

# The Origin and Evolution of Man

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In order to tell the story of Man and understand our emergence better, we can readily follow on from Heinz Tobien, though we do not need to go back so far in time – just a few million years.

Clearly, our fundamental origin is animal. Thus it is easy to understand that in the great genealogy (known as phylogeny), there was one vital (geological) moment when our line was forever detached from the animal “kingdom.” The evidence of palaeontology, like that of molecular biology, today locates this point – which is, by definition, the very point of origin of our family, the hominids – in Eastern Africa around 8 million years ago. In order to state this, palaeontology rests on two sets of results. All the most ancient hominids, without exception, are East African, and the oldest of all goes back more than 7 million years. Through the study of various characteristics of the cells of contemporary primates, having arranged them in an order of increasing complexity and having hypothesized that this contemporary complexity may be a reflection of that which developed through time, molecular biology has, on the basis of palaeontological dating, calibrated this transformation and its different stages and constructed what is called a molecular clock. In this way, it has arrived at two conclusions. The primates closest to Man are by far the great African apes (chimpanzees, gorillas), and the “distance” that separates us – in other words the degree of difference that exists between them and us – situates the divergence of our two branches at just over 7 million years.

It is essential to establish this first date. For about 8 million years, we have thus lived our own history without sharing it with anyone else; in other words, the history of our family and its independence covers the end of the Miocene, the Pliocene, the Pleistocene, and the Holocene.

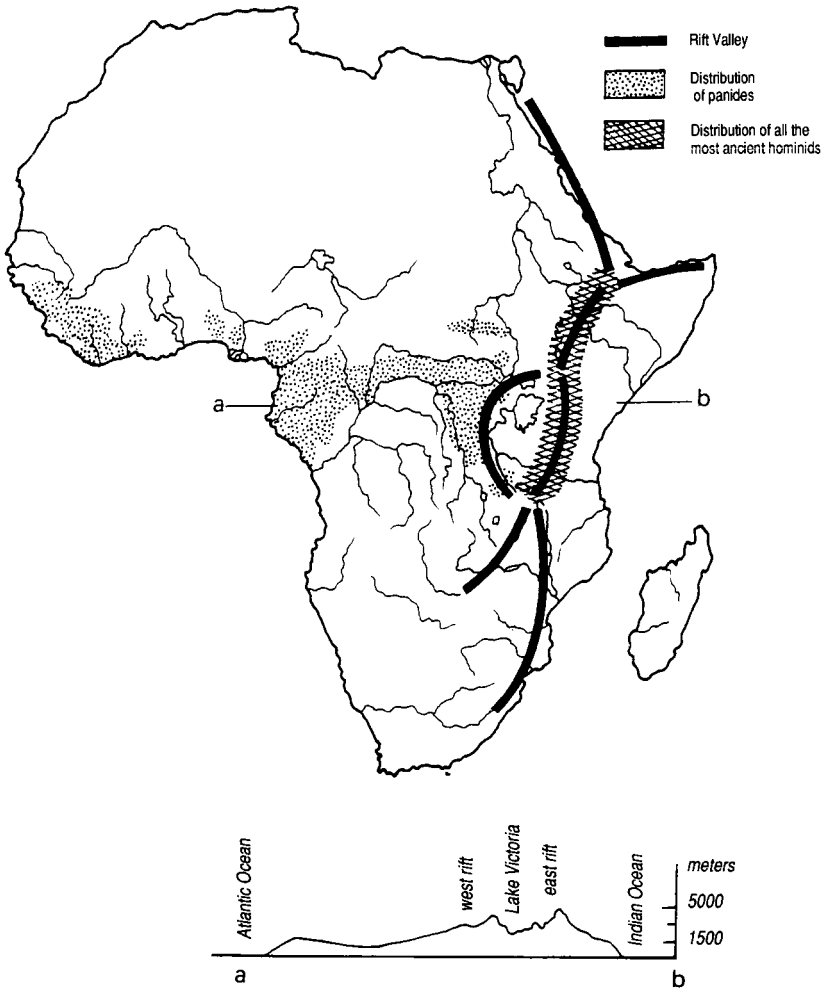
**The Origin of Our Family – *East Side Story***

Why then did this new family appear? Why in this particular place? Why at this particular moment? It is worth remembering here that the history of life is based on events. Although there are exceptions, in principle, a living form in equilibrium with a stable environment has no reason to change. If, on the other hand, this environment is transformed, the harmony is broken. In order to find a new equilibrium in a new environment, the living form in question has to transform itself in its turn – through random mutations and the selection of those that represent an advantage or by some other process of “shaping” to the new environment. The ill-chosen name of evolution is given to this transformation, as though it were inevitable. In any case, it is understood that if an event brings a new form into existence, the emergence of the new form stimulates the search for the event that created it. This is what I did for the hominids and I immediately came up against an apparent contradiction. From the point of view of biology and cytogenetics as well as anatomy, physiology, embryology, and ethology, we are very close to chimpanzees and gorillas, yet after a quarter of a century of intensive research in East Africa, we have not found the slightest fragment of bone or tooth of gorilla or pre-gorilla, of chimpanzee or pre-chimpanzee, among the 200,000 remains of vertebrate fossils from the last 8 million years, whereas we have found, among these same remains, nearly 2,000 pre-human and human hominid bones. In 1983, I proposed a “model” that took account of all these findings and that could be summarized thus: chimpanzees, gorillas, and Men were certainly cousins, and, if they have never been found together, it is simply that they never were together. Their common ancestor had very probably lived in a landscape of forest and wooded savannah that, around 10 million years ago, stretched over the whole of Equatorial Africa from the Atlantic to the Indian Ocean. Then, around 8 million years ago, tectonic events took place: the recommencement of the collapse of the Rift (the great fault that runs like a scar through East Africa) opened the Red Sea and the Near East; the simultaneous upward thrust of its western lip (Mountains of the Moon and the Ruwenzori) and of the East African plateau; the contemporary upthrust of the Tibetan plateau; and the consequent establishment (in the northwestern quarter of the Indian Ocean that was, from then on, blocked by a wall to the north and a wall to the west) of

the seasonal regime of the Monsoon. Thus to the west of the Rift, from the Atlantic Ocean to the fault line, precipitation took place with the regularity and frequency that it had had before 8 million years ago, while to the east, on the plateau, itself 2 to 3,000 meters high, in the shadow of the mountain barrier that runs along the Rift, and that, since then, has not stopped rising (to more than 4,000 meters today), the rainfall became intermittent, and the forest cover deteriorated. The descendants of the ancestors that we share with chimpanzees and gorillas, according to whether they found themselves to the west or the east of the Rift valley, had to deal with completely different environments. Consequently, their destinies were quite different. On one side, there would have been a priority for adapting to an arboreal environment, moving around by swinging on trees and standing up only occasionally. On the other side, there would have been adaptation to an open environment, encouraging bipedal movement and only vestigial climbing. The western descendants to these common ancestors became what we today call gorillas and chimpanzees. The eastern descendants became what we call Man. I have called this model *East Side Story* ! (Fig. 1 and 2.)

Born of a caprice of the Earth and its ecological consequences, our family thus found itself in a narrow tropical cradle, caught between the Red Sea, the Indian Ocean and the chain of lakes, Albert, Edward, and Tanganyika. There was nothing left for it to do but to prosper in this beautiful garden. And that is exactly what it did. Two great stages followed one another in these 8 million years. The first, which can be called the pre-human, covered the first 7 million years of this period. The second, the human, occupied the last 3 million, with the last of the pre-humans coexisting with the first of the humans.

The pre-humans, who carried the strange name of *Australopithecus* (southern apes), thus appeared in East Africa. There they developed, diversified, and, starting 3 million years ago, expanded their territory to the whole southeastern quadrant of Africa. The world of *Australopithecus* was thus more complicated than is generally imagined. It was composed of a certain number of species or different genera that succeeded one another or developed in parallel in different geographical regions (the east and south of Africa). Over a time period of this length, a transformation of the brain, of dentition, and even of locomotion can be easily observed.



**Figure 1:** Distribution of pongidae and of hominids, the former to the west of the Rift Valley, the latter to the east.



**Figure 2:** A consequence of the East African tectonic crisis, the climatic crisis of 8 million years ago brought about the development of the pongidae (chimpanzees and gorillas) to the west of the Rift Valley and the emergence of hominids (australopithecines, then Men) to the east. Above left: skull and pelvis of a chimpanzee (in extension); above right: skull and pelvis of an australopithecine (in pressure). The great fault runs between the two (courtesy of the Institute of Human Origins, Berkeley).

### **Lucy, the Ethiopian**

Since we do not have the space to look at them all, we will choose one of the six or seven species to describe the pre-human. We will not choose one from among the earliest, that are badly represented, nor among the latest, that are very specialized, but from the heart of the development of this group, one between 3 and 5 million years old. We will choose the species *afarensis*, that I helped to name in 1978, and its most celebrated example, the small, fragmentary skeleton discovered in 1974 in the Ethiopian Afar and nick-

named Lucy (with a *y* because this christian name was borrowed from the Beatles' song, "Lucy in the Sky with Diamonds").

Lucy was between 1 meter and 1.20 meters tall, with an estimated weight of 20 to 25 kilogrammes and with relatively short lower limbs and fairly long upper limbs. Her head was small and contained a brain of 340 cc, the shape of which revealed interesting tendencies, like the development of the height of the brain above the cerebellum and of the temporal and frontal parietal lobes and their convolutions at the expense of the occipital lobe. Her face was heavy and prognathous, her dentition strong, but carrying numerous human traits: vertically rooted incisors, small canines, the first lower premolars molarized, strong premolars and molars, thick enamel, scaling and streaking on the incisors, strong relief of the incisors and small, polished and shining areas of wear on the zygomatic teeth, which lead one to think of a diet based on seeds and roots together with young shoots and tender leaves. Her vertebral column had the same curve as ours, but was more elongated. Her pelvic area was not very deep and wide like that of a biped, but it was so wide that bipedal motion would have required a rolling of the hips and shoulders around the vertebral column of at least 40 degrees each way instead of 4 degrees for Man. Her lower limb consisted of a short femur with a long, spindly neck, with an oblique shaft, an intercondylar indentation more wide than tall, an articulation of the knee with a large degree of rotation, a short tibia, an articulation of the ankle as unstable as that of the knee, and a wide, short, flat foot with the weight on the outer edge and with an abducted big toe that could be opposed to the other toes with curved phalanxes. Her upper limb shows articulations of the shoulder, elbow, and wrist with perfect interlocking and a remarkable development of the extensor and flexor muscles. Thus one finds oneself in the presence of a strange, small personage who combines an inefficient but definite bipedalism with a still very active arborealism, whence this original association of a spine and pelvis of a standing creature with the supple lower limbs and stable upper limbs of a climber.

The discovery of what are unquestionably tools in strata more than 3 million years old (small fragments frequently touched up) gave me the idea some time ago that this pre-human was the first tool-maker. If this attribution were confirmed, it would mean that tools had preceded Man and were the creation of a hominid whose hands were partially freed from the locomotive function.

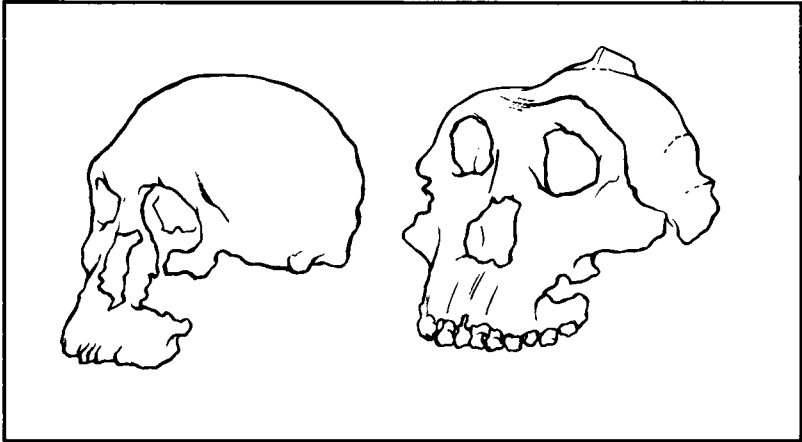
## **The Origin of Man: The Omo Event**

Around 3 million years ago, the first humans appeared, once again in East Africa. There was a single genus, a little larger, a little heavier, a better biped, a worse climber, equipped with a larger brain and dentition for eating anything. This was Man.

But why did this new genus appear? Why in that place at that moment? Palaeoclimatologists have recorded a general cooling of the Earth a little over 3 million years ago that was to last for around 900,000 years. In the Ethiopian valley of the river Omo, where I carried out excavations for 10 years, it was easy to find evidence of this new climatic crisis, manifesting itself here by a new drying up. Of all the great East African sites – Olduvai and Laetoli in Tanzania, Turkana in Kenya, Afar and Omo in Ethiopia – the Omo deposits are the only ones to illustrate this very important period. Moreover, it is a very generous illustration covered by sediments more than 1,000 meters thick, full of fossils of all kinds (I brought 50 tons to Paris to analyze!). These deposits show us in these 900,000 years of crisis the complete transformation of the landscape and its inhabitants and even of the soils on which they lived. The area went from being a wooded savannah with islands of forests made up of great tropical trees (*antrocaryon*) 3 million years ago to an open savannah where only a few wooded areas were left (*figus*, *myrianthoxylon*) along the rivers, around 2 million years ago. The ratio of the number of tree pollens to “grass” pollens can be taken, among other things, as a significant indicator. From 0.4 of 3 million years ago, it dropped to 0.01 of 2 million years ago! This new crisis saw the elephant increase the length of its molars by a factor of 3 (teeth are used more to eat grass than to chew leaves). Pigs multiplied by 3 the length of their rear molars and the number of roots of these teeth. Antelopes of the bush (tragulidae, buffaloes) gave way to antelopes of the steppe (alcelaphinae, gazelles). Tree living rodents were replaced by burrowing rodents, and this crisis saw the birth of the horse, a better runner than its predecessor hipparion, the wart hog, a better consumer of grasses than its predecessor metridiochere, as well as the robust australopithecine, known familiarly as “nut cracker” because its premolars were so large, and . . . Man, known familiarly as “opportunist” because his diet was enlarged.

The australopithecines being the hominids that are anatomically closest to Man, chronologically older than Men, and geographically

in the same area as the first among them, have every chance of counting among them the ancestors of Man. I have called this event the (H)Omo event, playing, of course, on the resemblance between the name of Man (Homo) and that of the river beside which, for the first time, the probable reasons for the selection of our genus were shown (Fig. 3).



**Figure 3:** The hominids “found” two answers to the climatic crisis of 3 million years ago: the robust australopithecine (left: skull found in Olduvai, Tanzania) and Man (right: skull coming from the eastern shores of Lake Turkana, Kenya).

Thus our family had two solutions to the climatic crisis of 3 million years ago – a pre-human form with a powerful body (1.50 meters, 50 kilograms) and a very specialized dentition for a tough vegetarian diet, but with a small brain, (500 cc) and the first human form, *Homo habilis*, with a very significantly developed brain (800 cc) and omnivorous dentition for a vegetarian and meat diet, but with a still spindly body (1.30 meters, 30 kilograms).

Born of a cooling of the globe and its climatic consequences, here is Man in his tropical cradle, this superb expanse all green or all yellow, dotted with clumps of thorny umbrella trees on the higher ground of the plateau, or with palm trees and fig trees on the lower ground in the wadies. This first Man went on to diversify his tools of stone and bone, to settle his family in encampments where he brought back for sharing the food that he had hunted or gathered, to construct his first shelters and his first huts, to experi-

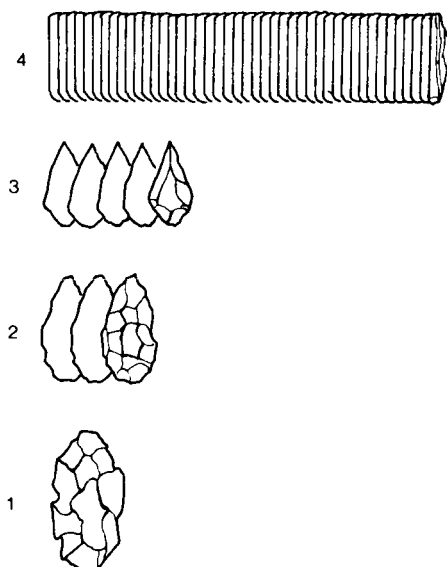


ence his first emotions, and to express them in a first articulate language. Consciousness, born from a better central nervous system, and mobility, born of a better bipedalism and a more varied diet, profoundly transformed the behavior of this new hominid. Thought developed, and with it curiosity. One thing led to another, and, for the very first time, Man embarked on the expansion of his territory, a task that was to lead him all around the Earth and soon, without doubt, all around the Universe.

### **The Evolution of Man: 100,000 Years of Balance**

Man, probably born in East Africa through a selection necessitated by a significant climatic change, forged ahead and pursued in a continuous fashion a biological microevolution that was to lead him, through 3 ill-defined stages (incorrectly called "species") – *Homo habilis*, *Homo erectus*, *Homo sapiens* – to our contemporary form *Homo sapiens sapiens*. His height and weight continued to grow as did his brain (1,200–1,800 cc today). His skull continued to develop, his teeth became smaller, his skeleton and muscles became more graceful, his bipedalism acquired an extraordinary dynamic equilibrium, but, above all, Man, in the course of his 3 million year history, developed, in an extravagant fashion, the new milieu that his predecessor had invented, the cultural milieu. The material tools that accompany him and that are the evidence of spiritual, moral, and intellectual tools that elude us show a technological development astonishing in its efficiency and diversity.

André Leroi-Gourhan had the idea of quantifying this progress by weighing stones cut in different epochs and comparing the total length of their active parts (in other words, of their cutting edges). In this way, he arrived at a total length of cutting edge of 10 cm for 1 kg of stones cut 2 million years ago, 40 cm for 1 kg of stones cut 500,000 years ago, 200 cm (2 m) for 1 kg of stones cut 50,000 years ago, and 2,000 cm (20 m) for 1 kg of stones cut 20,000 years ago (Fig. 4). Although impressive, this progress cannot be analyzed without taking into account the length of each of the stages and without a precise examination of who made the achievements. The measurement of time parallel to that of the cutting edges shows an exponential acceleration in the effectiveness of technology. The cut stones became smaller, and were thus shaped with greater skill, and it required more and more of them to make up 1 kg. But for much more than a million years, the yield did not exceed 10 cm of



**Figure 4:** These drawings show 4 kgs of cut stones. Drawing 1: one single stone of 2 million years ago weighs 1 kg and has 10 cm of cutting edge. Drawing 2: 3 stones of 500,000 years ago weigh 1 kg and have 40 cm of cutting edge. Drawing 3: 5 stones of 50,000 years ago weigh 1 kg and have 200 cm of cutting edge. Drawing 4: 40 stones of 20,000 years ago were needed to make 1 kg and 2,000 cm of cutting edge.

cutting edge per kilogram and during a little more than another million years, it quadrupled this figure but scarcely exceeded this result. Thus it was in the very last few hundred thousand years that these figures took off to achieve a succession of records, 5 times more, then 50 times more than the last record, 20 times and 200 times more than the first! But the search for the artisans who created these instruments was to prove to be even more revealing. *Homo habilis* (the first Man) was revealed as being the author of efforts that reached a ceiling of 10 cm of cutting edge per kilogram. But the first *Homo erectus* (the second Man), contrary to what had been predicted, did not prove to be any better. The slightly "younger" *Homo erectus* finished by moving the threshold from 10 to 40 cm of cutting edge per kilogram. Then, along came the first *Homo sapiens* (the third Man), who, once again, underwent a biological evolution that was more rapid than its technical progress, since it did not go beyond the limits of 40 cm of cutting edge per kilogram established by its immediate predecessors, the last *Homo erectus*. On the other hand, it was the "younger" *Homo sapiens* who

realized the immense advance of 200 cm of cutting edge per kilogram, and again it was *Homo sapiens* who multiplied this last record by 10 before giving way to modern Man par excellence, *Homo sapiens sapiens*, who drew, painted, sculpted, and around 10,000 years ago reached 7,000 cm (70 m) of cutting edge per kilogram of cut stone; invented agriculture, livestock breeding and writing; discovered gold, copper, tin, iron and their uses, as well as printing, electricity, nuclear energy, computing, and many other things. The lesson of these figures is self-evident. During 2.5 million years, maybe more, biological evolution remained "dominant," more rapid than technological, cultural, and creative evolution. Then, for several hundred thousand years, maybe less, the order was reversed. In its turn, cultural evolution became "dominant," more rapid than biological evolution to the point where the latter slowed down and even came to halt. The cultural milieu, entirely created by the hominids and insignificant at the beginning, finished by developing in such an extraordinary manner that, for the last few hundred thousand years, it has been surrounding us and it, rather than our body, has been responding to the requirements of the environment (Fig. 5). The hominids, 8 million years ago, and Man himself, 3 million years ago, underwent transformations of the natural environment that were the reason for their selection, in other words, for their emergence and their own course of development. In the shadow of the natural environment, the other strange environment – the cultural environment – was born. An extension of our body, it too developed little by little. It did so very quietly at first, then in a more excessive manner to the point where it began to act on biological development. For a long time, this account of the transition from the animal, where almost everything is innate, to Man, where everything is acquired or, in any case, much less instinctive, has hindered the natural aspect of thought. It is clear that Man – unquestionably a vertebrate, a mammal, and a primate – was nonetheless a curious representative of this branch, of this class, of this order, who, for the first time in the history of life, had, among others, the idea of finding out where he came from. Palaeoanthropology and prehistory, through demonstrating the different pace of biological and cultural evolution, thus began to explain to us how and when this "slippage," this inversion, this "change of balance" occurred. Cultural acquisition grew like a snowball and Man had to learn more and more. The consequences of this knowledge have been simple and marvelous. The

<i>Homo sapiens</i>	2 000 cm
<i>Homo sapiens</i>	200 cm
<i>Homo sapiens</i>	40 cm
<i>Homo erectus</i>	40 cm
<i>Homo erectus</i>	10 cm
<i>Homo habilis</i>	10 cm

Figure 5: In a long first phase, biological evolution was faster than technological evolution; in a short second phase, it was the opposite.

role of reflexes diminished and that of reflection increased. Little by little, Man conquered freedom, acquired responsibility and gained dignity.

### The Origin of Modern Man

The notion of Man and, even more emphatically, that of modern Man, carries within it such a philosophical burden that neither one nor the other is really clear.

#### *Man, Homo*

Man is consciousness, say some; he is tools, say others; Man is society, claim others for whom there is no such thing as animal society; Man is language, some add. Unfortunately, even though to a certain extent all are right, none of these criteria can be retained in a useful definition of Man, because consciousness and language cannot be fossilized, the oldest known tool is not necessarily the first

(and there is every likelihood that it is not), and the interpretation of social organization according to the distribution of remains in the soil of the habitat leaves much to be desired. Moreover, it does seem that, in fact, tools came before Man, that language followed this, and that consciousness and society evolved in a continuous manner without any of the convenient theoretical thresholds that are talked about and that one would like so much to come across.

*Consciousness.* It is said that the instinctive being happens "to know" while the thinking (conscious) being is considered "to know that it knows," Obviously, consciousness is not so easy to define, and one can easily imagine that it would be even more difficult to recognize in fossil documents. In order to reveal its presence, one willingly relies on fabricated tools, because they create the assumption that they result from some sort of plan. This would make consciousness more than 3 million years old. One also relies on the transformation of the cerebral structure and on the acceleration of the growth of its volume. The former is 7 or 8 million years old, the latter, 3. Moreover, it is not impossible that, before it definitively emerged, consciousness had appeared and existed for millions of years in a discontinuous form. In that case, what degree of consciousness are we talking about? Self-consciousness is shared with certain animals; so, perhaps, is awareness of death, but not, it seems, moral consciousness.

*Tools.* For a long time, Man was defined through his use of tools, but then it was noticed that Man shared this characteristic with many animals. Then, in order to define Man, one talked about tools that had been improved, but animals were observed who, for example, stripped the leaves from branches that they used, thus improving them in order to make them more effective. Today, one talks of second degree tools – tools made with tools – in an attempt to find a threshold between our culture and animal culture. The oldest tools of this kind were associated with pre-humans (australopithecines) between 3 and 3.5 million years ago (Omo valley, Ethiopia). But it was with Man that second degree tools became for the first time permanent. Therefore, although he did not invent tools, nor was he the first to conceive of second degree tools, Man was yet the first living being never to separate himself from this fabricated tools. There is no Man without tools, and, without doubt, it is this constraint that characterizes him. Henceforth, one could talk of the indissociable pairing of Man and tools.

*Society.* All primates are sociable beings, and hominids had no

reason to be exceptions to this rule, but one cannot simply translate information about tools or about the floors of habitations into degrees of complexity of the social organization of the societies that manufactured or occupied them. The oldest known floors of habitations are nearly 3 million years old (Omo valley, Ethiopia). They must have belonged to australopithecines. Only small, shaped stones, with cutting edges that were used to peel tubers, have been found scattered in no apparent order. Floors that were rather less ancient, nearly 2 million years old (Olduvai, Tanzania; Melka Kunture, Ethiopia), where *Homo habilis* probably lived, show, by contrast, in the midst of improved stones and abundant chippings a great variety of bones of animals that had been consumed. As they cannot all be bones of game killed on the spot, the behavior of the inhabitants becomes all the more clear. These special places must have been some sort of base camps (the structures of huts can still be found there) where members of a group brought back food that had been gathered or hunted in order to share it. This conviviality must have come into existence before these first signs, but it happens that Man, thanks to his partly carnivorous diet, was the first hominid to present these marker-bones to prehistorians. The distribution of food remains, carving, and bedding on the later floors shows a clear and significant evolution of society. At the beginning, one cut and ate in the same place where one carved and slept. Later, the area was improved and the functions gradually separated from one another on one, fairly restricted area; and then they eventually divided into as many specialized areas as there were functions, sometimes separated by hundreds of meters. But no matter how precise these observations, no matter how ingenious the deductions, it is very difficult to transform them into a description of the social structures or functioning of the group.

*Language.* From the beginning, the hominids must have communicated by means of sounds, sign language, or gestures, just as their primate cousins do today. These became so elaborate that their relationships grew richer and their consciousness emerged. But it is obviously the emergence of the ability to use articulate language that interests us here. Broca's area and Wernicke's area are, in the contemporary brain the areas "dedicated" to language. The endocranial casts of australopithecines do not show any significant development of these areas, while those of the 2 million year old *Homo habilis* (we do not know about the skulls of the first *Homo habilis* of 3 million years ago) show, on the contrary, interesting individualizations. In contemporary anatomy, the position of the

larynx and the profile of the base of the skull are linked to each other and also to articulate language. The base of the skull, since it fossilizes, enables one to reconstitute the position of the larynx and, as a result, to estimate whether or not articulate language existed. The bases of the skulls of australopithecines show a high larynx and probably the inability to articulate, whereas those of *Homo erectus* of 1.5 million years ago (no bony bases of the skulls of *Homo habilis* are known) show a larynx that, while it was not as low as our own, was substantially lower compared with the position that it occupied in *Australopithecus*. Thus, it seems that *Homo erectus* possessed the mechanical equipment necessary for speech – initially, a simple adaptation of the upper respiratory tract in order to function better in a climate that had become particularly dry.

In this way, the period around 3 million years ago seems to be a special one, despite imprecisions, for locating the emergence of a degree of consciousness that definitively distinguished Man from his ancestors, the tools that were to be improved with the help of other tools, the emergence of a level of organization of society that allowed solidarity to develop, and the anatomical aptitude that would allow articulate language to emerge. Even though tools and the degree of social development are consequences of the emergence of consciousness, and language is a product of the development of society, it is not certain that all these characteristics appeared at the same time and that the genus *Homo*, Man in his biological definition (according to bone structure and dentition), can be perfectly superimposed on these hominids of 3 million years ago, to whom one owes the establishment of what would become the principal characteristics of the extraordinary community of Man, humanity.

Around 3 million years ago in East Africa (Hadar, Omo in Ethiopia, Kanapoi in Kenya), there appeared (as we have just seen), coexisting with pre-humans, some hominids who, for the first time, differed from contemporary humans through no more than morphological differences no greater than those that separate two species. That is the reason why they are called Man (of the genus *Homo* that is the one to which we also belong) and are given a specific name (*habilis*) that is not the same as ours (*sapiens*). New characteristics of the teeth (adapted to an omnivorous diet) and of the brain (the volume of which increased considerably) are the main features that differentiate them from the australopithecine pre-human. Thus, the only definition of Man that can usefully be applied is one that takes these criteria into account. No others exist.

But it should not be forgotten that adaptation to an omnivorous diet means the development of scavenging and the invention of hunting, that is to say, an important change in behavior and, consequently, in social organization. Nor should it be forgotten that, for its part, the increase in volume of the brain means the complication and diversification of the capacity to invent and to create, that is to say, an important development of the capacity to think. To the certainly very dry biological definition of Man proposed here, a certain degree of complication of society, a certain progress in technology and a certain level of consciousness have to be added as logical consequences, but only as consequences. Thus, Man is the hominid with a large head and a jaw capable of eating anything, who became mobile and curious because he became omnivorous and astute, and went on to expand his territory first to the ancient world, then to the new world, and recently to the rest of the Universe.

### Modern Man – *Homo sapiens sapiens*

According to some, modern Man is the one who, 400,000 years ago, cooked his food. According to others, he is the one who, 100,000 years ago, buried his dead. Yet others would say that, in any case, he is the one who, 40,000 years ago, drew, sculpted, and painted. Still others say that he is the one with a brain of more than 1,200 cc. Unfortunately, some fires seem to be more than a million years old, certain hearths almost as old. Unfortunately, a drawing of a garland clearly adorns a 250,000 year old mammoth bone from Pech de l'Aze in the Dordogne. Unfortunately, intentional breakages of skulls from China and Indonesia, which are several hundred thousand years old, very much appear to represent rituals associated with death. Unfortunately, it seems to be the case that it was Neanderthal Man – derided, rejected; considered to be sick, arthritic, hairy, stooped, barbaric, brutal and cannibalistic; described as having an abductor big toe, as being incapable of speaking, as an intermediary between Man and ape but nearer to the ape and, of course, having nothing to do with our ancestry (but who has recently been raised to the rank of *sapiens* and is now called *Homo sapiens neanderthalensis*) – who has been shown to have made the first real burial chambers. Unfortunately, Peking Man, who has for a long time been denied the ability to cut stone and who, in any case, is not called *sapiens*, is a fossil Man who definitely has a brain that often exceeded 1,200 cc, whereas certain contemporary Men



do not have this capacity, and so on. The explanation for this misunderstanding is simple. The evolution of the *Homo* genus was completely gradual. The classification of fossil Man in three successive false species – *Homo habilis*, *Homo erectus*, *Homo sapiens* – thus has something illusory about it. An ordering of this kind, while clearly convenient, in any case only has some morphological reality beyond the limits, naturally false themselves, that are supposed to separate these three stages. Consequently, palaeoanthropology is incapable of deciding whether certain fossil Men showing the characteristics of both *Homo erectus* and *Homo sapiens* are among the last *Homo erectus* or the first *Homo sapiens*. Quite simply, such a distinction is meaningless. As we have seen, the anatomical continuity of Man is coupled with cultural continuity. Sometimes, they go out of phase with one another, first in one direction, then in the other. Thus, how can one establish a definition of modern Man on evolving but continuous natural characteristics and cultural characteristics that are just as evolving and as continuous and that, in addition, behave in a quasi-independent fashion.

### **The Brain**

The volumetric development of the encephalon is, undoubtedly, the most spectacular development. This clearly bears some relationship to the cultural development that goes with it. In the whole history of all the organs of all the vertebrates, it is the human brain that easily beats all records for speed of growth. Little Lucy, of 3 million years ago, did not have as much as 400 cc of endocranial capacity. *Homo habilis* had almost twice that, *Homo erectus* went beyond the 1,000 cc mark, and *Homo sapiens sapiens* can have more than 2,000 cc. The growth in the size of Man certainly counts for something – the volume of the brain cannot be considered as an absolute value – and variability also has to be taken into account, as contemporary Man has a brain ranging from just over 1,000 cc to just over 2,000 cc. It is nonetheless true that the quantitative growth of this organ in Man has been vertiginous and that this progress goes beyond all possible allometric relations.

### **Technology and Energy**

Technological development is fascinating and many aspects of it are surprising. First of all, its slowness. Sometimes one can be surprised by the apparent lack of creativity of Man, repeating the

same, or almost the same, gestures for hundreds of thousands of years. But one has to remember the size of his encephalon and his spinal chord and also the number of members of the species. It is no less interesting to examine that when a step forward is made, why it is made and why at that moment, rather than any other. It seems likely that society has to reach a certain level of development before it can, as it were, take up an invention and exploit it.

For instance, when the discovery of the soft method of striking was made half a million years ago (instead of striking one stone with another, known as hard striking, it was hit with a piece of wood or horn, which considerably improved the precision and neatness of the cut), it was observed that it came at the same time as the mastery of fire. Thus, this was not an isolated example of progress but a series of new techniques and behaviors that appeared at the same time. As we have seen, the trend of technological evolution was, in any case, toward the reduction of the size of tools and an increase in the variety and range of tools available. Tools diversified as activities multiplied. As for the history of the conquest of energy, it took Man 2.5 million years to really control fire, which he seems to have used on occasions a million years earlier, and almost 3 million years to discover artificial radioactivity.

### Religion

Existential anguish and the religious idea must have been born, together with consciousness (considered at the human level), some 3 million years ago. But it was necessary to wait over 2 million years to encounter the first proofs – human skulls that were broken, apparently deliberately and, therefore, ritually. A certain number of skulls of *Homo erectus* from Indonesia and China between 300 and 700,000 years ago seem to fit in with this observation. On the other hand, from 100,000 thousand years ago, the careful digging of holes, sometimes painted with ocre, and the burials of corpses in the company of flowers, food, and various symbolic or utilitarian objects were acts that clearly resulted from a belief in a world of the dead and in some kind of voyage to reach it. From then on, rituals multiplied, which suggests complex mythologies.

### Art and Writing

It was at the same time, 100,000 years ago, that one finds “beautiful” objects – fossil shells or colored minerals – in dwellings, col-

lected out of simple curiosity. It is not uncommon to find adorning a chest or a wrist bones, shells and teeth that had been pierced, strung and grouped together. A few tens of thousands of years later, around 40,000 years ago, Man made another immense step forward by projecting images from his consciousness on to a movable or immovable medium. By means of lines, colors, and shapes that had meanings in themselves and through their relationship to one another, he made it known to the gods and to men that he knew that he knew. The extraordinary transition from a predatory economy that was millions of years old to the first signs of a production economy a few tens of thousands of years later, around 12,000 years ago, gave him access to the accounting of goods and to linear writing that followed from it. Clay tokens of different shapes represented units and their multiples. Enclosed in hollowed out balls of clay, they represented invoices or bills of lading. Next, the clay balls were marked on the surface with the imprint of the tokens that they contained. It then became obvious that it was not worthwhile to have two examples of the message in the form of the contents (the tokens) and the imprinted container (the clay ball). And so, the ball became a tablet.

In fact, it was around 500,000 years ago in East Africa (Kaphurin in Kenya, Ndotu in Tanzania, and Bodo in Ethiopia), that, for the first time it seems, *Homo erectus* became a kind of *Homo sapiens*. His skull, with lateral walls that were already vertical, developed parietal protuberances, and his jaw developed a trigonal chin. These first modern characteristics and all those that followed thus appeared one by one in a disorderly manner, as though by a statistical evolutionary trend, until contemporary Man was shaped. *Homo sapiens* thus appeared as a normal development from *Homo erectus* wherever he was (and he was then all over the ancient world). Nowhere could *Homo sapiens* be distinguished phylogenetically from him. One could say, in a caricatural fashion, that there is no modern Man but one single Man who has been evolving for 3 million years according to the same program. In North Africa, it is the Moroccan remains of Sale Man and those of the Thomas 3 quarry that show the first features of *Homo sapiens* – parietal protuberances, delicacy of the tympanic bone, and weakness of the temporal lines. In the Far East, it was the Chinese skulls of Dali and Ying Kou that developed in the same direction – larger caliber, thinner bone, and greater width near the supraposterior plate of the temporal bone. In Morocco and China, from one side to the other of the

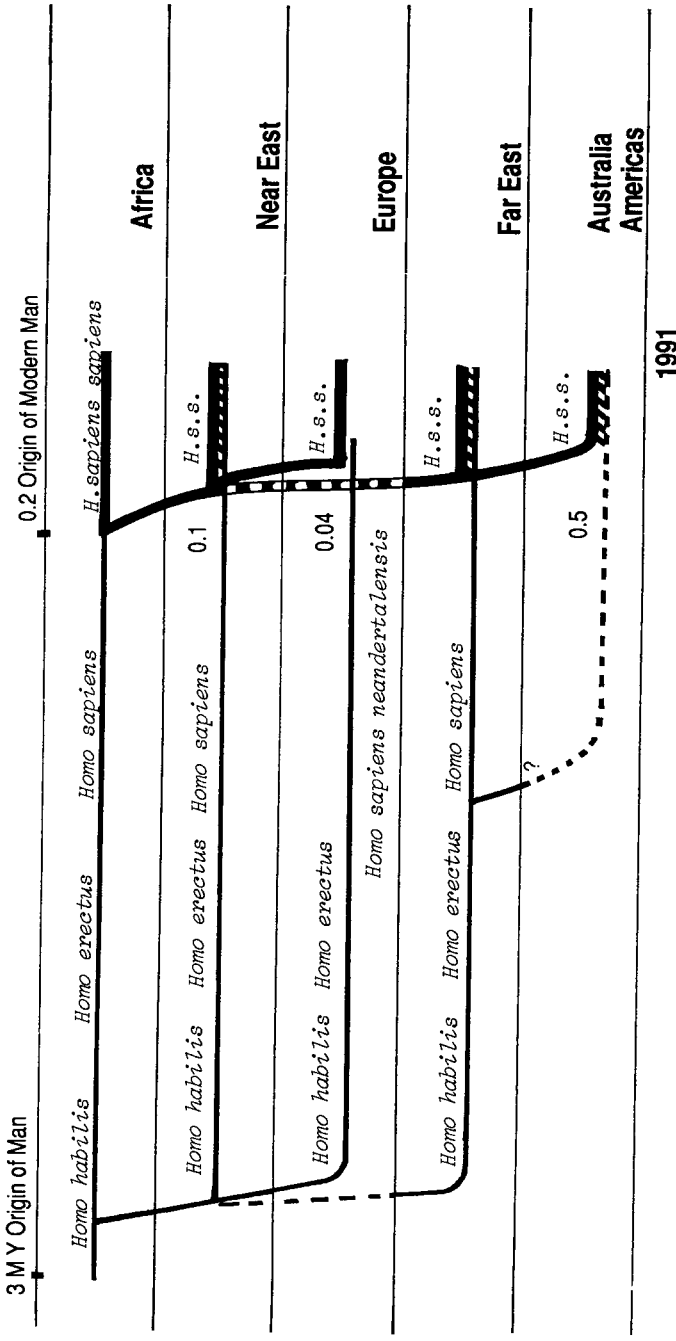


Figure 6: The population of the world. It seemed to take place in two "pushes," one spanning almost 3 million years, the other spanning 200,000 years or more. Both took place in Southeast Africa.

ancient world, these fossils were 300 or 400,000 years old. Because the Near East 2 million years ago was like everywhere else, Europe was no real exception to this evolutionary process. But, finding himself caught between the Alpine glaciers and the Mediterranean, Man became genetically cut off from his Near Eastern ancestors. He developed in a perfectly continuous fashion, from a no doubt ordinary *Homo habilis* into a special form of *Homo erectus* and, from that, into, 350,000 years ago, a very special *Homo erectus*, Neanderthal Man. Thus, Neanderthal Man is neither more nor less than *Homo erectus* shaped by European conditions. He represents, on our continent, the transformation of the latter into *Homo sapiens*, with a record increase of the endocranial volume.

But beyond this evolutionary process that brought *Homo sapiens* into existence from *Homo erectus*, wherever he happened to be, there began to form, around 150 to 200,000 years ago and once again in the extraordinary cauldron of East Africa, *Homo sapiens sapiens*, this time sharing everything with us right down to the subspecies. And, contrary to what had occurred for *Homo sapiens* himself, this new East African creation seems to have propagated through migration. This new drive followed the same routes as the first, that of *Homo habilis* 2 million years ago. It resumed the conquest of the world, meeting up with earlier peoples throughout Africa, Europe, and Asia who were already all *sapiens* and with whom it was obviously mutually fertile. Then it pursued and completed the conquest by occupying America, Australia, and the thousand islands of Melanesia, Micronesia, and Polynesia. It is often this Man, "modern Man squared," that is understood by modern Man tout court. In any case, he is the one whom genetics and molecular biology, through a multitude of ingenious approaches, try to trace through the contemporary distribution of thousands of pieces of genes and proteins. This Man can be distinguished better – except in East and South Africa where he obviously appeared in the continuum of human evolution – because when he moved around, he for a while stood out in the rest of Africa, in Europe, and in Asia from the earlier populations before interbreeding with them to a greater or lesser degree. In the Near East, there was the Mugharet-el-Zuttiyed Man of, perhaps, 150,000 years ago and those of Skhul and Qafzeh of, certainly, 90 to 100,000 years ago. In North Africa, there were the Men of Mechta-el-Arbi and Afalou-bou-Rhummel of 25 to 30,000 years ago. In Europe, it is Cro-Magnon Man of 35,000 years ago. In the Far East, it is the Man

of the upper cave of Chou-Kou-Tien of 40,000 years ago. Finally, in America, in Australia, and in the Pacific islands, the problem does not arise, since it seems that the *Homo sapiens sapiens* was the first occupier there.

### The Human Adventure

This epic of humanity is a very strange story indeed. Our genus (*Homo*) appeared, selected by a climatic crisis in the tropical depression of the East African province. His solution was to add meat to his diet and to think in order to survive. Wanderlust was born within him, and, from then on, he always wanted to go further (which is why, sooner or later, that we will undoubtedly colonize the planets). He began to expand within the first hundreds of millions of years of his existence (perhaps 2.5 million years ago), and he was led across the whole of Africa and the whole of Eurasia. One could count some 200,000 *Homo habilis* in the confines of our cradle. One could also count several million (but only several million) from the Massif Central to Yunnan and from Ain Hanech in Eastern Algeria to Sterkfontein in the Transvaal. Man (*Homo habilis*) was everywhere to pursue a certain common evolutionary program that caused *habilis* to "become erect" and caused *erectus* to "become sapient," while the great populated provinces were to develop a few characteristics of their own right up to the present. Despite this great dispersal, it is amusing to note that contact between all the Men of the Earth never died out, in any case, never for a sufficiently long time for one or several of these populations to reach a specific level of differentiation, that is to say, a differentiation of the kind that would break the interfertility between them and other Men. The Neanderthals, as was said earlier, were without doubt the ones who went furthest in this respect. If Cro-Magnon Man had not come from the Near East 35,000 years ago to stop "the experiment," this European isolate might have led to another Humanity. And then, 200,000 years ago, in East Africa once more, Man set out again in the footsteps of his ancestor *habilis*, to complete the conquest of the world and begin that of space. He is called *Homo sapiens sapiens*. He met *Homo sapiens* of Sale in North Africa, *Homo sapiens neanderthalensis* in Europe and *Homo sapiens daliensis* in China, interbred with them and then went on to discover America and Australia, the furthest corners of the Earth, and established himself there. Molecular biologists subscribe to the picture put forward by the palaeoanthropologists and nourish it, but

they refute the interbreeding. And yet, it does seem that interfertility has never been broken between all Men from the very first. The establishment of regional characteristics (indisputable on account of their frequency and their links) since the establishment, hundreds of thousands or millions of years ago, of the first populations of the great provinces (South East Africa, North Africa, the Near East, Europe, the Far East, Australia, and the Americas) and their persistence through all the vicissitudes that these populations have undergone, including the surging of the wave of *sapiens sapiens* down to the contemporary populations, is a demonstration of the hybridization of modern Man with his great predecessors that is difficult to refute. Therefore, it would appear that there were two modern Men, a polycentric autochthon and a monocentric allochthon, the latter having obviously been an autochthon at his point of departure in South East Africa. Today, there are 5 billion of us, all beneficiaries of this beautiful history.

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