

Decolonizing mathematics and science

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In a 2012 talk in Wardha, I spoke about “Swaraj in thought”,¹ explaining “swaraj” as a translation of “decolonization”, in which I was then already deeply engaged. As the first footnote in that paper pointed out, the title was a minor correction to Gandhi’s *Hind Swaraj*, and K. C. Bhattacharya’s ‘Svaraj in “ideas”’, correcting the Platonically loaded term “ideas”, a correction especially needed in the context of mathematics. Specifically, concerning decolonization of mathematics and science, much is summarised in this abstract² (and extended abstract³) to have been presented over two hours at a 2018 conference in Palestine Technical University, which could not be done since Israel censored it by refusing a visa.⁴

A subsequent keynote/paper⁵ explained that formal mathematical proof (pure deductive proof excluding the empirical) is *more* fallible than and inferior to normal mathematical proof (which accepts *both* empirical proof and reasoning). It also summarised the alternative math courses (calculus without limits, rajju ganita) since 2009. I had earlier again explained how the church metaphysics of infinity⁶ in math can be used to push religious prejudices into science, as was done by Stephen Hawking,⁷ and the winner of last year’s Nobel Prize in physics, Roger Penrose.⁸ My subsequent work at IIAS led to a revision of my retarded gravitation theory,⁹ and a reassertion of my theory of curved (relativistic) shock and blast waves. Further, in my last seminar at the IIAS¹⁰ I reiterated that colonial education was church education, and pointed out that the notion of proof in

1 <http://ckraju.net/papers/Swaraj-in-thought.pdf>.

2 <http://ckraju.net/papers/Palestine-short-abstract.pdf>.

3 <http://ckraju.net/papers/palestine-extended-summary.pdf>.

4 “Israel denies visa for talk on decolonisation exposing Einstein”, <http://ckraju.net/blog/?p=157>.

5 C. K. Raju, ‘Decolonising Mathematics’, *AlterNation* 25, no. 2 (2018): 12–43b, <https://doi.org/10.29086/2519-5476/2018/v25n2a2>. Keynote 11th HEC, Durban 2017. Also, How Colonial Education Changed Our Math Teaching | C.K. Raju, 2020, <https://www.youtube.com/watch?v=Rm6d-bUmmGg>.

6 C. K. Raju, ‘Eternity and Infinity: The Western Misunderstanding of Indian Mathematics and Its Consequences for Science Today’, *American Philosophical Association Newsletter on Asian and Asian American Philosophers and Philosophies* 14, no. 2 (2015): 27-33. <http://ckraju.net/papers/Eternity-and-infinity-Pages-from-APA.pdf>.

7 C. K. Raju, *The Eleven Pictures of Time: The Physics, Philosophy and Politics of Time Beliefs* (Sage, 2003); C. K. Raju, ‘The Christian Propaganda in Stephen Hawking’s Work’, *DNA India*, 16 January 2011, sec. Lifestyle, <https://www.dnaindia.com/lifestyle/review-the-christian-propaganda-in-stephen-hawking-s-work-1495047>.

8 C. K. Raju, ‘A Singular Nobel?’, *Mainstream* 59, no. 7 (30 January 2021), <http://www.mainstreamweekly.net/article10406.html>. Also, <http://ckraju.net/papers/Penrose-mod.html>.

9 C. K. Raju, ‘Retarded Gravitation Theory’, in *Sixth International School on Field Theory and Gravitation*, ed. Rodrigues, Waldyr Jr et al. (New York: American Institute of Physics, 2012), 260–76; C. K. Raju, ‘Functional Differential Equations. 4: Retarded Gravitation’, *Physics Education (India)* 31, no. 2 (June 2015), [http://www.physexu.in/uploads/publication/19/309/1-Functional-differential-equations-4-Retarded-gravitation-\(2\).pdf](http://www.physexu.in/uploads/publication/19/309/1-Functional-differential-equations-4-Retarded-gravitation-(2).pdf).

10 *Ganita vs Formal Math: An Obituary of Formal Math*, 2021, <https://www.youtube.com/watch?v=0UrMypVN6c0>. See, also, the detailed synopsis of the book posted at <http://ckraju.net/papers/IIAS-3rd-seminar-book-preface-and-synoptic-contents.pdf>.

formal mathematics (brought by colonial education), is identical to the notion of proof in Christian rational theology of Aquinas and the schoolmen, a fact that few know, since we grossly neglected to study the foreign aggressor, and the method of colonisation.

In a subsequent keynote “Euclid must fall”, at Tübingen/Pretoria I pointed out the connection of the church myth of Euclid to the origins of racism.¹¹ In a subsequent 2-day workshop in Bengaluru, I explained at length why traditional Indian rajju ganita is preferable to Euclidean geometry.¹²

Since, however, all this is too complex to cover in half an hour, I will instead speak on some assorted topics, for as much as time permits. A lot of detail is included to enable interested people to prepare in advance.

(1) **Notion of proof in Indian math.** The NCERT class IX math text (Appendix 1, p. 287) states that there is “no clear evidence” that Indians (or any others, except Greeks) had any notion of proof. This is false. Indians did have a notion of proof (Nyaya sutra,¹³ Buddhism,¹⁴ Lokayata¹⁵) and this notion of proof was used in Indian mathematics.¹⁶ However, ALL Indian notions of proof differ from the notion of proof in formal mathematics, which (as few understand) is divorced from the empirical,¹⁷ and rejects the one notion (प्रत्यक्ष) common to all the varied Indian notions of proof.

The NCERT text lies to avoid having to compare different notions of proof, to decide which is better.¹⁸ It conflates “proof” with formal mathematical proof, disjoint from Indian tradition. This is facilitated by the fact that no else one ever carried out this comparison, and the *Journal of Indian Council of Philosophical Research* (of which I once was an editor) refused to publish it, some years ago.

(2) **Proof and truth.** The NCERT text also confounds a formal mathematical theorem with truth. (Class IX, p. 305, A1.6(5) “A mathematical statement whose truth has been established (or proved) is called a theorem.”) However, the Lokayata critique of inference is still valid, a deductively proved proposition need not be true. The modern way to dodge the critique by calling theorems “relative truths” (actually relative to the axioms *and* logic) does not help, for “relative truths” may be complete nonsense, such as the Banach-Tarski theorem,¹⁹ or my simpler rabbit theorem.²⁰ Again, for example, the Pythagorean theorem is NOT true in the real world, not on the (curved) surface of the earth (as Indians certainly understood by the 7th c.²¹), not anywhere in (curved) space.

11 “Euclid” must fall. <http://ckraju.net/blog/?p=194>, 13 May 2021, for links to presentation and video.

12 “Euclidean” geometry vs rajju ganita. <http://ckraju.net/blog/?p=200>, 5-6 June 2021, for links to presentations and videos (total 5:40 hours). Also, *Sulba Sutra Geometry: Can We Teach It in Schools Today?* | C.K. Raju, 2020, https://www.youtube.com/watch?v=rLI_UU6dfnE.

13 Nyaya sutra 2, <http://ckraju.net/papers/presentations/images/Nyaya-Sutra-Gotama-2-proof.pdf>.

14 “Buddhism and science”, conversation with the Dalai Lama, <https://www.youtube.com/watch?v=SkS1HM6g0O4>.

15 Haribhadra Suri, षटदर्शन समुच्चय, 5th ed. (Bharatiya Jnanapeeth, 2000), 452–53.. (Bharatiya Jnanapeeth, 2000).

16 <http://ckraju.net/papers/presentations/images/Proof-table.html>.

17 C. K. Raju, ‘Computers, Mathematics Education, and the Alternative Epistemology of the Calculus in the YuktiBhâsâ’, *Philosophy East and West* 51, no. 3 (2001): 325–62. <http://ckraju.net/papers/Hawaii.pdf>, first line of abstract.

18 For a comparison at an elementary level, see “Euclidean” geometry vs rajju ganita. <http://ckraju.net/blog/?p=200>, presentation day 1 (<http://ckraju.net/papers/presentations/Bengaluru-day1.html>) and related video (<https://www.youtube.com/watch?v=ERm25QgyW1w>)

19 <http://ckraju.net/sgt/technical-presentations-faculty/ckr-sgt-tech-presentation-2.pdf>.

20 C. K. Raju, ‘To Decolonise Math Stand up to Its False History and Bad Philosophy’, in *Rhodes Must Fall: The Struggle to Decolonise the Racist Heart of Empire* (London: Zed Books, 2018), 265–70 (CENSORED article) ; C. K. Raju, ‘To Decolonise Maths, Stand up to Its False History and Bad Philosophy’, *The Wire*, 2016, <https://thewire.in/history/to-decolonise-maths-stand-up-to-its-false-history>.

21 *Mahabhaskirya* 2.5, extract: <http://ckraju.net/papers/presentations/images/Mahabhaskariya-II-5-sphericity.jpg>, translation: <http://ckraju.net/papers/presentations/images/Maha-Bhaskariya-2-5-trans.pdf>.

Superstitiously believing the theorem to be true led to huge European navigational disasters from the 15th to the 18th c.²² Why are mathematical axioms never true in reality? Because the axioms of formal math are and *have to be* unreal or metaphysics (actually a metaphysics of infinity²³), therefore the “truth” relative to these axioms will never be (exactly) true in the real world. (And there is no concept of “approximate truth” in formal math, declared to be an “exact science”, though it is neither exact nor science). The prohibition of प्रत्यक्ष was politically convenient for the rational theology of the crusading church²⁴ (e.g. Aquinas’ theorem about angels²⁵), hence glorified. Colonial education brought church education, with the specific aim of capturing the mind, and because the Indian mind is captured we boast, even today, that we did not change even one comma or full stop in school texts.

(3) **Myth of “Euclid”**. People imagine there is only one myth of Euclid, but the myth actually is *three* myths in one: (i) There was a Greek/White man called Euclid (Whiteness is shown, not stated, in the NCERT class IX math text, p. 80), (ii) The book Elements (which “Euclid” supposedly wrote) has axiomatic proofs, (iii) Axiomatic proofs are superior to other notions of proof. As regards (i), NCERT admits (in writing) it has no primary evidence for “Euclid”,²⁶ as I have been pointing out for over two decades,²⁷ and as admitted way back in 2002 by the leading Western authority on Greek math, in response to my critique.²⁸ But NCERT insists that Indians students *must* believe without question whatever myths are stated in Western secondary texts. Of course, 75 years of independence is not adequate, for वैचारिक स्वराज, or for understanding that evidence is the difference between myth and history, we need at least 200 years! As regards (ii), it is only some 120 years since the work of Hilbert²⁹, and Russell³⁰ *publicly* exposed that there are no actual axiomatic proofs in the book Elements attributed to “Euclid”. How can our “expert” authors understand it so soon? They have PhDs from Cambridge which made such a fool of itself over Euclid.³¹ For वैचारिक स्वराज regarding the church propaganda in NCERT math texts we need at least another 80 years!? We can’t do it even at the level of class IX school texts, even after my 15 year old struggle with NCERT, and the offer of cash prizes for the slightest primary evidence for Euclid. Blacks understood long ago,³² that the “history” of Greeks, and the myth of the “Pythagorean” *theorem* is concocted. [And the “Pythagorean” “theorem” is distinct from the two (approximate, सविशेष)³³ “Pythagorean” *calculations* found in India.³⁴] However, few understand that myths of Greeks and

22 “Euclidean” geometry vs raju ganita. <http://ckraju.net/blog/?p=200>, presentation day 1 (<http://ckraju.net/papers/presentations/Bengaluru-day1.html>) and related video (

23 Raju, ‘Eternity and Infinity: The Western Misunderstanding of Indian Mathematics and Its Consequences for Science Today’.

24 C. K. Raju, ‘Science, Reason, Superstition. 3: The Church Connection of Reason’, *Frontier Articles on Society & Politics*, 9 June 2020, <https://www.frontierweekly.com/views/jun-20/9-6-20-Science%20reason%20and%20superstition-3.html>.

25 Thomas Aquinas, *Summa Theologica*, First Part, Q. 52, article 3 <http://www.newadvent.org/summa/1052.htm#article3>.

26 <http://ckraju.net/blog/?p=173>.

27 See, the Nepal Times 1999 report cited in *Euclid and Jesus*.

28 C. K. Raju, *Euclid and Jesus: How and Why the Church Changed Mathematics and Christianity across Two Religious Wars* (Penang: Multiversity and Citizens International, 2012).

29 David Hilbert, *The Foundations of Geometry* (The Open Court Publishing Co., La Salle, 1950) <http://ckraju.net/geometry/Hilbert-Foundations-of-Geometry.pdf>.

30 B. Russell, ‘The Teaching of Euclid’, *The Mathematical Gazette* 2, no. 33 (1902): 165–67 <http://ckraju.net/geometry/Bertrand%20Russell%20on%20Euclid.htm>.

31 <http://ckraju.net/geometry/cambridge-note.html>.

32 C. K. Raju, ‘Not out of Greece (5 Lectures)’ (University of South Africa, Pretoria, January 2017), <http://ckraju.net/unisa>.

33 Baudhayana 2.12 read together with Manava शुल्ब सूत्र 10.10.

34 C. K. Raju, ‘Black Thoughts Matter: Decolonized Math, Academic Censorship, and the “Pythagorean” Proposition’, *Journal of Black Studies* 48, no. 3 (2017): 256–78, <https://doi.org/10.1177%2F0021934716688311>.

especially the “Euclid” myth was concocted by the Crusading church³⁵ in defence of its strange method of (axiomatic) proof or deductive reasoning minus facts. It was later used to promote the church method of proof as a “superior” way of doing math (as in our 2021 class IX school text, p. 79) and also to promote a racist sense of superiority. The point (iii) that axiomatic proofs are inferior, has already been covered above, but that will take much longer for our math “experts” to understand for they have not even understood the proof of propositions 1 and 4 of the Elements.³⁶

(4) **Method of validating knowledge.** The traditional method of validating knowledge was through a transparent public debate (शास्त्रार्थ). The colonial method is for ignorant bureaucrats to appoint “experts” based on social reputation, which is today decided by popularity (citations) and on publications based on the (church method of) secretive and non-transparent assessment by other such “experts”.³⁷ Further, since colonialism globalised the church education system, all mathematics “experts” are trained ONLY in formal mathematics. Further, by making math difficult, colonial education certainly makes most other people ignorant. This makes it next to impossible to change or even discuss the validity of authoritatively approved Western knowledge about math. For वैचारिक स्वराज we need a public debate on the *validity* of this “knowledge”. My efforts to start a debate over the past several years, either collectively,³⁸ or individually,³⁹ have failed. This exclusion of open public debate is a design feature of church education, which enabled the persistence of church dogmas. Indians are, today, helpless victims of that design of colonial/church education/indoctrination, caught in a church trap, and unable even to question the contents of a class IX school text (which ironically begins with unreal “real” numbers).

(5) **“It works” superstition.** Regardless of the critique of formal math, many people have the superstition that “it works” (and that nothing else can work better). This superstition is based on complete ignorance of even why $1 + 1 = 2$ in “real” numbers (not cardinals, not natural numbers, not integers, not rational numbers). To demonstrate this ignorance of “real” numbers (the first chapter of the class IX school text, and hence compulsory reading for all Indians), among our top intellectuals, I offered a prize of Rs 10 lakhs to the JNU faculty⁴⁰ for a proof of $1+1=2$, from first principles. Even though there was a reduced prize of Rs 1 lakh for the proof of $1+1=2$ if submitted in a week, both prizes went unclaimed.

In my Hawaii paper⁴¹ (written in 1999), I had pointed out that though “real” numbers are considered essential to the teaching of university calculus, actual applications (to, say, calculation of rocket trajectories) use computers hence floating-point numbers, for a computer CANNOT use unreal “real” numbers. Those who plagiarised my Hawaii paper 2001 paper in 2004 without citing it, failed to understand it.

Lack of understanding is a common feature of intellectual thieves, whether giants like Newton,⁴² or con-tricksters like Einstein⁴³ and Atiyah,⁴⁴ or intellectual pygmies like Joseph and Almeida. Some of their mistakes, such as the terrible mistake about the reasons for the theft of calendrical data from

35 “Euclid” must fall’. Keynote: Tübingen/Pretoria 13 May 2021. <https://www.youtube.com/watch?v=kAP1BcK8mLE>.

36 “Euclidean geometry vs rajju ganita”, <http://ckraju.net/blog/?p=200>.

37 C. K. Raju, *Ending Academic Imperialism* (Multiversity, 2011).

38 <http://ckraju.net/issa/call-for-participation-issa-special-session.html>.

39 “Conversation with a formal mathematician”, <http://ckraju.net/issa/conversation-draft-minutes.html>.

40 “Statistics for social science and humanities: should we teach it using normal or formal math”, JNU, 16 Sep 2020. <https://www.youtube.com/watch?v=A9Og1k-Z5O4>.

41 Raju, ‘Computers, Mathematics Education, and the Alternative Epistemology of the Calculus in the YuktiBhâsâ’.

42 C. K. Raju, ‘Marx and Mathematics. 4: The Epistemic Test’, *Frontier Weekly*, 8 September 2020, <https://www.frontierweekly.com/views/sep-20/8-9-20-Marx%20and%20mathematics-4.html>.

43 <http://ckraju.net/News/ckr-TGA-acceptance-speech.pdf>,

44 <http://ckraju.net/blog/?p=183>, and following.

India, to solve the European navigational problem, are documented in my book.⁴⁵ Hilariously, the serial plagiarists⁴⁶ Joseph and Almeida wrote in a 2004 article, published *after* an earlier act of plagiarism was partly but publicly acknowledged,⁴⁷ said that “the Kerala mathematicians employed...floating-point numbers...to derive infinite series”. Sadly, floating point numbers have nothing to do with “Kerala mathematicians”, they are a recent standard (IEEE, 754 of 1985) specifically for computers which use the binary system as described in my class notes⁴⁸ from the same time as the Hawaii paper. It is even more absurd to say that floating point numbers can be used to “derive infinite series”.

That is, “it works” but we don’t know how “it works”, and we do not know what exactly works. That is how indoctrination works! Indians particularly seem to have been very comfortable with this act of plagiarism, and celebrated it, since what they really wanted was only *publicity* that calculus was discovered in India: not knowledge about how it was done differently in India which makes it work better. They any day prefer publicists to knowledgeable scholars.

Therefore, since our primary desire is for publicity Raj, even when publicity comes from the dangerous half-truths of a plagiarist, not for truth or knowledge, or वैचारिक स्वराज, I have taken my course on Indian calculus without limits off-line, till such time as colonised Indians develop greater value for knowledge and truth. I will now run the course, if at all, only outside India. That is, since we Indians only care who did it first, whether about the “Pythagorean theorem” or calculus, and not how, let us keep studying calculus on the rotten method of fluxions, or using “real” numbers, and we need not check if the Indian method was better.

(6) **Laws of nature.** The teaching of Newton’s laws of motion in schools, and the related church superstition⁴⁹ that there *are* eternal laws of nature, with which God rules. How badly this can go wrong is shown by this minuted public debate⁵⁰ with a theologian from Singapore Bible college, with a PhD in history and philosophy of science from Cambridge, who wanted to preach this superstition as part of a university course. Newton’s “laws” (both of motion and gravitation, failed a century ago, as did the concept of deterministic evolution). But, obviously, a century is too short a time.

45 C. K. Raju, *Cultural Foundations of Mathematics: The Nature of Mathematical Proof and the Transmission of Calculus from India to Europe in the 16th c, CE* (Pearson Longman, 2007) Box on ‘Transmission of the transmission thesis’.

46 “George Joseph serial plagiarist” <http://ckraju.net/blog/?p=132>, “George Gheverghese Joseph serial plagiarist and mathematical ignoramus”, <http://ckraju.net/blog/?p=166> and related. Briefly, George Joseph and Dennis Almeida have been serially plagiarising my calculus transmission work ever since 1998 when I shared my unpublished papers with them and later also submitted another 1999 paper to a 2000 conference organized by Joseph in Trivandrum, which paper was first published anonymously in the conference proceedings in 2003, and then the same was verbatim publicised in the name of Joseph and Almeida in a publicity blitz of 2007 which had this as front page news, across India. The purported article was a verbatim copy, including references to my unpublished work (unpublished as of 2000). But Indians fall head over heels if someone from abroad praises them. This plagiarism was done on the same doctrine of Christian discovery which was used by Newton to appropriate the calculus, and which is part of British and US law, as Joseph a trained lawyer well knows. See the RETRACTION of the Hindustan Times news item in HT, 25 Aug 2007, <http://ckraju.net/press/HT25Aug07.jpg>. For the use of the doctrine of discovery to appropriate the calculus, see C. K. Raju, ‘Marx and Mathematics. 2: “Discovery” of Calculus’, *Frontier Weekly*, 31 August 2020, <https://www.frontierweekly.com/views/aug-20/31-8-20-Marx%20and%20mathematics-2.html>.

47 “the infinite was a difficult issue. On the other hand, from the fifteenth century onwards, the Kerala mathematicians employed computational mathematics with **floating point numbers** to understand the notion of the infinitesimal and **derive infinite series**” (p. 51. e.a). Dennis Almeida and George Joseph, *Race and Class*, 45(4) 45-59.

48 <http://ckraju.net/hps2-aiu/floats.pdf>.

49 Thomas Aquinas, *Summa Theologica*, n.d., <http://www.newadvent.org/summa/2091.htm>.

50 <http://ckraju.net/usm/Psc-minutes.html>. This public debate could be done only in Malaysia, not India.