

Nature 407: 128, 2000**Our last millennium in perspective:**

It is easy to lose perspective when analysing time windows which are much greater than our life span. Our brains are not adapted to think in those time frames. Thus, in analysing the past millennium, it would seem helpful to get a bird-view of it, by expanding our analysis as deep as possible in time. I will try to do so by using different time windows to analyse our last millennium (see figure 1).

The largest time window imaginable, comprising tens of millions of millennia, does not allow our last millennium to show up. This window serves to place the formation of the planet Earth and the emergence of life in perspective: If the event creating our present universe, the big bang, occurred some 15.5 million millennia ago, then the development of life on the planet earth represents about 25 % of the history of our universe.

A one percent of this large time window produces a second time window spanning 200.000 millennia, showing the evolution of extant animals and plants, the emergence of primates and those of the hominids. Analysis at these time scales shows a discontinuous evolutionary process: Geological catastrophes, such as the one creating the Jurassic / Cretaceous boundary mark the evolution of life.

A one percent of this last time window, produces a third time window, spanning 2.000 millennia, in which the human inventive starts to be apparent. Stone tools were used by our predecessors, and fire was domesticated, before the formation of the oldest known fossils of *Homo erectus* and of the emergence of *Homo sapiens*, showing that creativity, technology development and inventive, are features which were possessed by at least some of the australopithecine and other hominid long before *Homo sapiens* appeared. Human creativity developed slowly over the last 5.000 millennia. Interestingly, at these time scales, a large number of extinction's of other creatures (*Homo erectus* for example) are evidenced. The extinction of other hominids and mammals were probably caused by the increased technical powers of *Homo sapiens*, such as the use of traps, spears and projectiles.

A fourth time window, spanning one percent of the former, focuses on our past using a 20 millennia lens. This lens shows that human creativity (and the extinction of fellow creatures on our planet), continues to accelerate exponentially. Cloths to protect the human body from the environment were woven before the last ice age. The end of this ice age promoted the domestication of plants and animals, leading to developments of technologies, we call today agriculture, at over 10 millennia from present. The development of ceramics, the wheel, iron, bronze, steel and scriptures, followed at ever shorter intervals. The use of scriptures allows us to have a more direct view on the thought processes of our ancestors. Homer, Lao-Tse, Buddha, Aristotle, Christ, Ptolemy, Muhammad and many other thinkers are accessible to us from their scripts or from transcripts of their talks. These scripts show that emotionally, these ancient humans do not differ significantly from our contemporaries. A five percent of this 20 millennia time window, finally focuses on our last millennium.

The main feature of the last millennium seems to have been the emergence of the scientific method. Science, defined as the method which subordinates theory to experimental results, has been pioneered by Galileo, and has been widely accepted as a superior form of thought only during the last two centuries. An interesting aspect of this last millennium is a shift of creative power from China to the West. It was the nationalistic and xenophobic policies of the Ming dynasty, started by Chu-Yuan-Chang in 1368, that hindered commerce and the exponential expansion of creativity in China. I see also a short pause (a few centuries) in creativity growth in the Christian world spanning from the first millennium AC (approximately after Ptolemy and the Roman Emperor Julianus) to the Renaissance, overlapping with burst of creativity in the Islamic world of the time.

The last millennium shows no signs that the exponential expansion of human mental capabilities has stabilised. The analysis of the evolution of other animal species, however, suggest that all exponential evolutionary developments of behavioural or morphological traits, eventually stop. Even human creativity may start to do so in the third millennium AC.

