught in a conceptually clear way

since they presuppose a knowledge of formal real numbers which depends upon axiomatic set theory, neither of which is taught except in a naïve way to first year university students who take calculus courses. Limits have no practical implications whatsoever: in physics as we saw above, the non-existence of limits (as in the case of discontinuous functions) rules out nothing, while the existence of limits guarantees nothing. So, teaching of limits is more a matter of paying ritual obeisance to what western mathematicians regard as correct, and many engineering students, for example, resent it, for they find limits valueless. In contrast, Aryabhata's method of solving differential equations by using linear interpolation is so very simple for it involves only the elementary arithmetic rule of 3 taught to primary-school students. This remains a simple technique of calculation which has immense practical advantage and there is no need to defend the grandiose claim of infallibility underlying the notion of limits. (I again emphasize that I am not advocating this as a technique of calculation frozen in time: we should certainly accept any newer modifcations to this technique which are of practical value, and I do so.)

The third issue is a pedagogical one and relates to ease of learning. For non-math students the new course ensures that they are not cut off from science, and rendered scientifically illiterate, as happens under the present dispensation, where calculus is considered too hard to teach to non-math students. For math students, the new course enables them to do harder problems with immediate practical applications in science, as I have demonstrated: e.g., the use of Jacobian elliptic functions involved in the motion of the simple pendulum, or the study of ballistics with air resistance, etc., which no one else even dreamt of teaching in a calculus course so far.[33] Note carefully that this advantage of gain in technology shows that what I am advocating is exactly contrary to the usual prejudice that abandoning western mathematics will result in loss of technology.

There are further advantages such as that of a better math which is able to deal with discontinuous solutions of differential equations, required for studying everything from earthquakes to ballistic missiles and explosions. Since this is a more advanced topic, I will not go into further details apart from what has already been outlined above. The issue of a better physics in other respects (such as the renormalization problem of quantum field theory, reformulation of Maxwell's equations and Newtonian gravity, etc.,) is partly considered below.

Calculus without limits naturally requires modifications to other aspects of mathematics. It goes well with geometry with a string and without a geometry box. I emphasize that calculus without limits is not the end, but only a prelude to math without formalism. Working out this entire agenda will, however, take time.

Physics

Since math is the basis of science, one can expect that the theology in present-day university math would also creep into physics. Stephen Hawking's singularity theory is a clear case in point – a singularity means an infinity of some sort, and in Hawking's theory that infinity arises by differentiating discontinuous functions. All Hawking's grandiose claims about 'creation'[34] reduce to this: his theory has shown (granting its questionable assumptions) that discontinuities develop so that we are in the above situation of discontinuous solutions of differential equations (of general relativity). Though this goes beyond the math that most physicists learn, as noted above, that infinity can be easily tackled just by changing the math or its philosophy. Thus Hawking's infinities are, like the infinities of quantum field theory, a problem of formal math, not of physics.[35]

Singularity theory has been used by influential scientists to assert in print that 'Judeo-Christian theology is a part of physics.'[36] This last claim by Tipler has been directly backed by his publication on singularity theory in the high-impact science journal *Nature* – that 'no-return' theorem directly supported the curse on 'cyclic' time so critical to post-Nicene Christian theology. Hawking himself had earlier directly linked singularity theory to the chronology condition (which rejects 'cyclic' time by fiat) to arrive at the concept of creation peculiar to post-Nicene Christian theology. He did that in his serious scientific book published by Cambridge University Press. In his latest book, called *The Grand Design*, Hawking has indirectly endorsed Tipler's idea by dwelling on the Hollywood film Matrix which seeks to popularise these utterly pseudo-scientific beliefs, for the reason that they have been fitted to Christian myths.[37]

Going beyond the level at which Hawking, Penrose,[38] and especially Tipler, operate, there is a subtler aspect to the whole thing, which again relates to time beliefs. The notion of time being central to both science and religion, theology creeps into science through time beliefs, as I argued at length in *The Eleven Pictures of Time.* Indeed, even Newtonian physics has a problem with time, and that problem arose just because of Newton's misunderstanding of the calculus.

Now it is known (though not well known) that Newtonian physics had a problem with time.[39] This is apparent even from Newton's first 'law', which states that a body continues in its state of rest or uniform motion in the absence of external forces. Present-day physics text-books say that this 'law' defines an inertial reference frame. That is not the point here. Suppose we want to test the 'law' (in an inertial or freely falling frame). How do we go about doing it? One understands a state of rest, but what is uniform motion? A body is said to be in uniform motion if it covers equal distances in equal times. Let us suppose we know how to measure equal distances. But what are equal times? We cannot put two time intervals side by side and compare them. Therefore, we need a clock to determine whether two intervals of time are equal. But which clock should one use? Newtonian physics does not tell us. It is clear that different clocks will give different answers. If my heart beats are used as a clock, every time I run up the stairs, instead of saying that my pulse rate has gone up, we would have to say that a body earlier in uniform motion would not stay in uniform motion, and we would be compelled to say that a force is acting upon it, just because I run up the stairs. The same problem of measuring equal intervals of time appears with renewed force in the case of Newton's second 'law' which quantifies force as the rate of change of momentum. The momentum is the mass times the velocity, and to measure the velocity or its rate of change (acceleration) we again need a clock, and different clocks will give different answers.

In fact, Newton was unaware of any physical clock which would give the 'right' answer, having tried and rejected the natural clock (days and nights), sand clock, simple pendulum (which was known to be non-isochronous since Huygens), etc. He opined that no proper clock might exist (and also that there may be no inertial frame anywhere in the cosmos, because of gravitation). In this situation, he did what the church-dominated western mind typically does: he appealed to God. That is, Newton made time metaphysical. He observed, 'absolute, true and mathematical time flows on without regard to anything external.'[40] Though often quoted, this statement is little understood. Each adjective 'absolute,' 'true,' 'mathematical,' emphasizes the metaphysical nature of time as Newton conceived it. In case there is still a residual doubt after three adjectives, this is eliminated by saying 'without regard to anything external.' Newton evidently thought it was all right if time were known to God but not to man.

There are three issues here. The first is that one cannot do physics in this way. The time of physics must be known to humans, it is not enough to say it is known to God; *we* must know how to measure equal

intervals of time. The second issue is that Newton appealed to a specifically Christian God who is (on the stock interpretation of the church) *against* all other religious beliefs, and tortures even Paigambar Mohammad in hell; this has naturally been used to attack Islam, Hinduism, Buddhism, etc., as contrary to science. The third issue is this: Newton made this mistake about time in his physics just because he did not understand the calculus imported from India, though he used it to formulate his second 'law'. Briefly, this mistake in Newtonian physics arose because of Newton's religious beliefs about math.

Regarding the first issue, it took westerners two centuries to realize that physics needs a physical measure of equal intervals of time. The point was first clarified by Poincare,[41] who rightly suggested that equal intervals of time may be defined on the criterion of convenience by declaring the speed of light to be constant (so that a photon or particle of light bouncing between parallel mirrors measures equal intervals of time). This constancy of the speed of light had nothing to do with any experiment[42] (notwithstanding the glorification of the Michelson-Morley experiment in present-day physics texts), for there is no way to measure speed or anything else in the absence of a proper clock, so the Michelson-Morley experiment could not, in principle, have measured the speed of light. Poincare's definition of equal intervals of time, using a bouncing photon, on grounds of convenience, brought in its wake the special theory of relativity.

Unfortunately, issues got confused because the special theory of relativity was attributed to Einstein, who did not fully understand, till the end of life, the change this brings about in physics.[43] Mathematically speaking, the key change is not so much the time dilation and length contraction; it is that physics must use functional differential equations and not the ordinary differential equations used in the formulation of Newton's 'laws'. This was the reason for the incompatibility between electrodynamics and Newton's 'laws' which incompatibility precipitated relativity. Poincare, a mathematician, understood this, Einstein did not.[44] But the story about Einstein became so big that people blindly followed Einstein, and continue to do so. Many of these people who jump to defend the Einstein myth have never read the original papers of Poincare and Einstein, and never will. Their knowledge about these issues is not first-hand knowledge, but is based on trust. This shows how myths (like those about Newton, Einstein, and Hawking) are such an integral part of science, as are the superstitions introduced by these people.

Irrespective of these myths, and irrespective of what people believe, the use of functional differential equations brings about a paradigm shift in physics.[45] A quick way to understand it is this. Newton's 'laws' of motion are reversible, but it is a matter of direct personal observation that many features of the world, like aging and death, are irreversible. Therefore, Newton's 'laws' are *contrary* to this observation repeated countless times by so many ordinary people. Why then should we continue to believe in those 'laws' when they are contrary to observation? The reason is that western science is, in fact, all about trust in western authority, not reliance on one's own experience.

Incidentally, when I presented these ideas about a paradigm shift at a meeting in Groningen (Holland) in 1999, a physicist there protested so vigorously that the whole meeting was hijacked on this one issue. However, no one could come up with any serious arguments to refute what I said, and the most serious 'argument' was the one hissed at me during lunch: 'If you are right, you would be famous!' Notice how this argument requires implicit trust in the utopian nature of western society, contrary to all observation which shows up that society as extremely exploitative and untrustworthy.

The actual nature of western scientific societies was once again made clear when Newton's successor and a former president of the Royal Society repeated my ideas about a paradigm shift in physics through the use of functional differential equations in his Einstein centenary lecture of 2005. While it is

regarded as unethical for a person to claim ignorance of previously published work, this applies only to the non-west: the norm in the west from Copernicus to Einstein is to copy what others have said before and then shamelessly claim to have independently rediscovered it. Anyway, Sir Michael Atiyah told people not to forget that this was his own suggestion. Given the change in technology, the video multicast of his speech reached me in a day. (It has now been taken off.) Atiyah was promptly informed of my work, but nine months later the same claim of a paradigm shift in physics through the use of functional differential equations was published prominently in the *Notices of the American Mathematical Society*, and christened as 'Atiyah's hypothesis.' If western endorsement is the test of scientific truth, this is exactly what one can expect to happen, for that endorsement will naturally be extended to authoritative westerners, but denied to non-authoritative non-westerners, even when both say the same thing.

Exactly when was this article naming my theory as 'Atiyah's hypothesis' submitted for publication? How many days or months *after* Atiyah had been informed? This information would help to pin down Atiyah's guilt for the authors of the article admitted that it was shown to Atiyah prior to publication. With full knowledge of these facts, the editor of the journal refused to inform me about the date of submission, despite three queries. He treated this information as if it were some sort of secret, though this information is ordinarily public, and should have been made public especially when this ethical issue of a repeated attempt to copy came to light. The editor also refused to publish my letter pointing out that this was the *second* time that Atiyah had claimed credit. The American Mathematical Society upheld the principle of editorial freedom (to unethically suppress information). No doubt people in the west privately recognized that the editor's real job is to promote and defend powerful vested interests, by unethical means where necessary. There is not the slightest doubt that the same group of people would have screamed blue murder if a non-westerner had tried to grab credit for the work done by a westerner, not once but twice. This is not the first time that some westerners have *repeatedly* tried to grab credit for my work, and this is not the first time that the 'most reputed' western institutional structures have upheld such repeated unethical practices so long as they come from their own people, but that is another story. This sort of ganging up to defend unethical actions by their own people is a key aspect of western culture: when did the west *ever* condemn any westerner for copying from the non-west and claiming it as his own discovery? Was Marconi, for example, so condemned? This is the 'morality' about 'discovery' which papal bulls demand as a religious duty! By reducing science to belief in western authority, non-westerners are foolishly relying on people who have continuously cheated them for centuries.

To return to physics (as distinct from what western academics are willing to endorse), if we define a measure of equal intervals of time conveniently, physics in future must be done using functional differential equations as I stated long ago in my 1994 book, and the papers that preceded it. This applies also to gravity, and Newton's law of gravity must be appropriately amended.[46]

This brings us to the second issue that Newton believed in a specifically Christian God. The very term Newton's 'laws' is testimony to this fact, and to Newton's belief that he had discovered some laws which would hold eternally. Since Aquinas, post-Crusade Christian theology has maintained that God rules the world with eternal laws. This is not the belief in other philosophies and religions. For example, the belief that God answers prayers, allows for direct providential intervention. Likewise, the Islamic belief in creation as a continuous process, involves continuous intervention, is not compatible with the belief that God rules the world with 'natural laws' after one-time creation. Though various other religions do allow for some regularity, as in the Hindu belief in dharma, the Islamic belief in sunnah, or the Buddhist belief that the past only conditions the present, all of these leave room for human action to create the world at the next instant of time. This is denied by the belief in a world

governed by natural 'law' where everything is pre-determined. The contrary belief in human creativity (mundane) time is the belief that people live by, but when it comes to science, one is required to swear by the belief in 'natural laws'!

Naturally, the belief in 'natural laws' is not scientifically established; it is not, in fact, a scientific belief, for it is not refutable. It is a religious belief, for it is part of the theology of Aquinas in *Summa Theologica.*[47] Nevertheless, this belief is drilled into young children who are wrongly taught it as the first aspect of science. The net result is that they grow up into paid or unpaid mouthpieces of the west like Pervez Hoodbhoy. The point that the West has hammered all along is that science developed only in the west for the reason that the west had the right religious beliefs. This continues to be hammered today in various ways. A key issue here is that Islam, for example, does not believe in 'natural laws', and is hence against science. The myth propagated by people like Hoodbhoy[48] is this: the development of science in Muslim countries was arrested because Islamic theologians like al Ghazali somehow wrongly rejected the belief in 'natural laws'. This criticism applies not only to al Ghazali, but to all Islam which believes in continuous creation. Since Hoodbhoy retired as the head of a physics department, there is little to say: he either never learnt even elementary physics properly, or else is repeating and giving currency to a deliberate slander commenced by western academics.

Because science has been reduced to blind imitation of the West and to superstitious belief in its false stories about the achievements of western scientists, from Euclid and Ptolemy to Copernicus, Newton and Einstein, no non-western school text could so far summon the courage to state the truth that the belief in natural laws is not a scientific belief, that Newton was suffering from a serious religious delusion when he imagined himself as the prophet of science to whom God had revealed the laws with which he supposedly controlled the universe. Nor could they summon the courage to teach Newtonian physics, as it ought to be taught as a way to model regularities, and without this silly superstitious belief in 'laws of nature'. At least this point, together with a critique of Newton's 'laws', should now be introduced into university syllabi in the non-west. As for the west, let it remain prey to its own superstitions.

This brings us to the third issue, that this harmony of science with a particular religious belief came about because of Newton's attempts to reconcile the calculus with his religious beliefs about math as perfect. To formulate his second 'law' of motion, Newton needed the notion of the time derivative (d/dt). As he made clear in his anonymous auto-review of his report [49] exonerating himself against Leibniz's complaint, his own contribution to the calculus was to make it rigourous. (Otherwise he 'modestly' claimed credit only for 'Taylor's' sine series, an infinite series imported from India where it was known from a couple of centuries earlier!) This issue of rigour was first raised by Descartes in response to the enthusiastic acceptance of the calculus by Fermat and Pascal.

Descartes' objection was an excessively naïve one: he opined that summing an infinite series would need an infinite amount of time, while summing only a finite number of terms would result in an approximation which was not acceptable, since, on his ethnic understanding, mathematics was eternal truth, and hence had to be perfect. (This religious understanding of math as perfect arose from the Egyptian idea of mathesis repeated by Plato: that mathematics as eternal truth was best suited to arouse the eternal soul. Though the Egyptian/Platonic notion of soul was rejected by post-Nicene theology, it did nothing to change the idea of mathematics as eternal truth which persisted. Hence, it came to be believed that the eternal laws of God were formulated in the language of mathematics for mathematics represented eternal truth.) Newton thought he had made the calculus perfect through his doctrine of fluxions, by postulating a metaphysical time which 'flowed smoothly,' whatever, if anything, that might mean. The curious thing is that this is a core western belief that mathematics can be made perfect by

turning it into metaphysics. Present-day mathematics does something similar. Though it avoids the naivete of postulating a 'flowing time,' it postulates that time is like the real line (and not like the rational numbers, for example) just because the real line is used in current formulations of the (elementary) calculus. That is, the question of atomic vs continuous time is resolved in present-day physics not on grounds of any physical experiment or observation, but because of the metaphysics applied by Europeans to the Indian calculus! Note that this metaphysics is completely irrelevant to any calculation in physics, which will always use only rational numbers.

Europeans then were too backward and unsophisticated to understand the subtle techniques used by Indians to sum infinite series, which, as explained earlier, involved discarding infinitesimals in the non-Archimedean field of rational functions, a technique which can be readily formalised, and does not have to be discarded like Newton's fluxions. There is, however, no reason to formalise that process today; instead the correct approach, as explained earlier, is to discard formalism, which is an outgrowth of this misunderstanding, and to replace it by zeroism better suited, among other things, to computer arithmetic used to do physics today. If the west still does not understand that, we should let it wallow in its misunderstandings of mathematics, and move forward.

To summarise, the physics syllabus ought to be altered in three ways. First, given the new way of doing mathematics, the old emphasis on deriving symbolic formulae should be dropped as representing a ritual obeisance to an illusory exactitude. Second, physics itself should be done differently, denying the belief in any natural laws, and emphasizing that physics only seeks to model certain observed regularities, and that these models are fallible and perpetually subject to improvement. Third, post-Newtonian physics, involving new mathematical techniques, such as those requiring the solution of functional differential equations should be introduced in the syllabus. None of this has yet been done in the west, so here is an opportunity to get ahead by transforming the educational system, provided we give up the slavish attitude of waiting for western endorsement. Note once again that this will move us forward in terms of technology, not backward.

There is a fourth feature, concerning causality, which is somewhat subtler.

First, I would like to clarify that 'causality' in physics refers to the assumption that interactions propagate from past to future and not the other way around. Specifically, this causality is contrary to the belief in agency. This causality ensures mechanical control. This sort of mechanistic science is characteristic of the west, and is preferred by governments and corporations who want control. Munir Fasheh has emphasized that control was advocated as the objective of science even by Francis Bacon (though, in fact, he allowed that witches and spooks could overcome such control, leading eventually to Einstein's invalid polemic of 'spooky action at a distance'; denial of causality leads to the possibility of instantaneous action at a distance). In fact, even Roger Bacon advocated science on the grounds that it would help the church win the Crusades. This constant attempt to harmonize science with the dominant religious beliefs, accepted on trust, is also made clear by Hoodbhoy and Co., who have argued that the absence of belief in 'causality' in Islam was another key reason for Islam's arrested development, thereby suggesting indirectly that Islamic beliefs should be abandoned or modified in view of science, and particularly, causality.

Causality, though commonly treated by physicists as an established scientific principle, is a theological principle essential for the post-Nicene doctrine of sin. The Buddhist notion of *paticca samuppada* (conditioned coorigination), like the Hindu notion of *karma* has no room for such mechanical causality which is not an empirically established part of physics. To establish it, one would need to have two physical theories, a causal one and a non-causal one, and show that the causal theory is better. In fact,

few physicists bothered to check the consequences of non-causal electrodynamics. (Wheeler and Feynman did, but their reasoning was seriously faulty, as I pointed out. Strangely, physicists are neither able to spot that mistake themselves, nor has any one of those concerned [Paul Davies, J. V. Narlikar, ..] ever responded to my critique, except in private, though both those named have stopped referring to that theory. This is an example of how western science is all about dependence upon western authority.) A key consequence of dropping causality is spontaneity and absence of full control (from either past or future).

In fact, as already pointed out, mundane life is premised on the belief that one's action serve to create some (tiny and perhaps insignificant) part of the future cosmos. That is, the belief is that the future is decided (in a not-entirely-controllable way) by one's actions, and not by some pre-ordained 'natural laws'. This mundane fact, observed thousands of times by billions of people every day is contrary to the belief in any 'natural laws,' so that the belief in 'natural laws' ought to be abandoned as bad physics. (But that does not happen because science is not based on experience, but western endorsement is as necessary to decide 'valid' science as church endorsement was once necessary to decide 'valid' theology.)

It is exceedingly strange that pointing out this simple mundane fact of life immediately causes some people to jump to thinking about 'free will.' This notion of 'free will' is peculiar to Christian theology, and western philosophy (the difference between the two being hard to discern). More modern Muslim philosophers have occasionally discussed the issue as that between *jabr* and *qadr*. However, this notion is largely absent from Indian philosophy, though Buddhists and Jains accused each other of not believing in what orientalists, with their crude conceptual vocabulary, translated as 'manly strength.'

The point I want to make is just this: though science is supposedly based on observation, the simplest physics (Newton's 'laws', say) cannot be reconciled with the simplest observation without bringing in categories of belief ('free will') and harangues peculiar to post-Nicene Christian theology with its need to reconcile conflicting beliefs about a transcendental but omnipotent god and the doctrine of sin. That is, science is not based on simple experience, which it denies, but requires that the most mundane experience be interpreted within Christian theology under the guise of western endorsement!

This is another aspect of current physics which ought to be undone. One way is to keep emphasizing all the silly mistakes and unethical things that western scientists have done and keep doing, and to put these things into texts and supplementary reading material, so that students can learn the realities of science from that.

Summary and conclusions

- Indoctrination through western education enabled colonization by capturing the mind. False claims about the western origin of *hard* sciences enabled westernization of education, and are still used to maintain it. In fact, the western university system originated, after the fall of Toledo, to make the flood of incoming knowledge theologically correct. Like censorship, the present-day process of west-endorsed publications, as the primary means of validating hard science (as in the ISI norm adopted by OIC countries), serves the same western tradition of avoiding public debate and seeking secretive endorsement. This has helped to propagate bad science because innovators, who are usually dissenters, are branded and excluded as 'heretics'.

- The calculus is at the base of hard science, since physics is today formulated using differential equations. Its false history and consequent bad present-day philosophy accordingly needs to be refuted.

- Historically, the calculus developed in India over a thousand years (starting in the 5th c.) in relation to the two key means of producing wealth in India: agriculture and overseas trade. Monsoon-dependent Indian agriculture and navigation both required a good calendar, hence good astronomical models, hence accurate trigonometric values. In the 5th c. CE these were calculated in India, to an accuracy of the 4th decimal place, by numerically solving differential equations (5th c.). Later (ca. 14th c.) the accuracy was pushed up to the 9th decimal place using infinite series expansions.

- These accurate trigonometric values were critical for solving the problem of European navigation (latitude, longitude, and loxodromes), on which European dreams of wealth then rested. In 1500, the first Indian Roman Catholic mission was set up in Cochin, and this turned into a Jesuit college by 1550 which then taught Malayalam to locals (Syrian Christians). Indian astronomy texts from the vicinity of Cochin, which *explained* those infinite series, were translated and despatched to Rome from the Cochin college. (The Jesuit syllabus was changed to include practical mathematics from ca. 1570.) These trigonometric values could also have been used to solve the longitude problem, but that needed two things: a correct value for the size of the globe and an ability to do mental calculations, both of which Europeans lacked.

- While the practical advantages of the imported calculus were immediately grasped in Europe, the infinite series posed a philosophical challenge which floored European minds such as Descartes and Newton. Descartes declared the length of a curved line to be beyond the human mind, though Indian children were taught how to measure curved lines using a flexible string. Newton attempted to fit the Indian calculus to western metaphysics, using fluxions. To this end he insisted that time 'flows smoothly' and hence made the fatal mistake of turning time metaphysical, leading to the eventual fall of Newtonian physics.

- In the west, infinities got associated with the simplest mathematical propositions, such as 2+2=4, because of the religious view of mathematics (as a relic of mathesis) as eternal and universal truth, hence perfect. Formal mathematics (real numbers, set theory, limits) is an outgrowth of the western struggle to make those infinities compatible with western philosophy, founded on confused western theological beliefs about eternity. The net result was that in the 20th c. mathematics was turned into pure metaphysics.

- This metaphysics is NOT universal. It is contrary to *all* Indian philosophies, and to Islamic beliefs. It serves no practical purpose whatsoever, since theorem-proving guarantees no epistemic security, given the cultural variation in logic which is not empirically certain. However, under pressure to imitate the west and fetch western endorsement, this religiously biased western mathematics is imitated. Teaching this kind of mathematics indoctrinates people against all indigenous systems of knowledge.

- Accordingly, it is harmful to the interests of former colonies to teach mathematics the way it is taught in the west. Governments in these countries ought not to rely on the private opinion of a few west-endorsed experts, but ought to notice that their private interests may be in conflict with the interests of people at large. Students should be informed that there is no universal

model for the philosophy of mathematics, and forcing an inferior western philosophy of mathematics on students is a political exercise.

- An alternative history and philosophy of mathematics has been worked out, and its use for teaching calculus at the early university level has been tested and reported. This teaching model needs to be grown and extended backwards to school level mathematics, changing concepts of geometry, number, etc.

- Physics should be taught as firmly based on observations. Contradictions with mundane experience (such as the contradiction of mechanical Newtonian physics with mundane time beliefs, allowing creativity, or the contradiction between Newtonian reversibility and observed irreversibility) should not be 'managed' by sliding into western theology of free will, etc. On the contrary, it should be explained to students that any theory can be defended against any facts by piling on the hypotheses. The object of physics should be to teach practical value and not to inculcate awe of some westerners, and defend their silly mistakes by stock tricks of theological discourse. As such, critiques of existing science should be included in university texts, to dispel the false feeling of universality.

- Early university texts in physics should point out that functional differential equations (and not ordinary differential equations) are the correct way to do classical physics. They should point out that the equations of motion of classical electrodynamics are functional differential equations, and explain the difficulties in solving those equations and the way out of those difficulties. It is a shame that this has not been incorporated even into the first year university syllabus of special relativity.

- The emphasis on old-fashioned formulae and their symbolic derivation should be given up in favour of numerical calculation, and it should be explained that a numerical calculation is not inferior to a formula. Students' creativity should be directed towards building and studying more complex models which can be handled numerically but not symbolically.

- The history of astronomy and physics in texts should be fundamentally revised. It should be pointed out, for example, that a scientific evaluation of the evidence indicates that Claudius Ptolemy did not exist (this would also teach students a lesson on how and why to do physics practicals in a more genuine way). It should also point out that Copernicus was no revolutionary, that Newton was a deeply religious person, and that Einstein might have played legalistic tricks which a patent clerk is expected to know. There are many other aspects of history and physics nomenclature which need to be revised (in texts).

- These again are preliminary recommendations for a fundamental change in the physics curriculum.

1 Raja Ramamohun Roy, letter to Bentinck, 11 Dec 1823. Available online at http://www.languageinindia.com/april2003/macaulay.html.

2 C. K. Raju, 'Ending Academic Imperialism in Hard Sciences: a Beginning,' in *Confronting Academic Knowledge*, ed. Sue-San Gahremani Ghajar and Seyyed-Abdolhamid Mirhosseini, Iran Universities Press, Tehran, 2011, chp. 7. A longer draft at http://multiworldindia.org/wp-content/uploads/2010/05/ckr-Tehran-talk-on-academic-imperialism.pdf. Corrected version in *Ending Academic Imperialism: a Beginning, Penang*, 2011.

3 Organization of the Islamic Conference, *Report on adopted Criteria, Procedures and Mechanisms for Ranking of Universities,* Tehran, 2007.

4 C. K. Raju, 'Computers, mathematics education, and the alternative epistemology of the calculus in the Yuktibhasa,' *Philosophy East and West*, **51**(3) (2001) 325-61. Available from http://ckraju.net/Hawaii.pdf

5 B. Russell, *The Foundations of Geometry*, London, 1908. D. Hilbert, *The Foundations of Geometry*, Open Court, La Salle, 1902.

6 For a fuller discussion, see C. K. Raju, *Cultural Foundations of Mathematics*, Pearson Longman, 2007.

7 E.g. Immanuel Kant, a western philosopher, says that logic has not changed since Aristotle. (He also confounds Aristotle of Stagira who had nothing to do with the syllogisms, with Aristotle of Toledo.) Immanuel Kant, *Critique of Pure Reason*, trans. J. M. D. Meiklejohn, Encyclopedia Britannica, Chicago, 1996, preface, p. 5 '*logic*..., since Aristotle,...has been unable to advance a step, and, thus...has reached its completion.'

8 For an account of these logics, see my article on 'Logic' in the *Springer Encyclopedia of Non-western Science, Technology and Medicine*, 2008. Draft at http://ckraju.net/papers/Nonwestern-logic.pdf.

9 C. K. Raju, 'The Religious Roots of Mathematics,' *Theory, Culture & Society* **23** (1–2) Jan-March 2006, Spl. Issue ed. Mike Featherstone, Couze Venn, Ryan Bishop, and John Phillips, pp. 95–97.

10 C. K. Raju, *Time: Towards a Consistent Theory*, Kluwer Academic, Dordrecht, 1994, chp 6b 'Quantum-mechanical time.'

11 C. K. Raju, 'Life after death,' chp. 1 in *The Eleven Pictures of Time*, Sage, 2003.

12 C. K. Raju, 'The curse on "cyclic" time,' chp. 2 in *The Eleven Pictures of Time*, Sage, 2003.

13 Curiously, Egyptians too saw mathematics like Samkhya-Yoga as a form of mental discipline analogous to yoga, and with the same purpose of union (=yoga). (The Farsi/Arabic word *riyaziyat,* meaning mental gymnastics or discipline, involves somewhat similar ideas.)

14 C. K. Raju, 'Teaching mathematics with a different philosophy. 1: Formal mathematics as biased mathematics' (to appear).

15 'Approximation and Proof in the Yuktibhâsâ Derivation of Madhava's Sine Series.' Paper presented at the National Conference on *Applied Sciences in Sanskrit*, Agra, Feb 1999. In Proc. See also, the Hawaii paper cited above. Both are superceded by the book *Cultural Foundations of Mathematics*, cited above.

16 I would be curious to know what if any non-western input in math and science was ever acknowledged by Europeans from the 12th to the 20th c. or whether Europeans ever condemned even established plagiarists from Copernicus to Marconi. On the contrary, as is well known, racist philosophers like Hume and Kant used this bad history to propose a philosophical defence of racism. David Hume, 'Of National Character' (1748), in *The Philosophical Works of David Hume*, Volume III, Bristol: Thoemmes Press, 1996, p. 228, 'the negroes and in general all the other species of men... [are] naturally inferior to the whites. There never was a civilized nation of any other complexion than white, nor even any individual eminent either in action or speculation. No ingenious manufactures amongst them, no arts, no sciences.' Kant happily seconds this. Immanuel Kant, *Observations on the Feeling of the Beautiful and the Sublime*, trans. John T. Goldthwait, University of California Press, Berkeley, 1991, pp. 110–1. 'Mr. Hume challenges anyone to cite a single example in which a Negro has shown talents...not a single one was ever found who presented anything great in art or science...The blacks are very vain but in the Negro's way, and so talkative that they must be driven apart from each other with thrashings.'

17 C. K. Raju, 'How and why the calculus was imported into Europe,' chp. 7, and 'Navigation...' chp. 5 in *Cultural Foundations of Mathematics*, cited above.

18 For more details, see *Cultural Foundations of Mathematics*, cited above.

19 For more details, see 'Time, latitude, longitude and the globe,' chp. 4 in *Cultural Foundations of Mathematics*, cited above.

20 *Cultural Foundations of Mathematics*, chps 5 and 7 cited above.

21 C. K. Raju, 'Math Wars and the Epistemic Divide in Mathematics,' paper presented at Episteme-1, Goa, Dec 2004. Available at: http://www.hbcse.tifr.res.in/episteme1/themes/ckraju_finalpaper. This is a bit different from the abstract available at http://www.hbcse.tifr.res.in/episteme/episteme-1/allabs/rajuabs.pdf, and the final version (with the same title) in chap. 9 of *Cultural Foundations of Mathematics*, cited above.

22 It is irrelevant that church history dates the 'official' start of the Crusades from a few years later; the fall of Toledo must be considered part of the Crusades, for Toledo fell, like Jerusalem, by using the Christian loyalty of Mozharabs to divide it internally, and because prototype Crusades, involving multinational armies organized around religious belief, had

already been tried out even earlier against the remnants of the wealthy Cordoba caliphate after it disintegrated into small *taifas* under its own internal pressures.

23 For a summary of the arguments, together with references to the book-burning tradition of the church, see C. K. Raju, *Is Science Western in Origin?* Multiversity, Penang, 2009.

24 For more details and references, see 'Newton's secret,' chp. 4 in C. K. Raju, *The Eleven Pictures of Time*, Sage, 2003.

25 See, e.g., 'Goodbye Euclid!', *Bharatiya Samajik Chintan* **7** (4) (New Series), 2009, pp. 255–264. Or, *Is Science Western in Origin?* cited above.

26 C. K. Raju, *Is Science Western in Origin?* cited above.

27 C. K. Raju, *Time: Towards a Consistent Theory*, Kluwer Academic, chp. 5b, available from http://arxiv.org/ftp/arxiv/papers/0808/0808.0767.pdf.

28 M. Walker, 'Retarded Differential Equations and Quantum Mechanics,' *Notices of the American Mathematical Society*, **54**(4) (2007), p. 472. http://www.ams.org/notices/200704/commentary-web.pdf, hidden in the second page.

29 Part of the discussion is still archived at http://mathforum.org/kb/thread.jspa?threadID=383956&messageID=1184740, 24 Jan 2003. A recap is in 'Mischievous Eurocentrism,' http://ckraju.net/blog/?p=14.

30 Thus, the journal *Philosophia Mathematica* published by Cambridge university claims to be the only journal in the world on the philosophy of mathematics. The editor of that journal solicited my book *Cultural Foundations of Mathematics*, for review, and then published a review which sought to propagate the petty falsehood that I was not trained in mathematics, although the book clearly states I was, and then reviewed only two chapters of the book claiming there was no philosophy in the book beyond the second chapter, although a discussion of the new philosophy begins in the third chapter, and continues till chapter 8. This is the gatekeeping one has come to expect from the 'top-ranked' western journals!

31 Technically speaking, Colombeau's theory circumvents the Schwartz impossibility theorem by allowing multiple distributions to be 'associated' with a product of, say, two delta functions. Thus, it formally corresponds to the naïve procedure of multiplication of smooth functions in the non-standard extension of the space of distributions. This makes it completely useless for physics, and no novel or testable conclusion could be derived from the theory in all these years, unlike my theory which leads to new and testable conditions for shock waves, for example. See appendix to *Cultural Foundations of Mathematics*.

32 C. K. Raju, 'Probability in Ancient India,' *Handbook of The Philosophy of Science: Philosophy of Statistics,* P. S. Bandyopadhyay and M. R. Forster (ed) Dov M. Gabbay and John Woods (series ed*,)* North Holland, San Diego, 2011, pp. 1175-1195.

33 C. K. Raju, 'Time: what is it that it can be measured,' *Science&Education*, **15**(6) (2006) pp. 537–551. For a high-school project on Jacobian elliptic functions see Suvrat Raju, 'Pendulum Project,' at http://ckraju.net/11picsoftime/pendulum.pdf.

34 'The actual point of **creation**, the singularity, is outside the scope of the presently known laws of physics.' S. W. Hawking and G. F. R. Ellis, *The Large Scale Structure of Spacetime*, Cambridge University Press, 1973, concluding sentence, p. 364.

35 C. K. Raju, *The Eleven Pictures of Time*, Sage, 2003.

36 'The central claims of Judeo-Christian theology are in fact true, that these claims are straightforward deductions of the laws of physics as we now understand them. I have been forced into these conclusions by the inexorable logic of my own special branch of physics...created...by...Roger Penrose and Stephen Hawking...' F. J. Tipler, *The Physics of Immortality*, Macmillan, 1995, p. ix.

37 C. K. Raju (review of Stephen Hawking's *The Grand Design*), in Daily News and Analysis, 16 Jan 2011, p. 9. Original title, 'Theology in a Scientific Bottle.' http://www.dnaindia.com/lifestyle/review_the-christian-propaganda-in-stephen-hawkings-work_1495047.

38 C. K. Raju, 'Penrose's Theory of the Mind: a Rebuttal.' Debate with Roger Penrose, in: *Matter of the Mind*, India International Centre, New Delhi, 22–23 Dec 1997. Penrose tried to brazen out the question about a parallel computer on the indeterministic CSP model, saying it was just a (finite) ensemble of Turing machines (which just amounts to a single Turing machine). He correctly assumed that no one else in the hall understood the point.

39 C. K. Raju, 'Newton's Time,' *Physics Education* (India) **8** (1) (1991) pp. 15-25.

40 I . Newton, *The Mathematical Principles of Natural Philosophy*, A. Motte's translation revised by Florian Cajori, *Encyclopaedia Britannica*, Chicago, 1996, Scholium, p. 7.

41 For a selection of quotations from Poincare's *Science and Hypothesis* and the *Value of Science*, see, C. K. Raju, 'Einstein's time,' in C. K. Raju, *Time: Towards a Consistent Theory*, Kluwer Academic, 1994 (Fundamental Theories of Physics, vol. 65) chp. 3b.

42 C. K. Raju, 'The Michelson-Morley Experiment,' chp. 3a in *Time: Towards a Consistent Theory*, cited above.

43 For a quick account of Einstein's mistake, see http://ckraju.net/misc/Einstein.html. For the significance of this test, and for the use of my epistemic test to check copying, see, *Cultural Foundations of Mathematics*, cited above.

44 See note above. For more details, see C. K. Raju, 'Einstein's Time,' chp. 3b in *Time: Towards a Consistent Theory*,

Kluwer, 1994, and C. K. Raju, 'In Einstein's Shadow,' chp. 5 in *Eleven Pictures of Time* (Sage, 2003).

45 C. K. Raju, 'Electromagnetic time,' chp. 5b in *Time: Towards a Consistent Theory*, cited above.

46 C. K. Raju, 'Retarded gravitation theory: the velocity effect in gravitation, galactic rotation curves, and the flyby anomaly,' arXiv:1102.2945.

47 Thomas Aquinas, *Summa Theologica*, First part of the Second Part, 91,1, 'A law is nothing else but a dictate of practical reason emanating from the ruler...the whole community of the universe is governed by Divine Reason. Wherefore the very Idea of the government of things in God the Ruler of the universe, has the nature of a law. And since the Divine Reason's conception of things is not subject to time but is eternal, according to Proverbs 8:23, therefore it is that this kind of law must be called eternal.' http://www.newadvent.org/summa/2091.htm.

48 http://www.guardian.co.uk/commentisfree/belief/2009/nov/25/islam-science-muslims-religion

49 Isaac Newton, 'An account of the book entituled Commercium epistolicum collinii Et aliorum, de analysi promota,' *Phil. Trans. R. Soc.,* No. 342. Jan and Feb 1714/5 , pp. 173-224. http://www.maths.tcd.ie/pub/histmath/people/newton/commerciumaccount/commacc.pdf.