Where does Ethnomathematics Stand Nowadays?

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These thoughts on Ethnomathematics were induced by an invitation to give a talk a few months ago, for which the organizers suggested the title "Is Ethnomathematics Revisionism?".

Revisionism entered the dictionary of ideas *via* the critical views of Marxism expressed by the German socialist Edward Bernstein (1850-1932). He claimed that the social and political environment in which Marx's ideas grew had changed and that many of the concerns that led to the communist proposal had been met within the capitalist system. These ideas were not appealing to the protagonists in the revolutionary process going on in the USSR and the term was much used in the struggle for power during the consolidation of the Soviet regime. It has also frequently been used in relation to the new communist proposals adopted by some countries and parties all over the world after the end of World War II. Feuding groups of communist adherents accused each other of revisionism.

Revisionism came to be used in American historiography in the 60s and 70s with the proposal for a new view of the history of the Cold War and the US involvement in the Vietnam War. The term was used again in discussions about the Smithsonian Enola Gay Exhibit, in mid-1995.

The ongoing arguments about Afrocentrism and Eurocentrism frequently mention "historical revisionism". And one side in the current dispute labelled "Science wars", which emerged from the search for "new paradigms", involving Fritjof Capra, Paul Feyerabend, Ilya Prigogine, and other sociologists, philosophers, and historians of science, claims to sound the alert against scientific revisionism. The reaction of scientists to discussions "about" science invariably appeals to competence. Indeed, the introductory editorial of Andrew Ross in the controversial issue of *Social Text* expresses the situation quite well: "The rise of a privatized knowledge society does not translate into a scientifically informed citizenry; rather, it creates a hierarchy of technical expertise and, in particular, releases scientists from public accountability on the grounds that their critics just don't know enough". [1] This is no different from the attitude surrounding the emergence of mathematics education as an academic field. [2] So to be asked the question whether Ethnomathematics is revisionism did not surprise me from an epistemological point of view

We notice the same tone in the unjustifiable wariness about the growing presence and acceptance of Ethnomathematics in school systems. Although in many circles there is a sympathetic attitude towards Ethnomathematics, we also see reactions that do not differ from that of the "hard" scientists with respect to sociologists of science. In the week that I was giving an invited talk about Ethnomathematics at the HIMED-94 conference in England, an article entitled "Education's Guerrillas Prepare for War" appeared in *The Observer* (London, March 27, 1994), in which the author referred to Ethnomathematics in a distorted and contemptuous way: "Ethnomaths? This is the maths we pick up by chance in day-to-day life, said to be as valid, if not more so, than the maths we're taught in school". So the suggestion for the title of my talk did not surprise me as an educator either, since Ethnomathematics is frequently treated as pedagogical revisionism too.

There is a general acceptance of and interest in the mathematical ideas of other cultures. Mathematicians and educators seem to enjoy learning about the *tipi* of the prairie cultures, the *whakapapa* of the Maoris in New Zealand, the *oware* game of the Asante culture in Ghana, the male and female geometric figures in Amazonian cultures. [3]

Figure 1

A paternalistic curiosity prevails But when we try to view these facts as complex forms of knowledge and try to relate them to the way these cultures think—the way they think about, for example, property and production—there is incredulity. And when we take the same questioning stance and try to identify similar complexities and relationships in Western mathematics, the reaction met with is disdain and even scorn. It is common to hear the accusation that this is a revisionist approach to mathematics

I learned from my masters in history, who adhered to the *École des Annales*, that politics and the social sciences, as well as religions and the arts, the sciences and the professions, all evolve in a symbiotic relation.

When we try to understand the state of the world, particularly humankind, we cannot avoid an analysis of the five hundred year period from the great navigations, conquests, and colonizations up to the present day. In particular, when we look into the history of mathematics it is insufficient and misleading to try to find the roots of current mathematical knowledge in Greek antiquity, even in medieval creativity. The globalization that occurred after the sixteenth century was the decisive factor in the development of modern science and mathematics, carrying with it the ideology of superiority and predestination intrinsic to the Mediterranean religious traditions In a very lucid remark, sociologist Philippe Braillard once said "Whole areas of research have been determined largely by ideological options—of which the scientists themselves have been unaware—channelled by the choice of analytical tools or conceptual framework." [4] This kind of awareness seems to be overlooked, even avoided, on the ground of its irrelevance for mathematics seen as a corpus of knowledge.

Ethnomathematics helps us to realize the falsifying nature of this attitude. By relying on alternative epistemological grounds, Ethnomathematics places us in an advantageous position to look into the nature of mathematical knowledge, the questions about which cannot be resolved within the framework of Western mathematics itself We might use Kurt Gödel's conclusion as a metaphor for this remark. [5]

We will find the roots of current development in mathematics not so much in Pythagoras and Euclid but rather in the economic and political development which took place in and after the sixteenth century and the new vision of the world which developed alongside. Pythagoras and Euclid, of course, have much to do with providing the *means* for the navigations, conquests, and colonizations. (I refer not merely to the technological means, but mainly to the intellectual and ethical means.)

These remarks suggest a different approach to the history of mathematics: looking into the strata of society which were shaping its behavior, values, and knowledge, not only to those listed as mathematicians in the typical history of mathematics sources—papers, treatises, and encyclopaedias Surely we need a considerably broader concept of sources, consequently a new historiography for the history of mathematics. The reaction against this proposal, which is crucial for Ethnomathematics, is very strong. Thus, from a historical viewpoint, it does not surprise me when I see Ethnomathematics labelled as revisionism.

Let me elaborate on the role of history in ethnomathematical studies.

The colonial statute relied strongly on the strategy of conversion, which had been the main characteristic of both Christian and Islamic expansion It brought to the new lands new conceptions of space (*permanence*) and of time (*fluidity*), which are the most relevant categories for understanding the foundations of mathematical knowledge. The strategy of removing local historical and intellectual knowledge and the consequent elimination of the intellectual trust and pride of the conquered was also decisive in the process of conquest.

After World War II, the end of political colonialism brought a new protocol in cultural relations: a reluctant recognition of different styles of knowing, freed from colonial biases. As a consequence, we see the emergence of new forms and styles of explanation, of understanding, and of practice in just about every field of human activity.

A new historicity, hitherto ignored and even repressed, now emerges and is largely accepted and adopted as a guide for action. We see an intensification in the studies of ethnoastronomy, ethnoagriculture, ethnobotany, ethnohistory, ethnopsychology, ethnomedicine, ethnomusicology and so on, which consider the development of knowledge in relation to an investigation of ethnic types and behaviors. These studies combine the skills of the archaeologist, the anthropologist, the ethnographer, the conventional historian, the specialist in the discipline, and all this makes up into a typical interdisciplinary approach. The approaches used in these studies include combining collections of data from tangible materials and from oral traditions, analyses of behavior, comparative studies, and cultural dynamics. History thus gains a new breadth, for the concept of sources has to be changed and amplified, and chronology has to be entirely revised in order to include developments which followed different, in many cases unrelated, lines. How can mathematics stay unaffected by the opening up of these new directions?

Different styles, forms, and modes of thought aiming at explaining and dealing with reality were developed in different natural and cultural environments and run throughout history in parallel with the development of Western mathematics. Although reactions against this assertion are still heard, this is now generally accepted. Western mathematics developed out of the Mediterranean environment, hence belongs to the ensemble of behaviors of the Mediterranean cultures. Of course, these behaviors are not immune to cultural dynamics and they reveal innumerable contributions from other cultures. But, understandably, those in power are zealous in reaffirming the intellectual hegemony of the West. This particularly affects science Hence the seemingly unchallengeable position of mathematics.

Ethnomathematics may be, and indeed is, tolerated, even taught, admired, and practiced. And there is acceptance and praise for the fact that some cultures show achievements that match—even if minimally —some of the achievements of Western mathematics, which continues to be the paragon exemplar of rationality. In my talk at ICME-5 in Adelaide, many people became enthusiastic

about the pictures of baskets from the Amazonian cultures which I showed. The reason: they could explain the aboriginal basketry in mathematical terms. These artifacts revealed a mathematical knowledge—"intuitive", of course—in the indigenous cultures. This then became yet another example proclaiming the universality of Western mathematics, echoing what Vitruvius said in the first century B C.: "The philosopher Aristippus, a follower of Socrates, was shipwrecked on the coast of Rhodes, and observing geometrical diagrams drawn upon the sand, he is said to have shouted to his companions: There are good hopes for us; for I see human footsteps!" [6]

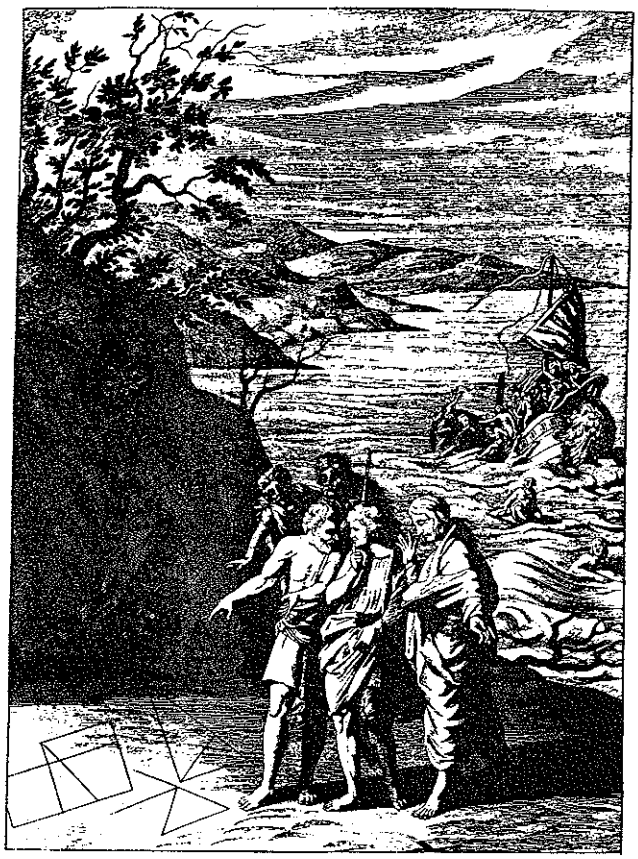

Figure 2

Much of the research in Ethnomathematics today has been directed at uncovering small achievements and practices in non-Western cultures that resemble Western mathematics . Western mathematics remains the standard of rationality. It is even suggested that if other cultures had a few more centuries of development, they might reach higher stages of rationality! The key issue, which seems to be omitted from most developments of Ethnomathematics, is that mathematical developments in other cultures follow different tracks of intellectual inquiry, hold different concepts of truth, different sets of values, different visions of the self, of the Other, of mankind, of nature and the planet, and of the cosmos. All these visions belong together and cannot be isolated from each other. These visions get built into the behavior of each human being and in each human society. Civilization is the result of precisely this movement.

The mission of bringing Western civilization to the planet has been the essence of conquest and of the colonial enterprise. Now we are at a crossroads. The human species and the planet itself are threatened. We cannot accept a kind of grand tautology, saying that things are the way they are because this is the way they have to be, because this is normal. *Normopathy* is the most serious threat to survival!

The only possibility for survival depends on a better understanding of the entire set of possible explanations and views of the individual, of society, of nature, of the cosmos. Western mathematics, the most perfect embodiment of Western civilization, cannot be immune from the search for this deeper understanding. We can benefit much from understanding the workings of different systems of knowledge, the same way a stranger can tell us much about ourselves. [7]

A corpus of knowledge results from a complex of needs and interests, of experiences and memories, of symbols and representations. The intangible process of imaginative thought which underlies the acquisition of knowledge distinguishes the human species from all other living creatures. The quest of men and women for themselves and for the Other, for nature and for the cosmos, gives them their special dignity and their feeling for truth. The effort to present images of the truth in forms that delight the mind and the senses of the beholder gives meaning to humanity. The common distortions of these images, leading to such a preposterous arrogance and arrogation and to hegemony, are the main concerns motivating this paper.

The frameworks of modern society, science and technology, religion and the arts, political organization and philosophical schemes, all sprang out of the Mediterranean region. From some of the elements an entire corpus of knowledge resulted. For some reason the Greeks paid attention to the sum of the angles of a triangle, though this property has no meaning at all in, for example, the natural and cultural environment of the Amazonian region. There is not much point in looking for contingencies in modes of thought from different natural and cultural environments. Most probably the Greeks were not able to distinguish a male triangle from a female triangle, as some Xingu cultures do. Categories which become important in a particular context and are responsible for directing corresponding intellectual constructions may have no importance at all in other contexts. Every culture attributes mythological properties to the facts of reality. The formalisms which derive from the mythological attributes generate distinct corpora of knowledge. Nowadays, all discourse about indigenous development refers to these broad aspects of knowledge.

Although this form of cultural relativism is increasingly accepted, there are attempts to deny a corresponding cognitive relativism. Most of these attempts use mathematics as their demonstrative tool. Many of the arguments just reassert the romantic claim of the universality of mathematics, unique among all cultural manifestations. Of course, mathematical knowledge is the same in Rome or Lapland or Amazonia, just as are myths, music, and hot dogs. But what about "producing" and "consuming" mathematics, myths, music, and hot dogs? All these cultural manifestations have to do with people. What do Lapps and the Yanomami have to say about hot dogs, music, and myths?

This seems an acceptable question. But if one puts a similar question about mathematics, the answer is simply "This does not make sense" To Lapps and the Yanomami we just say: learn mathematics (we mean Western mathematics). No one will take the trouble to deny that some Lapp or Yanomami may one day receive a Fields Medal, or that McDonald's may find that its best selling indices are in Lapland or the Amazon. We may even conceive of Lapps or Yanomamies scoring first in FIMSS (Fourth International Mathematics and Science Study)! The obvious possibility of these events leaves unresolved, indeed it masks, the real issue.

These are key points to consider when we look at the "civilizing" mission used to justify conquest and the colonial process, and the chroniclers have reported and identified all the contradictions resulting from the way the encounter was handled. Regrettably the chroniclers are not recognized in the histories of mathematics. This is an inadequacy of current historiography in its dealings with Ethnomathematics, which has been, and to a large extent continues to be, treated as a curiosity, dismissed in the same way as ethnoreligions are regarded as obscurantism and ethnomedicines as superstition.

In the 19th century, and well into the 20th, there were claims of ethical and intellectual predisposition based on race and gender. It was normal to think this way. A typical representative of these theories was Cesare Lombroso, who influenced schools, particularly in the United States. [8] Although eugenics is nowadays apparently in disrepute, a subtle piece of resistance is related to mathematics, seen as rationality *par excellence*. The social recognition of the specificities of mathematical knowledge, attributing to a mathematician traces of geniality and even implying an archetypical behavior and physical appearance, is well reported.

There is a widespread feeling that without the reasoning associated with mathematics, clearly understood Western (academic, school) mathematics, man cannot reach full understanding and knowledge of facts This was best spelled out by Richard Dedekind: "I recognize a convincing proof that their [i e., of those readers who scarcely recognize in the shadowy forms which I bring before them the numbers which all their life long have accompanied them as faithful and familiar friends] possession or belief in them is never given by inner consciousness but is always gained only by a more or less complete repetition of the individual inferences." [9]

It is quite important to notice that Dedekind is a contemporary of the main drive of the colonial enterprise and of the most intensive interpretations of Darwinism in a social context. It was the prevailing feeling of the time that moral abilities were attached to background: "Good seed generates sound and healthy fruit, and imperfect parentage can only yield defective offspring " [10] Dedekind's statement suggests the redirecting of modes of thought to achieve rationality and closes this possibility to non-initiates.

Now it is difficult to deny that every human being can understand, practice, and advance any cultural form In the attempts to renew education, making it clear that good minds are available in every sector of society, it is important to demonstrate the rationality of peasants, women, native americans, blacks, and others by showing they are also capable of doing some mathematics. Although this mathematics was originated by and directed towards the interests of Mediterranean populations and later on of aristocratic-male-white-Christian populations, the search for non-aristocratic, female, non-white and non-Christian mathematicians is intense.

Of course, all this is important and laudable, and provides a basis for that proper cultural and individual esteem which has been violated for centuries. The total rejection of racial hegemony is a major step toward a planetary civilization with equity and dignity for every human being. But this leaves unresolved the question of cultural hegemony. To regard certain cultures as inferior is still common. Comparisons are based on achievement in competitive confrontations, and this continues to give an advantage to Western science and technology, hence to Western mathematics.

A most important goal of Ethnomathematics relates to the very nature of mathematical knowledge. Why is mathematics distinct from—and by many regarded as superior to—other forms of knowledge in modern society? (The discussion above linking mathematics to myths, music, and hot dogs perhaps shocked some readers!)

The question of the nature of mathematical knowledge cannot be resolved within the framework of Western mathematics. Since Ethnomathematics has substantive differences from mathematics, manifested in their different methodological and epistemological, as well as contextual, grounds, it has a role in helping us clarify the nature of mathematical knowledge and of knowledge in general.

To get started, we have to ask about the source of knowledge. I assume that reality has an existence of its own. Knowledge results from our perception of reality, and we proceed from this. [11] The accumulated experiences of the individual and of one's ancestors are responsible for enlarging natural reality through the incorporation of "mindfacts" [ideas, particularly mathematics facts]. This enlarged, imaginary reality is the ground of myths, codes, symbols and culture in general, obviously also of mathematics. Abstract thinking is the result of an intellectual elaboration of this enlarged reality. It is preposterous to say that abstract thinking is the privilege of Greeks! The fact that the Xingu natives elaborate on male and female triangles carries with it all the mythology, symbolism, and traditions of their culture This kind of property carries considerable abstraction, which is culturally as meaningful as the concurrence of the medians of a triangle. But when I refer to male and female triangles audience and readers usually laugh!

I find an implicit denouncement of the abusive treatment of other cultural forms in the words of the renowned Hellenist G. E. R. Lloyd: "The best way of disabusing ourselves of those assumptions [that the Greek way of doing things was the natural or inevitable way of doing them, that the Greek's view of the questions to be asked focussed on the right ones to pose, the only ones that count, that the Greek's preoccupations with their ideals, models, goals, are the preoccupations that provide the necessary, if not the

sufficient, conditions for the eventual development of modern science] is by using all the considerable resources available for the investigation of other ways of doing things, other perceptions of key questions, ideals, goals, preoccupations—dificult as the work is." [12] Mathematics should not be excluded from this appeal to view other ways of doing things.

There is no future in denying some successes in the science and technology developed following the Greek style We will surely not be able to build faster jets and more powerful missiles using the male and female triangles of the Xingu ethnomathematics But maybe the male and female triangles could help us *not* build the missiles and the jets carrying bombs.

Notes

[1] *Social Text*, 46/47, vol. 14, nos. 1 and 2, Spring/Summer 1996 (p. 11)

[2] See the paper by Ubiratan D'Ambrosio and Beatriz D'Ambrosio, An International Perspective on Research Through the JRME, *Journal for Research in Matrhematics Education*, Vol. 25, No. 6, 1994; pp. 685-696.

[3] This has been identified by Pedro Paulo Scandiuzzi, from UNICAMP, Brazil, in his research among the Kamaiurá culture in Amazonia Figure 1 is credited to him.

[4] Philippe Braillard, The social sciences and the study of international relations, *International Social Science Journal,* Vol. XXXVI, No 4, 1984, pp. 627-642 (p. 634).

[5] A clear statement of Gödel's difficult results on undecidability is given by R B Braithwaite: "Every system of arithmetic contains arithmetical propositions, by which is meant propositions concerned solely with relations between whole numbers, which can neither be proved nor be disproved within the system." In Kurt Gödel, *On formally undecidable propositions of Principia Mathematica and related systems* (orig. pub 1931), translated by B. Meltzer, introduction by R B. Braithwaite, Dover Publications, Inc., New York, 1962 (p. 1)

[6] Vitruvius, *On architecture* , edited and translated by Frank Granger (in two volumes), The Loeb Classical Library, Harvard University Presss, Cambridge, 1934; vol. II (p. 3). Figure 2 is the frontispiece of a 1792 edition of Apollonius (thanks to the cover of Malba Tahans *Al-Karismi*, n 8, Rio de Janeiro, Outubro de 1951)

[7] In illustration of this remark is the fact that one of the most well-regarded analyses of early XIX century American society was made by an outsider, Alexis de Tocqueville (1805-59) By the way, it is interesting to see what Tocqueville had to say about the role of numbers in building "the American way", anticipating something that would penetrate the whole world by the turn of the century. It is enough to look into the concepts of production, of marketing, of fast food, of dress, of music, the emergence of "new" religions, and the generalization of political styles and ideals Many of the current developments in science and mathematics nowadays are linked to U.S A. priorities. There is still some hesitation, including by Americans themselves, in recognizing the emergence of the United States as an imperial power from the mid-nineteenth century and the "American imprint" which began to be felt across the entire world after this succesful enterprise. A good account can be found in Howard Zinn: *A people's history of the United States*, Harper Colophon Books, New York, 1980

[8] See the interesting study by Carl N Degler, *In search of human nature. The decline and revival of Darwinism in American social thought*, Oxford University Press, New York, 1991

[9] Richard Dedekind, *Essays on the theory of numbers* [1887], Dover Publications Inc , New York, 1963 (p. 33)

[10] Robert Fletcher, 1891, quoted in Carl N Degler, *op cit*, (p 36)

[11] This is amply discussed in my book in Portuguese, *Da realidade à ação* (From reality to action), Summus Editorial, São Paulo, 1986, and was a key point in my talk at ICME-5, in Adelaide, published as *Sociocultural bases for mathematics education*, UNICAMP/Campinas, 1985 Chapters 2 and 4 in particular refer to ways of knowing

[12] G E.R Lloyd, *Adversaries and authorities. Investigations into ancient Greek and Chinese science*, Cambridge University Press, Cambridge, 1996 (pp 18-19)