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SCIENCE AND MULTICULTURALISM¹

Introduction:

Over the past decade participants in these annual conferences have engaged in a thorough-going analysis of the relationships between science and culture, with special emphasis on the religious components of culture. Today I will focus on a new chapter in the long history of interactions between science and society at large. I want to analyze the antagonistic relations that have developed between science and the complex of ideas and values that can loosely be labelled as “multiculturalism”.

I will not attempt to give a comprehensive account of the diverse contexts in which appeals to multiculturalism are made. Instead I will concentrate on three tenets to which I believe many people who self-identify as multiculturalists or “cultural workers” would subscribe:

First, there is a high value placed on cultural diversity and a strong commitment to work actively for its preservation.

Secondly, it is argued that science as well as technology is detrimental to and subversive of local cultures.

Thirdly, from these core beliefs multiculturalists draw the

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conclusion that science must be modified in such a way so as to promote cultural diversity. They claim that the required modifications will dramatically change the character of science as it has been conceptualized from the time of the Scientific Revolution and Enlightenment.

The project of this paper is to clarify and evaluate each of the above claims.

1. Why Cultural Diversity Is Thought To Be a Good Thing: The Analogy with Biodiversity

The sorry history of colonialism provides excellent reasons for emphasizing the importance of respecting other cultures. Today, however, I will focus on arguments that hinge on parallels between biodiversity and cultural diversity. First, I will quickly survey some of the reasons people have given for why biodiversity is valuable and then turn to analogous arguments made on behalf of multiculturalism. I will defer any critical comments until the end of this paper.

One common plea for biodiversity relies on the Nature-as-Apothecary argument. A recent article in the *National Geographic* reminds us that common medicines such as digitalis and ephedrine come from familiar plants. It goes on to describes new drugs for childhood leukemia and Hodgkin's disease that have been extracted from more esoteric plants, such as the Madagascar rosy periwinkle, and then concludes:

Plants like the periwinkle have contributed to the development of 25 to 50 percent of all prescription drugs used in the United States

Biologists also emphasize the ecological value of diversity. In an interview concerning the recent discovery that a fungus living in the soil under black cherry trees prevented seedlings from growing under mature trees, thus leading to a dispersal of new cherry trees, biologist Keith Clay remarked:

² "Nature's Rx", *National Geographic*, April, 2000, p.?

The pattern causes greater diversity in the forest. And a more diverse ecosystem
follow the same philosophy [my italics]³

In his book called *Biophilia*, sociobiologist E.O. Wilson argues that humans have an “innate tendency to focus on life and lifelike processes”. Drawing an explicit parallel between diversity in the biological and cultural spheres, he continues:

Novelty and diversity are particularly esteemed; the mere mention of the word *extra*
explore and affiliate with life is a deep and complicated process
in mental development. To an extent still undervalued in
philosophy and religion, our existence depends on this
propensity, our spirit is woven from it, hope rises on its currents.⁴

Even if Wilson were to convince us that diversity is something which humans intrinsically love (and given that we also have fears of the unknown and the different, any such claim would have to be very qualified), additional arguments would have to be made to establish that it is desirable for humans to cultivate this particular innate tendency. But that is a problem for philosophers of ecology and biodiversity to deal with. Proponents of cultural diversity follow the current *Zeitgeist* in assuming that biodiversity is a good thing and use that fact in supporting their own concerns.

A nice example of such an appeal is found in an editorial by the President of the Field Museum in Chicago:

The story of evolution is like that of a mighty river slicing through the landscape of
along the way. The same is true for human evolution which today
relies on the rich mosaic of the world’s cultures to propel it
forward and shape its course. No longer exposed to the new
ideas, creativity and knowledge that diversity fuels, the mighty
river of human-cultural evolution could be in danger of running

³ "IU Tree Study Sparks Nationwide Interest,"
Bloomington Herald-Times, March 25, 2000

⁴ E.O. Wilson, *Biophilia*, p.1.

dry. For years, anthropologists have been sounding the alarm that cultural diversity, which they believe is as essential to our survival as biological diversity.

Not only is the fostering of cultural diversity said to be needed to promote creativity, it is hoped that an appreciation of cultural differences will alleviate cultural conflicts. The same brochure from the Field Museum announces the formation of a Center for Cultural Understanding and Change, whose mission is “to promote understanding and respect for cultural diversity through the use of the Museum’s various anthropological resources”. Pointing out that Chicago is a sort of microcosm of the diversity found around the world, the article continues:

At times, this diversity can lead to confusion and conflict among diverse groups--with different cultures have made to our lives and how these cultures continue to enrich them.⁶

Thus the Museum works with local ethnic centers to sponsor workshops on Ukrainian Easter eggs or the history of a particular ethnic group’s contributions to Chicago. It is relatively easy to preserve and share the cuisine and folklore of minority groups. Sustaining core cultural values is much more difficult. A newsletter from the Native American Women’s Health Education Resource Center describes a cultural immersion pre-school program run by some Dakotan grandmothers:

Wana wota! (Time to eat!) Breakfast is served after the children put their belongings away. The heartbeat accompanies most of the songs they learn. The children can fluently sing numbers 1-10 in Dakota and are working towards mastering 11-20. Language is an amazing gift and one of the most important we have.

⁵ “Cultural Diversity in the 21st Century”, *In the Field*, March/April, 2000.

⁶ *Ibid.*

⁷ “NAWHERC Launches Dakota Language and Culture Immersion Program,” *Wicoanni Wowapi: Good Health Newsletter*, Winter, 1999-2000.

We have seen the strong parallels in the arguments and the imagery used to extol diversity in both the biological and cultural spheres. Let us now turn to shared concerns about the impact of science and technology.

2. How Science/Technology Is Seen As Threatening Local Cultures

In a recent well-received book Thomas Friedman dramatizes the conflict between *the Lexus and the Olive Tree*, his metaphor for the tension between “the globalization system and ancient forces of culture, geography, tradition, and community”. He sums up the new threat to local cultures this way:

The railroad, steamship and automobile led to falling transportation costs. Now microchips, satellites, fiber optics and the Internet are leading to falling communication costs. *Information is even more intrusive than products.* [My italics]⁸

The connection between technological development and the McDonaldization and Disneyfication of the World is direct and non-controvertible. To the multiculturalist this is an unmitigated disaster. Friedman’s own evaluation is more mixed and he even playfully proposes a “Golden Arches Theory”, based on the observation that, at least at the time the book was written, no two countries who had McDonald’s restaurants had ever been at war! (One thinks immediately, of course, of the hostilities between India and Pakistan, which were also responsible for the refutation of the theory of no war between cricket playing nations.)

But even if the homogenizing and dominating effects of technology could somehow be mediated, many would argue that the very goals and core values of science are at odds with what we might call an ethnosensibility. There is a long tradition coming out of the Romantic reaction to the Enlightenment of arguing that the scientific quest for the simple and the universal works against an

⁸ Thomas L. Friedman, *The Lexus and the Olive Tree: Understanding Globalization*

appreciation of the particular and the complex. Whitehead was perhaps struggling to provide a synthesis when he wrote that “the great Harmony is the harmony of enduring individualities connected in the unity of a background”⁹ and when he stressed that both complexity and harmony are necessary ingredients of what he calls “intense experience”. Nevertheless, there are many who are firmly convinced that the analytic tools of science work against our ability to feel at home in the world. And, rightly or wrongly, it is traditional cultures which are thought especially to treasure the seamless whole of human experience.

A very popular resolution of the conflict between science and religion is the “separate spheres” approach which posits that when each enterprise is understood properly there can be no strict inconsistency because the domain of scientific facts is distinct from the domain of religious values. As Galileo succinctly put it in his Letter to the Grand Duchess Christina:

The Bible tells us how to go to heaven. Science tells us how the heavens go.

In his Presidential Address at the 2000 meeting of the American Association for the Advancement of Science Stephen J. Gould voiced a similar sentiment:

Science can describe and explain the structure and operation of the World. Religion supplies its meaning and purpose.

But although it may sometimes be possible to truncate the claims of a systematic theology in such a way as to remove conflict with scientific accounts, when we look at the broader value structure of a culture, conflicts seem inevitable. Any culture presupposes many factual claims that may not gibe with modern scientific findings while science incorporates cognitive values that may clash with traditional cultural norms.

When Pervez Hoodbhoy, a Pakistani nuclear physicist who also

⁹ Alfred N. Whitehead, *Adventures of Ideas*, p. 281.

writes on conflicts between science and religion, set out to make a series of science documentaries to be broadcast on an Urdu television station, he was surprised at how many of the topics covered had the potential to offend his audience.¹⁰ There were, of course, conflicts between modern cosmological theories and the creation account in the Koran. And in Pakistan, where custom places a high premium on consulting an astrologer before significant life choices and events, the undermining of certain astrological claims by astronomy and psychology was distressing.

But even the basic genetics of sexual reproduction, viz., the XX/XY account of the sex of off-spring whereby the Y chromosome comes from the father, could threaten the local practice of beating or at least blaming the woman if there were no male children. Other programs would challenge the custom of cousin marriages and the “blue blood” theory of the inheritance of desirable social characteristics. Even to describe the human heart as a mechanical object, as a pump, rather than as the seat of spiritual attributes ran strongly counter to folk psychology.

Parallel conflicts are well known in the United States. Native Americans feel their culture is threatened by the study of Kennewick man. The Internet provides a new site for the evolutionist/creationist controversy. When I opened up my web connection to Amazon.com recently, it greeted me with several books that it thought I might find interesting, based on my past purchases. Since I often buy children’s books as well as books about science, the Amazon computer had decided I might like *The Great Dinosaur Mystery and the Bible*, a popular children’s book that carefully explains which scientific claims about dinosaurs are inconsistent with the Bible and hence must be rejected. American folk culture is rife with pseudo-scientific beliefs. I don’t know about people in Kentucky, but in Southern Indiana we still consult the almanac before planting cucumbers and believe that the stallion is more influential on both the color and the speed of foals than is the

¹⁰ See Pervez Hoodbhoy, *Islam and Science -- Religious Orthodoxy and the Battle for Rationality*, ZED Books, London, 1991. His remarks about making the documentary were made in a recent lecture at Indiana University.

mare!

Some of the conflicts between science and culture are, of course, more contentious and have more important policy implications than others. But the fact remains that the conflicts are real and multiculturalists are often correct in thinking that science as well as technology *is* in tension with their project of preserving local cultures. Sometimes the Galileo-Gould ploy of trying to keep science and value enterprises in separate compartments doesn't work.

3. How Should Science Be Made More Friendly to Multiculturalism?

The efforts to protect local cultures from advances in science range from the flat denials of religious fundamentalists and sophisticated obfuscations of postmodernists to various attempts by anthropologists to design an ethical approach to the study of ancestral remains. Many of the current debates in the so-called Science Wars bear directly on these issues. Here I have only time to criticize a couple of examples of multiculturalist attempts to modify science and then make a few remarks about more positive routes to reconciliation. First, the examples of how *not* to make science more friendly to local culture:

It may look like a case of "piling on" to mount yet one more attack on Creationists, but I can't resist summarizing the strategy adopted in the children's book mentioned above (which I eventually purchased from Amazon out of curiosity!). The author begins by pointing out the fallibility of science in general and the difficulties of reconstructing whole organisms from fragmented fossil remains. Much is made of past scientific mistakes - at one time a museum exhibit of what was then called a Brontosaurus (we now know it is a Diplodocus) had the skull of an Apatosaurus attached.

As a philosopher of science who was influenced by Popper, I cannot object to the emphasis on fallibility; however, what the book slights over is the fact that scientists work constantly to eliminate mistakes and constantly improve their techniques for interpreting fossils. In the case of this children's book, however, such subtleties are beside the point because we quickly learn that it is the Bible

which should guide us in our scientific studies of dinosaurs. I had not realized that the Bible actually talked about dinosaurs, but evidently there is a passage in Job where God says, "Look at the behemoth, which I made with you and which feeds on grass like an ox." We also know that all the animals lived peaceably together in the Garden of Eden until after the Fall.

But does not science tell us some dinosaurs were meat eaters? The book offers various reassurances to the puzzled child: perhaps some were scavengers, but the fossilized stomach contents of a tyrannosaur have never been found; furthermore, fossil evidence suggests that their teeth were not rooted well and their front legs seem far too weak for grabbing prey. Of course, many animals became fierce after the Flood, but:

Bible-believing Christians can be sure of one thing. When dinosaurs were originally dinosaurs as beautiful, living creatures designed for our enjoyment. And Man will once again be able to rule with love and wisdom over all the animals, even the dinosaurs.¹¹

This book is clearly an attempt to protect religious fundamentalist culture -- the book jacket speaks of the big problem children have in "understanding how dinosaurs fit with Creation and the Bible". It solves the mystery by allowing children to continue participating in much of the popular media's fascination with dinosaurs while teaching them to filter all claims, even the scientific ones, through the sieve provided by the creationist interpretation of the Bible. It is easy to dismiss this educational enterprise as "indoctrination" -- which it is, of course -- but it does have the positive features of asking children to evaluate critically the messages of popular culture and it does not attempt to make children ignorant of what science claims, although it does then systematically undermine those claims in an explicit fashion.

On the face of it, some of the critiques of science by postmodernist academics seem more subtle and benign; yet they

¹¹ Paul S. Taylor, *The Great Dinosaur Mystery and the Bible*. Colorado Springs: Chariot Victor Publishing, 1989.

may in the long run be more deleterious. Consider, for example, those who claim that the concepts of ordinary mathematics are not congenial with thinking patterns in various local cultures. I'll give only two brief illustrations of such claims.¹²

First, here is an argument that mathematics conflicts with women's cultural experience. It comes from a Cambridge University Press volume dedicated to *Equity in Mathematics Education*:

In the context provided by Irigaray we can see an opposition between the linear time of mathematics problems of related rates, distance formulas, and linear and, indeed, that the linear mathematics of schooling describes the world of experience in intuitively obvious ways?¹³

acceleration versus the c

Similar claims about the incongruity between indigenous modes of thought and mathematics are found in a mathematics newsletter:

[T]he Western world developed the notion of fractions and

decimals out of a need to

[N]on-Euclidean geometry, motion theories, and/or fundamentals of calculus may be naturally compatible with

Navajo spatial knowledge

A startling recommendation for curricular reform follows:

In other words, for some students, it might be appropriate

to teach calculus as elem

¹² For further discussion, see my "Postmodernisms and the Problem of Scientific Literacy" in *A House Built on Sand: Exposing Postmodernist Myths about Science*, edited by Noretta Koertge, Oxford University Press, 1998.

¹³ Suzanne Damarin in *New Directions for Equity in Mathematics Education*, Cambridge University Press, 1995.

¹⁴ *UME Trends* 2 (1990).

¹⁵ Shulman, *Journal of Women and Minorities in Science and Engineering* 1 (1994)

We should note one sharp contrast between this response and the Creationist strategy discussed above. The Creationists assumed their kids were smart enough to understand both the scientific approach and the Bible-centered approach to the study of dinosaurs and then choose between them. The intention of the Creationists is that their kids understand *more* than what they learn in school, although they may believe less! The ethnomathematics strategy illustrated above assumes that girls and Navajo children are not really capable of learning ordinary mathematics as it is usually taught and hence are not in a position to compare the mathematical stance with their own indigenous world view. The program of the Lakotan grandmothers, on the other hand, sounds more like a focus on cultural enrichment. They teach their kids to count - and don't stop at ten - while also teaching them about animal spirits and the significance of the drum.

These examples suggest two quite different strategies for reconciling modern science with the belief systems of local cultures: One uses science as a means of enriching local culture, hoping also that local culture may sometimes enrich science. The other tries to defend local culture from the intrusion of science, even to the point of being reluctant to teach children science unless and until it has been recast in culturally appropriate terms. Both strategies can be illustrated by contrasting the use of Vedic mathematics in Jaipur, India and in Albany, New York.

4. Two Strategies for Deploying Vedic Mathematics

In 1988 a National Workshop on Vedic Mathematics was convened at the University of Rajasthan in Jaipur. In his opening remarks Vice-Chancellor Agarwal who is also Professor of Mathematics framed the discussion this way:

The history of evolution of Vedic Mathematics indicates that it has been more than religion. It is in this context that the present workshop is very significant and we have to present the diverse opinions in the correct modern perspective, without bringing in the conflicting socio-religious philosophies.

¹⁶ H.C. Khare, ed., *Issues in Vedic Mathematics: Proceedings of the*

Participants in the Workshop included mathematicians and engineers from universities, school headmasters, at least one judge, and various religious leaders. Browsing through the Proceedings, several points of disagreement emerge:

(a) So-called Vedic Mathematics, a series of procedural shortcuts for doing long calculations using mental arithmetic, was supposedly first formulated in ancient Sanskrit *sutras*, but some historians claim that they were invented by Swamiji in the 20th century, not discovered in classical texts.

(b) Enthusiasts believe that children not only enjoy using the shortcut *sutras* (the Chair of the Maharishi Academy of Vedic Science describes how they amaze their parents by multiplying a 20-digit number by a 19 digit number, without using pen and paper), it also improves their overall cognitive abilities. A civil engineer says:

Only the left half of the brain is activated and developed by the present Maths education the human brain -- the intuitive faculty -- unfortunately, remains undeveloped in most students.

[B]y the regular practice of the most natural mental procedures of the Vedic maths system, the holistic development of the human brain automatically takes place. *In a nutshell we can say*

However, in discussing the proposed shortcuts for factoring, a professor of Mathematics says that they may not be understandable to children who have not already learned the standard procedures and in his opinion the regular method is "less cumbersome". More problematic is the fact that the Vedic method does not work in all cases:

...Swamiji's technique completely ignores quadratics which involve 'perfecting the square' when a, b, c are integers. (p. 61)

National Workshop on Vedic mathematics, Delhi: Rashtriya Veda Vidya Pratishthan in association with Motilal Barnarsidass Publishers (1991), p. 10. The volume contains articles in both English and Hindi. I was unable to access the material in Hindi.

c) The sharpest disagreements concern the significance of the rules for calculating. Most of the educators at the conference say polite things about the importance of a “reconciliation between the formal mathematics curricula and the Vedic formulae” (p. 72) and regret that “we have neglected our rich mathematical heritage for so long” (p. 65), but also insist that we must “throw out the dead wood and take up from where our ancestors left” (p. 65), the goal being to “evolve a new concept of mathematics which will preserve the best in our ancient heritage and at the same time make the most modern available in the same classroom package” (p. 72).

Political and religious leaders at the workshop, on the other hand, call for a replacement of the standard approach to mathematics. A member of the Rajasthan Patrika would include natural science within the new Vedic curriculum:

An entirely new interpretation of Vedic knowledge has come to light for the first time in history. The meaning of Vedic terminology is revealed in a way to prove that the Vedas are nothing but science and the Vedas cover all aspects of the universe. It is an irony of the situation that such treasure of knowledge remained hidden for quite a long time (p. 89).

[Vedic sources] do not talk in vague language. Everything is precise and accurate.... There are 84 lakh species on the earth. (p. 95)

As Meera Nanda points out in an essay on attitudes towards science in India, the rise of Hindu nationalism coupled with postmodernist calls for “decolonizing” science has increased the popularity of Vedic mathematics and engineering curricula in the schools.¹⁷ Thus in India the more moderate and nuanced perspectives on Vedic mathematics intended by at least some of the conveners of the Workshop lost ground to the forces of Hindu fundamentalism.

¹⁷ Meera Nanda, “The Science Wars in India,” *Dissent*, Winter, 1997. Reprinted in *The Sokal Hoax: The Sham That Shook the Academy*, University of Nebraska Press, 2000.

When we look at the deployment of Vedic mathematics in the context of Indian immigrants living in Albany, New York, however, we are presented with a more optimistic possibility of combining multiculturalism with a high quality technical education. The materials described below are drawn from the web site of Dr. Mukkai Krishnamoorthy, a computer science professor at Rensselaer Polytechnic Institute who teaches a five weeks class on Vedic Mathematics in a Hindu Heritage Class for Albany middle and high school students.¹⁸ The notes for his lectures suggest an approach that successfully integrates a concern with preserving traditional culture without undermining the scholarly integrity of modern mathematics.

The course begins by providing a historical background for the role of mathematics in traditional religious practices, including some bibliography. Since sacrificial fires were to be lit at set times of the year, people needed to be able to construct lunar and solar calendars. Both astronomy and astrology required extended mathematical calculations. The information conveyed by sutras was typically presented in a very condensed form so as not to use up expensive writing materials. The instructor compares a Vedic calculating rule such as “all from nine and the last from ten” to the more familiar “i before e except after c”.

The notes then present the sutras for multiplication, division and factorization and illustrate how they work using simple examples. Although the lecturer is obviously enthusiastic about the usefulness of these methods, he goes out of his way to integrate the Vedic rules with what the students are learning elsewhere and in a slide entitled “Why does it work?”), he presents an algebraic representation of the Vedic method and shows how it yields the correct answer. As a result, this short course on Vedic Mathematics not only supplements the students’ understanding of their own culture and the history of mathematics, it also reinforces the mathematical skills they are learning in their regular classes. This

¹⁸ The slides for his presentations are posted at:
<http://www.cs.rpi.edu/~moorthy/vm/>

appears to be an attractive paradigm of how multicultural approaches to science and mathematics might work!

Concluding Remarks:

For the purposes of this paper I have left pretty much unchallenged two key premises of current defenses of multiculturalism, namely, that biodiversity is an unmitigated good and that the analogy between biological diversity and cultural diversity is a helpful one. Even ecologists are starting to modulate some of their enthusiasm for preserving biodiversity at all costs.¹⁹ More suspect is the analogy. Preserving samples of the small pox virus for study is one thing; sustaining a live, self-reproducing culture of Naziism would seem to be quite another! One wonders if the strong advocates of cultural diversity really want to preserve the cruel, racist, sexist, inegalitarian elements that are found in traditional cultures as well as our own. Once we start to make judgments about which elements of these cultures we wish to sustain and which we want to drop or modify, once we start to subject the mores and practices of a culture to a moral critique, why may we not also subject their belief systems to a scientific critique?

My strategy in this paper was not to challenge the appeal for cultural diversity head on. Indeed, I believe that as a slogan it can at times be valuable in combatting the excesses of scientism and the cultural arrogance of the people in power.²⁰ What I do call for is a careful re-evaluation of how we deal with conflicts between science and local belief systems. Nothing is gained by trying to deny that there are sometimes real conflicts -- merely advocating an intellectual tolerance of diverse beliefs does not help the child

¹⁹ See for example, Lila Guterman, "Have Ecologists Oversold Biodiversity?", *Chronicle of Higher Education*, October 13, 2000.

²⁰ At other times the slogan serves primarily as a rhetorical shield for the promotion of agendas dictated by the narrow self-interest of ethnic activists.

who is genuinely puzzled by inconsistencies between what is taught at school and what is taught at home. Perhaps even more destructive is the attempt of some cultural activists to exaggerate the incommensurabilities between the conceptual system of the subculture and that of the dominant culture. Minority kids feel alienated enough without telling them that mainstream mathematics and science will be inaccessible to them because of their holistic worldview!

What everyone can benefit from is a more sensible kind of multiculturalism -- one that encourages us to enrich our own perspective with an understanding of alternative approaches to some of the same problems. Everyone, not just Hindu children, can benefit from learning some mental arithmetic shortcuts summarized in the Vedas, as long as we are honest about their limitations. Every cultural practice can be studied with respect as long as we put it into an appropriate historical context. We do not mock Ptolemaic astronomy or Galenic medicine even though these systems have been superseded. We should not mock the astronomical theories and ideas about disease and healing found in various cultural traditions, but neither should we advocate that children born into that cultural tradition feel obligated to accept them uncritically. Preservation is the highest priority of archivists and historians and cultural activists have every right to make sure records of their heritage are being preserved. But as for our children, we want them to be able to sample and participate in everything valuable that exists today, regardless of its cultural pedigree.

