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Preamble

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Every culture has, in their traditions and religions, myths explaining the beginnings, the creation. This is true for pagans, animists, polytheists, monotheist. The foundation myths lead to deities responsible to all creation, the universe and the humanity. The actions of deities such as Enlil, Zeus, Fuxi and Nüwa, Brahma and Shiva and Vishnu, Ometeotl, Olorum, Yahweh/God/Allah and the "scientific" explanations such as chaos, *ex-nihilo,* big-bang, are very different and sometimes controversial, but they have many points of convergence. I will not discuss these views and simply accept the theories that places the Big Bang at 13-14x10^{10} years ago, the consolidation of Earth at 4,6x10^{10} years ago and the emergence of life at 3,8x10^{10} years ago.

What is life? This is one of the most difficult questions philosophers and scientists face from immemorial times. A comprehensive concept is to view life as a complex of chemical elements structurally organized, interacting with their environment and capable of reproduction. Accepting Charles Darwin theory of the LUCA (Last Unique Common Ancestry) that all extant terrestrial organisms share a common genetic heritage, each being the genealogical descendant of a single species from the distant past, we recognize the dinosaurs, arising 200 million years ago, some small, about 50cm, other large, about 40m by 20 m. They were two-footed animals, omnivorous, with large grasping hands, and lasted until 66 million years ago, when occurred a was a sudden mass extinction of some three-quarters of the plant and animal species on Earth. Mammals are recognized since about 125 million years ago and they evoluted towards hominids. The first species recognized as hominids is the *Sahelanthropus tchadensis,* about 7 million years ago, in Africa. It is followed by the *Ardipithecus Ramidus,* (possibly the earliest showing vocal ability), by the *Australopoithecus Afarensis* (Lucy) and by other *homo* species. There are indicators that

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Homo erectus, *Homo heidelbergensis* and *Homo sapiens* have migrated out of Africa at least two, three and possibly four times, reaching the entire Eurasia.

As modern humans spread out from Africa, they encountered other hominins such as *Homo neanderthalensis* and *Homo denisovan*, who may have evolved from populations of *Homo erectus* that had left Africa around 2 million years ago. The nature of the interaction among early humans, either one species replacing others, or similar species interbreeding, is an open question. *Homo sapiens* were contemporary of *Homo neanderthalensis* and *Homo denisovan,* who lived in Europe and Asia from 400,000 and were extinct about 40,000 years ago. *Homo sapiens* survived and reached all of Eurasia and Oceania by 40,000 years ago and the Americas by at least 14,500 years ago. All these considerations and datelines are based on fossils and genetic material. Cultural traces contribute to this research.

In order to survive as individuals and as species, every species developed tools and communication as mediators between individual and nature and individual and others. The species homo made and use more complex tools.

The oldest tools made by humans are flakes from Kenya, about 3.3 million years ago and from Ethiopia and Tanzania, about 2.3 millions years ago, giving origin to the Oldowan technology, chipping off flakes with other stones. This technology spread through Eurasia. After about 50,000 years ago, we have evidence of more refined and specialized flint tools, such as knives, blades, skimmers, which were made by the *neanderthals*, the *denisovans* and the *homo sapiens*. They also started to make tools out of bones. At this time, they started to hunt with more sophisticated techniques and weapons, such as fish hooks and arrows, to bury their dead, to use animal hides to make clothing and to find appropriate shelter. Probably in this period, maybe as a consequence of sharing shelter, communication developed into language, they engaged in cave painting and began to question facts and phenomena. This was the beginning to the creation of myths and the development of religions. Family ties were recognized, which led to demarcation of space and family shelters, i.e., homes. These homes, neighborhoods, shared satisfaction of their basic needs, their technologies, mutual protection, myths, language and common ancestry, are the early communities. It is the beginning of what we call culture in the broad sense.

Different communities introduced novelty to existing technologies, to myths, to languages, to culture in the broad sense, differentiating populations of humans. Cultures are in permanent evolution. Neither is static. The dynamics of the encounter of groups of people of different cultural and ethnic heritages is common. Individuals and groups move, either fortuitously or purposely, with many different objectives, such as trade, looting, exogamy and permanent settlement, as conquests. Since pre-historic times these were common events, mainly skirmish between local clans. Conflicts between clans and communities arose.

The first conflict that we have register as an organized war which dates back to about 3200 years ago, when two armies clashed at a river crossing near the Baltic Sea. Thousands of warriors came together in a brutal struggle, perhaps fought on a single day, using weapons crafted from wood, flint, and bronze, a metal that was then the height of military technology. The motivation was to find solid footing on the banks of the Tollense River, a narrow ribbon of water that flows through the marshes of northern Germany toward the Baltic Sea. The armies fought hand-to-hand, maiming and killing with war clubs, spears, swords, and knives. Such conflicts became more intense with the emergence of nation-states, some aiming at establishing permanent settlements, others only for temporary settlements and looting. Celtic, Transoxianic, Mongolian, Viking, Barbarians incursions, as well as the Vietnamese military colonies south of their original territory from the 11th through the 18th centuries, a process known as *nam tiên*, are well studied. They have their specificities. Some arrivals stayed, others retired after looting. The consequence and material and intellectual remains of such events are present in memories, sometimes in myths and in phantasy, even in folklore. In many cases it is possible to identify factors affecting the transformation of the demographic change as a result of these incursions. Some of these incursions were pacific, without violent confrontation. Voyages in the Mediterranean, the Indian Ocean and Coastal North Atlantic, as well as Chinese exploration of the Pacific, were common since Antiquity through the Middle Ages.

The changes in the political and ethnic-racial structure of the populations, both at home and abroad, are noticeable. The same as nowadays, the travelers, after visiting other places for either violent or pacific reasons, such as trade and tourism, return home with different experiences, perspectives and ideas. His vision of the World is broader. From Ancient times, there are records of tourism. The word comes from the Hebraic *torah* which means studying, learning, searching. The reasons were also looking for better climate and food resources, trading, pilgrimage, health, new opportunists. The development of tourism is closely associated with new means of transportation, from bipeds through space travel.

The cultural dynamics resulting from tourism, from commerce and from the relocation of populations, either voluntary or forced, is responsible for intellectual advancement of the human species. Their behaviors and knowledge spread through social contact and network structures responsible for their diffusion.

This is the background for the Program Ethnomathematics, as a research program with focus on a new historiography supported by archeological and anthropological studies.

As a preliminary introduction to this research program, it is very important to clarify that the word ethnomathematics is misleading. I do not use it as "mathematics of an ethnic group". Each culture and ethnic group have their specific ways and modes of quantitative and qualitative practices, such as counting, weighing and measuring, comparing, sorting and classifying, and inferring, accumulated through generations in their natural and cultural environments. The Program Ethnomathematics goes much beyond this. It is conceptually designed as a broad research program of the evolution of ideas, of practices and of knowledge in the human species in different cultural environments.[2]

Essentially, it implies an analysis of how groups of humans generated ways, styles, arts and techniques of doing and knowing, of learning and explaining, of dealing with situations and problems of their natural and socio-cultural environment. I practiced an etymological abuse with the "free" appropriation of Greek roots: *techné* [*tics*] meaning ways, styles, arts and

[2] Ubiratan D'Ambrosio: A Historiographical Proposal for Non-western Mathematics. *Mathematics Across Cultures. The History of Non-Western Mathematics*, ed. Helaine Selin, Kluwer Academic Publishers, Dordrecht, 2000; pp.79-92.

techniques; *mathema* for doing and knowing, for learning and explaining, for dealing with situations and solving problems; and *ethno*, as specific natural and socio-cultural environment. Thus, using these Greek roots, I synthesized the way groups of humans generated ways, styles, arts and techniques of doing and knowing, of learning and explaining, of dealing with situations and of solving problems of their natural and socio-cultural environment as the locution *tics* + *mathema* + *ethno*. So, this conceptual etymological construction gave origin to the word *Ethnomathematics* in a broad sense.

Although the words ethnobotany, ethnomusicology, ethnolinguistic, ethnomethodology and other *ethno+disciplines* are used by anthropologists, by ethnographers and by sociologists for research of specific disciplines in different ethnic and social contexts, they base their research on the views of an observer of other cultures, trying to find commonalities between the culture of the researcher and the culture of the researched. Obviously, Mathematics in the view of the academic researcher, which was originated from the Greek Antiquity, has no meaning at all for natives of other cultures. It is a European construct springing out of specific styles and ways of counting, weighing and measuring, comparing, sorting and classifying and inferring, organized by Euclid and several others academicians and scholars. In Modern Civilization it was assimilated and incorporated, in every country, to the main stream of education and to research in all areas of knowledge.

There are evidences, mainly thanks to the research of archeologists and anthropologists, that, since pre-historic times, different cultures have developed specific myths, systems of explanations and ways and strategies of observing, comparing, sorting and classifying and counting, weighing and measuring, and also inferring, historically organized by their own sages. I call the ensemble of all the theories and practices the *mathema* of that culture. The research program is focused in three basic questions: how *ad hoc* solutions are generated, how *ad hoc* solutions develop into methods and how methods give rise to theories? In other words, to understand the evolution of the *tics* of *mathema* in distinct *ethnos*. This gave rise to the conceptual locution *Ethno+mathema+tics*, which means recognizing specific cognitive strategies of a culture to deal with reality. It is important to clarify that the term *ethno* is used in a broad sense, meaning groups identified by their myths, shared values,

knowledge systems (theories and practices), particularly language and daily practices, food and also professional groups and guilders, essentially groups with affinities.

Affinity groups are identified in urban and rural communities and in immigrant and native groups in which extant *mathema* survived colonial rule. As an example, numerical tools for meaning quantities, as well as figures, artistic representations and abstractions emerged in human communities over cultural evolutionary time to serve specific purposes. It does not make sense to address certain ethnic groups asking questions such as "what is the meaning of a triangle?" or "how would you add 2 plus 3?" or "what is the color of this flower?" The categories triangle, 2 plus 3, color may be absolutely senseless in some cultures. Illustrative of this remark is the research on the *pirahã* culture in the Amazon Basin conducted by Daniell L. Everett.

Research in the Program Ethnomathematics is related to the intriguing question of mutual influences of culture and cognition. My appropriation of the concept of *mathema* as a philosophical category is fundamental. We might further explore my claim discussing the dispute of monism versus pluralism in logics. I will not discuss this in this preamble.

As Ethnomathematics producers, we face some unexpected contradictions such as the impact of the digital era in traditional practices. This creates apparent boundaries among different degrees of modernization affecting traditional societies, labor, artisanship and art, as well as spiritual values, religions and politics. This special issue of RELAET reflects on the contradictions in the construction of knowledge.

Modern Civilization is imposed to the entire planet through economics, politics, technology and knowledge systems. In other words, through shared knowledge (science and technology) and compatible behavior (international laws and codes of public conduct), supported by a system of values. For example, calendars and time regulated by the Greenwich standard are universally accepted. Countries honor international IDs, such as passports, and control their space through visas. Keys and lockers keep daily privacy and property. A sort of equivalence of different legislation is guaranteed by treaties.

Supranational institutions and organizations are increasing. The supporting values of modern civilization are, essentially:

- rigor in the discourse;
- precision in time and space;
- increasingly strict *etiquette,* codes, language and social stratification.

This is seen in the religions, in politics, in the arts and, specially, in the sciences in general. They are accepted and regarded as absolute values by groups of individuals, by communities, by nations, by religious sects, by learned circles and academies.

The ideal of a planetary civilization must reject ethnocentrism, in the sense of "me and the others" and the belief in the inherent superiority of one's own group or culture, although internal contradictions persist. They view and try to understand and explain alien groups or cultures from the perspective of one's own. In essence, this bounds behavior and inquire to "my and my group" detain truth. The key issue is the concept of truth.

I believe we reach truth with a combination of sensorial, intuitive and dianoetic capacities. These concepts are used in many ways and shift their relations depending on the caprices of who uses them. The combination of the three does not exclude actions which contemplates reason together with beliefs and emotions. Previous experiences, since birth and fetal life, support these actions. Analyzing how the capabilities are mutually reinforcing and even fused for each individual and cultural group is basic for conceiving transdisciplinarity and transculturality. They are essential in multicultural education.

The eminent philosopher Sri Aurobindo (1872-1950) has a deep reflection on truth:

> For Western philosophy, a fixed intellectual belief is the most important part of a cult, it is the essence of its meaning and what distinguishes it from others. Thus, creeds are formulated and make true or false a religion, a philosophy, a history, a science, according to the agreement with the creed of their followers.[3]

[3] This quote is from the *Complete Works of Sri Aurobindo* (37 volumes). I copied it, but failed to annotate the reference.

This thought by the Indian philosopher may be the starting point to discussions about fundamentalism and other “isms” that permeate the world scenario, to the benefit of some and to the detriment of others, fundamentalism will prevail.

The many authors of this collected essays, all distinguished researchers, will present several aspects of how Ethnomathematics in an integrating part of the material and intellectual life of humanity.