# Chapter $10^5$: THE LAST FEW HUNDRED-THOUSAND YEARS
(300,000 – 30,000 Years Ago)

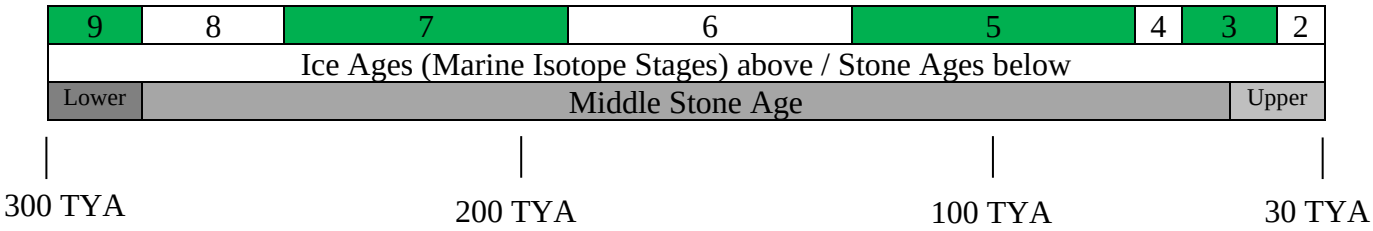
## Contents

# I. INTRODUCTION AND TIMELINES

Chapter 5 is the keystone chapter of this book in more than one way. I wrote TEOH from the outside in, so Chapter 5 was the last chapter to be written, the final bridge between past and present. It is the halfway point; Chapter 5 measures 100,000 years, and Chapter 10 measures 100,000 times again as long as that. More materially, this was the period when our species graduated from the animal kingdom, so to speak, and became a spiritual being. We are ready to pivot from the biological evolution of the human body to the forward-looking progression of human accomplishments and products of the mind.

This chapter takes place entirely within the Pleistocene Epoch. At this scale, we are now able to discern individual glacial and interglacial periods. Geologists number them as Marine Isotope Stages (***MIS***) in reverse chronological order. * The present interglacial (Ch. 4) is MIS 1 and the most recent glacial period was MIS 2. As this pattern continues, all preceding interglacials (green on the timeline below) have odd numbers and the glacials (white) are even. The timeline reveals unusually rapid climate fluctuations in this chapter. MIS 3 was a minor interglacial, so the last cycle similar to today's climate was MIS 5, particularly the subcycle called MIS 5e, about 120 TYA. [1]

For archaeologists, Ch. 5 is pretty well concordant with the Middle Paleolithic (Eurasia) or Middle Stone Age (Africa). The number of stone age industries increases in the more recent past. These industries differ by region and overlap in time, so they do not lend themselves well to a timeline or a brief summary. The Middle Stone Age in general is characterized by more refined knapping techniques than the Lower Stone Age. The most advanced "modern" human behavior characterizes the Upper Stone Age after about 50 TYA.




* It is easier to track ice ages with marine evidence, because each ice age on land has a frustrating tendency to erase evidence of earlier cycles.

At long last, it's time to introduce ourselves to *Homo sapiens*, aka modern humans. In Chapter 5, our species literally stole the stage. *Homo sapiens* began to appear 300 TYA, and by 30 TYA it was the only surviving human species. Section II details the appearance of modern humans and the extinction of the rest of the *Homo* genus.

The rest of the chapter discusses the qualities that make *Homo sapiens* a unique species. Section III describes modern human anatomy and genetics. Geneticists divide the human species not into "races" but ***haplogroups***, which are defined by migratory patterns of the last 100,000 years. Section IV is about behavioral modernism, which probably matured with spoken language. The human brain, which developed the capability for speech and other symbolic and abstract thought, also gave us a spiritual instinct. For the first time, humans saw themselves reflected in the world around them, a worldview that would eventually be organized into the earliest religions.

# II. HELLO, MODERN HUMANS; GOODBYE, EARLY HUMANS

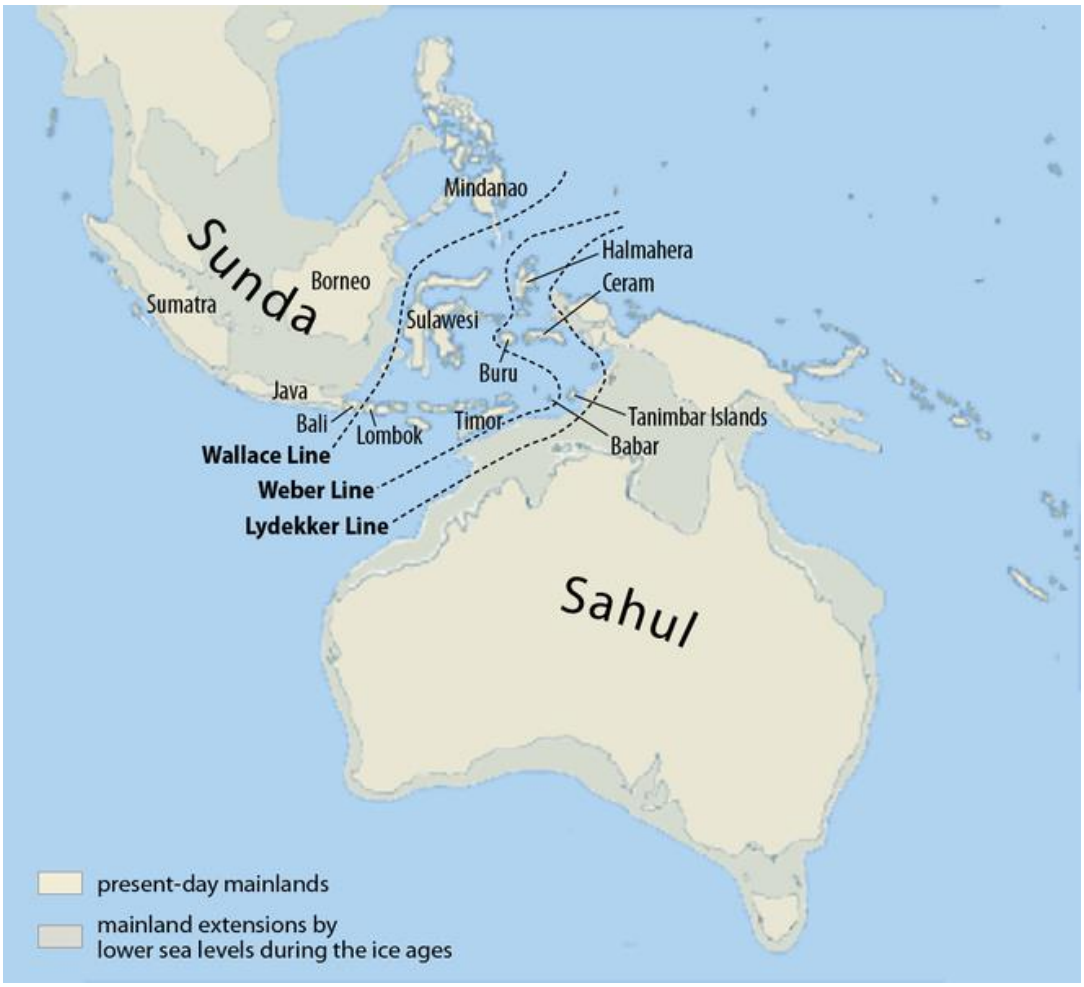
## *A. The Last Early Humans*

If we took a time machine back 300,000 years and felt adventurous enough to scour the Old World, we would encounter several varieties (species?) of early humans. We will probably never know the full story of their demise, but all were gone by the end of this chapter.

### 1. Erectus and Heidelbergensis

*Homo erectus*, the longest-lasting human species of all time, continued to live well into Chapter 5. After 300 TYA, it was found only in southern and eastern Asia. In a time when sea levels were lower, southeastern Asia was more interconnected by land than it is today, forming a peninsula called Sundaland that extended all the way to what is today the island of Bali. Eastern Asia offered one of the most open north-south corridors in the Old World. Unrestricted by mountain ranges, deserts, or seas, *erectus* was able to freely migrate to different latitudes as climate and ecology changed. This mobility could explain its lasting endurance. [2] Rising sea

levels eventually stranded *erectus* on tropical islands. The youngest *erectus* fossils are found on Java with an age currently estimated at 50,000 years. [3]




**Pleistocene shorelines of Sundaland (Southeast Asia) and Sahul (Australia / New Guinea / Tasmania). Early humans expanded as far as the Wallace Line.**

By Maximilian Dörrbecker (Chumwa) (Self made, using this map for the background) [CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

It is difficult to track the fate of *Homo heidelbergensis*, partly because it is seen as a transition between *erectus* and later species. Its fossil characteristics gradually blurred into Neanderthal features in Europe and modern human features in Africa. The African version, then, is the most likely candidate for our parent species. The youngest fossils still described as Heidelberg (at least by some scientists) survived into the last few hundred thousand years. A famous late specimen from Zimbabwe, once called Rhodesian Man, is dated to 125 – 300 TYA.

Some populations that lived in northern China 130 – 260 TYA are also possibly late Heidelbergs. These Chinese lineages seem to have gone extinct. [4]

## 2. Neanderthals and Denisovans

Neanderthals are mostly known from sites 30 - 100 TYO and ranging from western continental Europe to western Asia. They were robust, muscular people with large noses and brains even bigger than our own. Neanderthals were heavily carnivorous. They fished and hunted mammals (their favorite was the ibex, a long-horned sheep) probably by stabbing them directly with wooden spears! [5] The entire Neanderthal genome has been sequenced, revealing details such that some Neanderthals had pale skin like modern Europeans, and they shared one of our genes associated with speech. There is a great deal of debate about Neanderthals' intellect and the "modernity" of their behavior. We know that they buried their dead and created simple art such as rectangles and handprints. [6] However, there is no direct evidence of ritual or spirituality, and we can only speculate about what these activities meant to them.

***Denisovans*** speciated from Neanderthals 200 – 500 TYA. [7] They roamed a broad territory from Siberia to Sundaland before vanishing less than 40 TYA. The species is known from just a few teeth and knucklebones in Denisova Cave, Russia. This is obviously not enough physical evidence to reconstruct the Denisovan anatomy (other than that they had large teeth and bones) but it has yielded a nearly complete genome. [8] The sampled individuals had dark skin and hair. Artifacts from Denisova Cave include some of the world's oldest jewelry and needles, though it must be kept in mind that modern humans used the same cave. [9]

## 3. Hobbits and other Exotic Humans

The species officially called *Homo floresiensis* is named after its tiny home island of Flores, Indonesia. It is nicknamed "Flo" or "the hobbit" because it was the size of a modern three-year-old child and had large feet. Flo is more closely related to australopithecines than to modern humans, [10] raising the possibility that its ancestors left Africa even before *Homo erectus*. Its fossils are dated to 60 – 100 TYA, [11] surprisingly recent for such a primitive species. Flores, east of the Wallace Line, was never joined to Sundaland. This raises the puzzling question of

how Flo got there. It is fun to speculate about hobbit boats, but, due to Flo's Oldowan technology, small brain, and exclusion to one island, fortuitous island-hopping or tsunamis are more likely scenarios. [12]

*Floresiensis* was not the only barely-human species to survive so long. Dinaledi Cave, South Africa, is filled with the bones of *Homo naledi*. This 200 – 300 TYO human still had the hips, shoulders, and curved fingers of an arboreal ape. Its skull was modern in shape but archaic in size, and its body was midway in size between Lucy and *erectus*. [13] While its unexpected physique is perplexing enough, *naledi*'s location has really thrown paleontologists for a loop. The only known specimens are all crammed into two small, pitch-dark, nearly inaccessible cave chambers. Its discoverers believe that the only way those remains could have gotten there is if *naledis* deliberately buried their dead. [14] This is a bold claim, because *naledi* lived long before Neanderthals or modern humans practiced burial. For now, other scientists are reserving judgment. [15]

## *B. Introducing* Homo Sapiens

At long last, the moment we've been waiting for! After patiently waiting 100,000 years 100,000 times over, this universe finally produced *Homo sapiens*. Anthropologists also refer to our species as "modern humans", to distinguish *sapiens* from the extinct members of the *Homo* genus.

When we pick up a natural history book, we crave easy answers to simple questions like, "Where and when did the first modern humans live?" The answers to these questions depend just as much on our own arbitrary categories as on the facts of the past. If we are to understand the origins of the "modern human", we must now wrestle with its definition. Brace yourself; it's complicated. In fact, there are at least four ways to define human modernity: cladistic, anatomical, genetic, and behavioral. These characteristics all emerged gradually (and not necessarily together) over a considerable span of time.

The modern human clade is the family tree of our ancestors shared by no other species, living or extinct. Depending on our definition of "species" and the history of inter-human cross-breeding, this clade originated somewhere between 30,000 and 2,000,000 years ago! Most scientists would agree that the departure of Neanderthals from Africa several hundred thousand

years ago was the last significant speciation event. The Heidelbergs left behind in Africa were apparently our parent species. There is no definitive line where *heidelbergensis* ends or *sapiens* begins.

Of course, the pre-*sapiens* Heidelbergs, like Rhodesian Man, did not quite resemble us. It took some time for the skeletal features that define anatomically modern humans (***AMH***) to appear. The earliest known arguably AMH fossils are 100 – 300 TYO, all from Africa. [16] This is the timeframe in which paleontologists feel it is appropriate to start using the label *Homo sapiens*. Not surprisingly, we also find evidence that the modern human gene pool coalesced around that same time and place. [17] Modern mentality and sapient (literally "wise") behavior also began to appear in the Middle Stone Age, but were not universal until the Upper Paleolithic.

Anatomical, genetic, and behavioral modernity will all be elaborated further in this chapter. For now, suffice it to say that *Homo sapiens* joined the human races over the last few hundred thousand years, apparently in Africa. That brings us back around to the debate opened in Chapter 6 with multiregionalism. Let us now take a closer look at the flipside of modern human origins – recent African evolution.

## *C. Out of Africa One Last Time*

### 1. Modern Humans in Africa

The idea that Africa gestated and gave relatively recent birth to a fully modern *Homo sapiens* is usually described as the "Out of Africa" theory. That phrase can be a little confusing, because we know that early humans and some of their ape ancestors had already been venturing out of Africa for millions of years. The phrase "recent African evolution" is less poetic but more accurate. Maybe we could compromise and call the intercontinental conquest of modern humans "Out of Africa one last time".

Chapter 6 introduced the multiregional aspect of human evolution, which we now know is partly true. After several hundred thousand years of separation, Neanderthals and modern humans never quite lost the capacity to mate with each other. In that literal biological sense, the *ergaster* branch of humanity has been a single species the whole time.

Going further, the multiregional model originally asserted that modern humans evolved continuously and simultaneously across four continents ever since *erectus* colonized Asia. This strong conclusion has not held up against recent evidence. Recall that the basis for belief in multiregional origins was regional continuity. The idea was that we could line up a series of European skulls and, as they progressed from old to new, their features would gradually morph from Neanderthal to modern. Likewise, another timeline of skulls from China would blend smoothly from *erectus* to modern. In reality, no such lineup of skulls is available, [18] and the fossil evidence that does exist can be interpreted in different ways. [19]

Instead, today's best evidence indicates that early Eurasian humans lived in small scattered patches, [20] [21] and their contributions to the modern human species have been minor afterthoughts. The prolonged isolation of populations such as Neanderthal, Asian *erectus*, and *floresiensis* is evident in their persistently different anatomies, so it is appropriate to call them different species. African populations eventually grew larger and denser, and that is where most of the evolution toward the modern form took place.

In fact, Africans also suffered periodic population losses and fragmentation. The southern continent endured a series of "megadroughts", when even tropical Africa had deserts. [22] Middle Stone Age technology is strangely sporadic. Sometimes innovative new forms of tools or behavior show up in the archaeological record only to vanish for tens of thousands of years before resurging. This might indicate that these cultural forms were sometimes confined to shrinking isolated communities. [23]

At other times, African populations were more robust and interconnected. This is where the multiregional model still finds a place in the story. There is now good evidence of multiregional evolution on an African scale. That is, some modern features first appeared in northern Africa, others in southern or eastern Africa, and over time they blended together into the modern human composite. [24] Multiregionalism, which was originally proposed as an explanation for present-day racial diversity, is now ironically useful for explaining human commonalities.

Modern humans established a limited presence in western Asia almost 200,000 years ago. [25] Some modern human fossils as far away as China are 70 – 120 TYO according to some studies. [26] For unknown reasons, those pioneering populations did not persist or expand.

It wasn't until 50 – 70 TYA that *sapiens* migrated from Africa in great numbers. Although the Sahara Desert is virtually uninhabitable now, it has gone through numerous wet and dry cycles [27] that may have served as a "pump" for these migrations. There is evidence that southeastern Africans were drawn to northern Africa during a "green Sahara" phase in MIS 5 and were then forced to evacuate when it was desiccated again in MIS 4. [28] It was this latest phase of migration that led to permanent settlement of the entire Old World.

## 2. Modern Humans in Eurasia, or "When Africans Conquered Europe"

Once out of Africa, modern humans slowly but surely proceeded to encroach upon the domains of early humans. We know that *sapiens* prevailed mightily while the older species faded away. Our imagination is tantalized, but we know frustratingly few details about this takeover. We can't help but wonder if *Homo sapiens* entered this world in a bloody genocidal campaign. Fortunately, there's not much evidence of that, though, knowing human nature, it would be surprising if there were no interspecies skirmishes. It's probably a more important factor that modern humans were simply better survivors, and they outcompeted archaic human species that were already endangered.

The most significant interactions were with Neanderthals and Denisovans, who both mated with AMH. Neanderthals occupied the Levant when modern humans first entered that region. The two species coexisted near the Sinai gateway for millennia, and this was probably their mating nexus. [29] Neanderthal DNA is present in almost all modern human populations outside of sub-Saharan Africa. [30] This suggests that our modern ancestors mated with Neanderthals early in their expansion into the Old World, before scattering in different directions.

Anthropologists cite several survival advantages that *Homo sapiens* may have had over Neanderthals. Technology was the best-known advantage. Modern humans were throwing spears with sharp stone / bone points while Neanderthals were still stabbing their prey with sharpened sticks. Modern humans sewed tailored clothes. We don't know if Neanderthals wore anything at all, but if they did it wasn't very sophisticated. They lacked needles and made limited use of animals traditionally used for fur trim. [31] Neanderthals wore down their teeth using them as tools. Biologically, *H. sapiens* had a more diversified omnivorous diet, while

Neanderthals were overly reliant on meat. [32] There is mixed evidence that Neanderthals grew up faster than modern humans. [33] [34] If so, they may have missed out on some important social and educational development that comes with our extended childhood.

Mysteriously, *sapiens* paused at the Levant for perhaps 10,000 years before entering Europe, where they are known as Cro-Magnon Man. Some authors speculate that Neanderthals resisted Cro-Magnon expansion. [35] As the harsh MIS 2 ice age took hold, Neanderthals retreated to southern Europe and Cro-Magnons filled the void. The two species probably shared Europe briefly around 40 TYA. [36] The last known Neanderthal refuge is at the Rock of Gibraltar, where the cliffs of Spain look out across the Mediterranean to Africa.

Denisovan DNA survives most predominantly in Melanesia, at the far reaches of the Pacific Islands. We can be sure that Denisovans never made it that far, so eastbound modern humans must have mated with them en route, probably in southeast Asia. Another wave of migrants that ended up in China and Japan picked up a smaller trace of Denisovan DNA. [37] One of the genes important for survival at high altitudes was passed from Denisovans to modern Tibetans. [38]

Less than 5% of modern DNA is derived from early humans. Assuming that Neanderthal and Denisovan populations were only a small percentage of *sapiens*', then the interbreeding somewhat assimilated them into the gene pool while retaining only slight traces of their physical appearance. But their extinction cannot be explained by assimilation alone. A major advantage that modern humans had over their sister species was sheer numbers. In times of crisis, *sapiens* could absorb more losses.

There is little to no evidence of direct AMH contact with the other surviving early human species, though their habitats probably did overlap. The general presumption is that the ancient species such as *Homo erectus* simply couldn't keep up. By 30,000 years ago, they were all gone. It was *Homo sapiens'* world now.

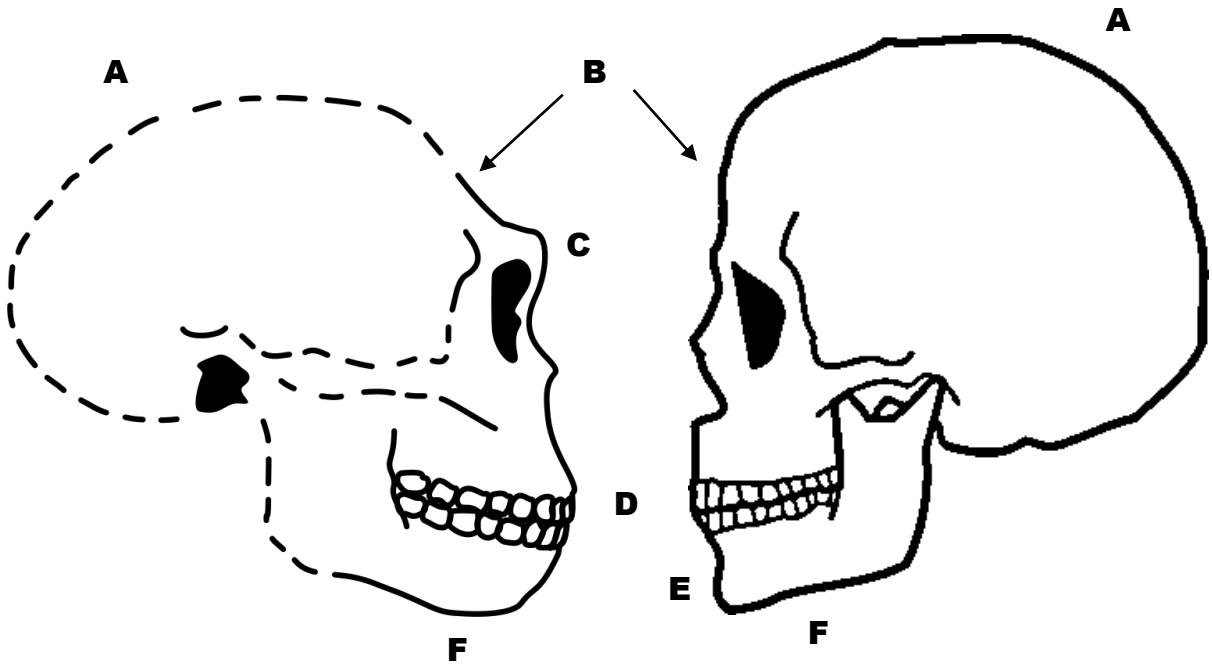
# III. Anatomically And Genetically Modern Humans

## *A. The Modern Skeleton*

The first fossil ever recognized as an early human was "Neanderthal 1", discovered in 1856. Paleontologists immediately knew that Neanderthal Man didn't look "like us" – but what

did that mean? Two more centuries of fossil discoveries have forced scientists to come up with a definition of what "we" look like in order to track our species' evolution. There are just a few key features that set *Homo sapiens* apart from our extinct human predecessors. The most important of these features are a rounded skull, a recessed face, a chin, and an overall more lightweight skeleton, especially visible in the brow ridge.

Scientists almost universally use the word "globular" to describe the *sapiens* skull. Early humans had longer, flatter skulls that were somewhat pointed in the back. It would be fair to say that they resembled American footballs compared to our soccer-football heads. The modern forehead is nearly vertical, and the modern human face is set back further in alignment with the forehead. The chin is probably just a byproduct of the changing jaw, but it is a unique *H. sapiens* marker.




**Early human, left; Anatomically Modern Human (AMH), right. A) AMH skull more globular. B) Sloping vs. vertical forehead. C) Browridge: heavy in early human, virtually gone in AMH. D) AMH lower face more "tucked in" under braincase. E) AMH chin juts forward, F) Smaller jaw and teeth in AMH reflect general gracilization.**

Left: https://commons.wikimedia.org/wiki/File:Antecessor_Skull.png
Right: By Ichthyovenator [CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0)], from Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Sapiens_Skull.png

These differences between *heidelbergensis* and *sapiens* might seem to be minor examples of random shape-shifting. In fact, closer analysis reveals a consistent tradeoff: a larger braincase at the expense of chewing power. [39] For instance, the depressions on the outside of the skull, which accommodate the major chewing muscles, have become smaller in *sapiens*. Our teeth and jaws are also smaller, as is our brow ridge, which offers structural support against the strains of chewing. [40] Of course, we don't need vice-like jaws when we cook our food and process it with tools.

These modern features did not evolve simultaneously, but also were not completely independent of each other. 300 TYO fossils in Morocco display modernizing faces with a still-archaic braincase. The rounded skull did not appear until after 200 TYA, [41] and the chin within the last 100,000 years. On the other hand, the skull is a complex 3D puzzle with 22 bones, and it is difficult to change one without modifying the others. [42] Just a few small independent changes could have led to the retracted face, globular braincase, reduced brow ridge, and even the shape of the vocal tract. [43]

The most recent change to the human skeleton – still an ongoing trend – goes by the technical term of ***gracilization***. Human bones, in the body as well as the skull, are getting thinner and less dense. Note that a thinner skullcap helps provide an even roomier braincase. In the long bones, gracilization might be an environmental condition as much as a genetic one. As living tissue, bones develop in response to exercise, just like muscles do. Thinner bones can reflect a less active lifestyle. In fact, gracilization has been most pronounced in the last 10,000 years as humans have made the transition from foraging to farming and settled life, [44] and is still accelerating with industrialization. [45] Gracilization has now reached pathological levels; as we get old we are vulnerable to osteoporosis, deterioration of the bones to the point of brittleness.

## *B. Haplogroups And Migration Patterns*

### 1. Understanding Phylogeography

This topic focuses on the ***phylogeography***, or population ancestry, of modern humans. DNA analysis has helped reconstruct the major branches of the global family tree. Before discussing the conclusions, it is necessary to understand a few key concepts about this field. [*]

Phylogeography works by examining ***snippets*** [†] of DNA. In prehistory, we must think of our ancestors not as individuals but as populations of interbreeding people. A population is defined by its gene pool, the set of snippets that flows through the population. Slow changes in the gene pool – the births and deaths of DNA snippets over hundreds of generations – leave records of our lineage.

A genetic mutation creates a new snippet. If successful, that snippet will multiply throughout its local gene pool. To the extent its local population is isolated from others, that snippet will not escape into other populations. This is how snippets serve as "markers" to distinguish populations that have been isolated from each other for millennia. When a population splits in two (such as when one migrates), each subpopulation retains the original marker plus new markers of its own. By studying patterns among living DNA samples from throughout the world, we can retrace the travels of ancient ancestral populations.

Even DNA snippets do not live forever. If a population becomes very small, some snippets will die out, and the survivors will become more prominent in the gene pool. Geneticists call this situation a population ***bottleneck***. As phylogeographers, we have mixed feelings about bottlenecks. They are limits to discovery; we cannot study the evolution of earlier extinct snippets. On the other hand, they help us zero in on our ancestors. Each single surviving snippet must have had its origin in one person, so genetic ancestry ultimately maps our descent from these individuals. We can call them the first "genetically modern" humans. All we can really know about them is approximately where and when they lived.

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[*] If you are feeling a little rusty about genetics, you might want to revisit sections 10.V: Life, 9.III: Sexual Reproduction, and 9.IV: The Sexual Evolution.

[†] The basic unit of DNA mutation is the "single nucleotide polymorphism", abbreviated SNP and pronounced "snip". I like using "snippet" as a plain English word coincidentally similar in sound and meaning.

Researchers focus most of their attention on ***mitochondrial DNA*** (***mtDNA***) and the ***Y chromosome***. These are the only snippets that do not intermix during sex but are copied in full for the next generation. Your mtDNA comes from your all-female line of ancestors (your mother, her mother, etc.) If you are male, your Y chromosome comes from your all-male line (your father, his father, etc.) Each of these snippets contains the full record of its mutations since the last bottleneck. The major world populations that have separated since the last mtDNA and Y chromosome bottlenecks are called ***haplogroups***. They are usually designated with capital letters, such as Y-haplogroup A.

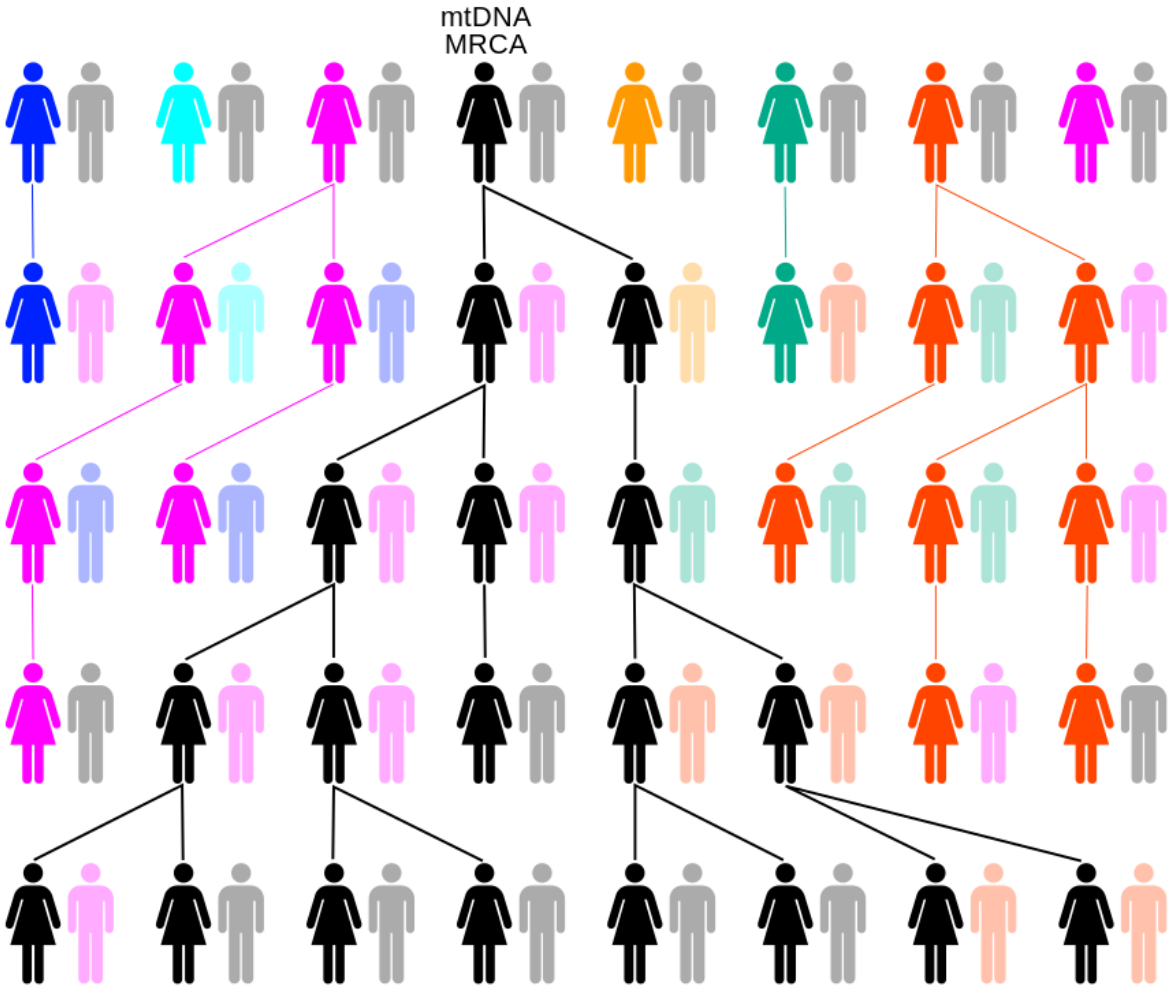
**2. The Global Family Tree**

When phylogeographers map out a family tree of human mtDNA throughout the world, they find that everyone's all-maternal ancestry converges on one woman who lived in Africa [46] 100 – 200 TYA. [47] She is nicknamed "Mitochondrial Eve", an endearing but unfortunately confusing term. In her time, she was an ordinary woman among a population of maybe 20,000 people. [48] By a twist of fate, she just happens to be the last woman who has had daughters' daughters' … daughters down to our times (including your mother). Everyone's all-paternal lineages likewise coalesce in a "Y-Chromosomal Adam" [49] who, despite his name, never knew Mitochondrial Eve. [*] Current research places him in central – northwestern Africa [50] about 250,000 years ago [51].

These are the two most venerated genetically modern humans, though they only represent two modest portions of our DNA. We have inherited the rest of our genetic diversity from an estimated 90,000 "Adam and Eve" individuals. [52] This accounts for the 0.1% of our genome that is widely variable. The other 99.9% is the same in all humans and was passed down by earlier species.

These facts are all strong evidence in favor of recent African evolution. If *sapiens* had descended from the entire *erectus* diaspora, then we would expect Mitochondrial Eve and Y-Chromosomal Adam to have lived millions of years ago. We would also expect much higher worldwide diversity. Humans are only ¼ as genetically diverse as chimpanzees, because human common ancestors are much more recent. [53]

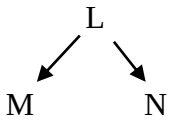
[*] Just as your mother's mother didn't know your father's father.




**Graphic showing how one lucky mother (black) came to be Mitochondrial Eve during a population bottleneck. All other lines (colored) died out when those women failed to have daughters.**



On our mothers' side, the great migration out of Africa is reflected in this simplified mitochondrial family tree:



Mitochondrial haplogroup L is the world's oldest. It is common throughout Africa and nowhere else. Group L3, a subgroup of L, spawned groups M and N right around the time that Africans entered Asia. The M and N branches of the family then spread from Asia to the rest of the world.

A similar tree is exhibited on our fathers' side. The six major lines descending from Y-Chromosomal Adam are labeled haplogroups A – F. The two oldest, A and B, are native to Africa. The largest branch, Y-haplogroup F, originated in India about 50 TYA. [54] This group now encompasses 90% of the men outside of Africa.

Oddly, the oldest line outside of Africa, Y-haplogroup C, is found in Australia! Humans reached Australia as early as 65 TYA [55] and occupied the whole continent by 50 TYA. They obviously traversed Asia to get there, but so far scientists have found only faint traces of their so-called "southern route". These were the first humans to reach Australia. Interestingly, many large Australian animals went extinct around the same time. It seems that human activity was a major factor. [56]

The settlement of Europe was surprisingly late. Haplogroups originating from the Levant to the -stan countries spread westward into Europe around 40 – 45 TYA. By 20 TYA, modern humans had reached the furthest shores of the Old World.

Two recent genetic findings are consequential. First, no haplogroup is completely isolated from the others. They are all intermixed, with regional hotspots for each one. This shows that the modern human species has indeed evolved multiregionally since leaving Africa; we are one global family. Related to this, the genetic variation from one geographic region to another is minor. We are visually impressed by the physical features distinguishing, say, Africans from Europeans or Asians. These are due to distinct [57] , but slight [58] , genetic differences.

Genetic testing services can reveal your mtDNA and Y-chromosome haplogroups. [59] Their reports are accompanied by maps and timelines. It's a fascinating way to connect your lifeline to the earliest *Homo sapiens*.

# IV. BEHAVIORALLY MODERN HUMANS

Up to this point, the evolution of the human being has been much the same as any animal. Now we have reached that remarkable turning point when humans began to show clear signs of the higher intelligence that we recognize in ourselves today. This section will describe what anthropologists mean by "modern behavior" and how it may have emerged.

## *A. The Modern Human Brain*

The brain is the seat of intelligence. Whatever it is that happened in early *Homo sapiens*, it must have originated in the brain. We have already taken note of the big brain bang. [*] Here, we will see that it isn't just a matter of size. The human brain is also unique in its structure, from the level of gross anatomy down to the snippets of DNA that control brain development. The big question is when this happened. Archaeology suggests that fully modern behavior blossomed fairly recently, within 50,000 years. As we study humans in comparison to other species, we are especially on the lookout for correspondingly recent changes.

The nearest living brain we can compare to our own is the chimpanzee's. The human brain does not seem to have any "new parts" over chimps. The differences lie in the size, function, or structure of the same parts. A human brain is proportionally more well-endowed in the cerebellum [60] and the ***association areas*** of the cortex. [61] The cerebellum controls voluntary movement, including hand-eye coordination and the production of speech. The association areas allow us to make higher-order decisions about things we sense, such as recognizing a face. They are also involved in the highest-level mental activities independent of the senses, like making plans or expressing our feelings in words.

The human brain is more asymmetric than the chimp's, both in form [62] and function. A symmetric brain allows for redundancy – if the left side gets injured, the right half can still handle the same task. Ape brains, especially humans', sacrifice redundancy for specialization. When the left and right brains specialize, together they can perform twice as many functions. The human brain does most of its language processing in the left hemisphere, while the right side specializes in perception and imagination. Brain / mind complexity arises from connecting

[*] See Topic 6.III.C

different regions like the left / right hemispheres; integration gives our mind a chance to look at things from different angles.

At the cellular level, some regions of the human brain are unusually rich in white matter, the "wiring" beneath the surface that connects neurons in different areas. [63] There are also newly-discovered human brain cells that have not yet been detected in other animals. [64] "Rosehip neurons" provide very targeted control of other brain cells. [65] "Predecessor cells", interestingly, are the first cells to appear in the cortex of the developing human embryo. [66]

Two particular genes called MCPH1 and ASPM, which are associated with brain size, are thought to have experienced mutations within the last 100,000 years. [67] [68] One of the most oft-discussed genes is called FOXP2. Variations in this gene are known to have profound effects on language, [69] and the human version of FOXP2 is not found in chimps. Interestingly, it was shared by Neanderthals, electrifying the debate about whether they could speak. The age of FOXP2 rules it out as a miracle mutation in modern humans, but it is only one of several genes involved in language.

When it comes to our DNA, the difference between humans and chimps is not so much new genes as gene regulators – the controls that turn genes on or off. [70] Geneticists have identified a whole class of DNA snippets called Human Accelerated Regions (*HAR*) that are uniquely human. Many of them are involved in regulating genes for brain development. [71] Some of these HARs, like FOXP2, were already present in Neanderthal and Denisovan DNA, so they are not smoking guns in modern human adaptations. [72]

One of *Homo sapiens'* most distinctive characteristics is the large, globular skull. This is no coincidence; a changing skull indicates a changing brain. The adaptations in our braincase would be necessary to accommodate growth in the regions called the frontal lobes, parietal lobes, and cerebellum. [73] The history of the human skull tells us that these regions swelled precisely during the emergence of modern humans. The frontal lobe is dominated by association areas. Two of these areas, the prefrontal cortex and the fronto-insular cortex, are particularly larger in humans than in chimps. The prefrontal cortex, at the very front of the brain, is associated with personality, social behavior, and decision-making. The fronto-insular cortex is one of the few regions of the brain that contains spindle neurons. It has been associated with spatial awareness, self-awareness, the complexities of emotions, cravings, and even addiction.

What does it all mean? The human brain is not only large but uniquely organized. However, the organ has been evolving for several million years. Only a few specific changes can be pinpointed to the last few hundred thousand years. It's a safe bet that modern behavior was facilitated not just by biology but also by culture.

## *B. Language*

### 1. What is Language?

In the mind of an individual, the essence of language begins with symbolic, abstract thought. When you see, say, a tree in your backyard, you can symbolize that tree with a sketch, a hand gesture, a name ("Leafy"), or anything else that your mind can perceive. You can then use that symbol in ways that you can't use the tree. What's more, you can mentalize abstractions of that tree. When you see several trees that look like Leafy, your mind can lump them into a category represented by another symbol ("elm"). The process of abstraction is unlimited ("tree", "green thing", etc.) By abstracting your immediate surroundings, you can imagine things in a different place or time – even things that don't exist (a "tree of life").

Next, language is social. Communication requires a listener as well as a speaker. The two conversationalists must share *joint attention*, a deliberate shared focus on a topic of conversation. [74] Furthermore, language must be taught culturally; it is not entirely instinctive. In the rare cases when children grow up without exposure to language, they do not create their own.

Language can be conveyed with gestures, pictograms, or smoke signals for that matter. The human medium of choice, as we know, was vocalization. Spoken language has unique properties. It is formed with a small set of meaningless vocal sounds ("c", "a", or "t") that can be combined in an infinite number of ways. Some of these combinations ("cat") are chosen as meaningful symbols, which can again be combined with infinite variety to express complete thoughts.

That brings us around to grammar, which is a socially-agreed set of rules about how words are strung together. An intelligent ape can sign words in combination like "cat me give food", but is incapable of creating finer clarifications like "I will give food to the cat" or "give me the cat food."

## 2. The Origins of Language

As foreshadowed in Chapter 6, the origins of language are notoriously inscrutable. We frankly don't know when, how, or "why" our ancestors progressed from animal communication to human language. Speculative hypotheses can (and do) fill entire books. Some models are gradualist, proposing that language skills evolved bit by bit over time. Others believe that a recent genetic mutation rapidly bestowed the gift of language on our recent African ancestors. If there's anything I have learned in my decade researching this book, it is that nature is patient. I am inclined toward a gradualist belief just as a matter of principle.

The evidence in favor of lightning-bolt language acquisition is the archaeological record of modern behavior. The earliest African emigrants clearly exhibited modern behavior (more on that behavior in the next topic). The line of reasoning is that these humans must have become "modern" because their capacity for language allowed them to communicate complex thoughts and to perpetuate culture through the generations. The circumstantial evidence is noteworthy: modern behavior, the worldwide spread of *Homo sapiens*, and the extinction of all other human species all accelerated rapidly 40 – 50 TYA. The key assumption is almost undeniable: language does seem necessary to explain the sophistication of modern behavior. We can establish 50,000 years, then, as a conservative minimum age for the proliferation of language as we know it.

The further we go back in time, the less direct evidence is available. A few recent (controversial) archaeological discoveries could be interpreted as signs of modern behavior in Africa almost 200 TYA. [75] Linguists search for clues among the world's living languages. Some teams have concluded that today's degree of diversity would have required upward of 100,000 years of language development [76] , with a proposed origin in Middle Stone Age Africa. [77] Others insist that any linguistic analysis beyond 10,000 years is futile. [78]

## 3. Language and the Mind

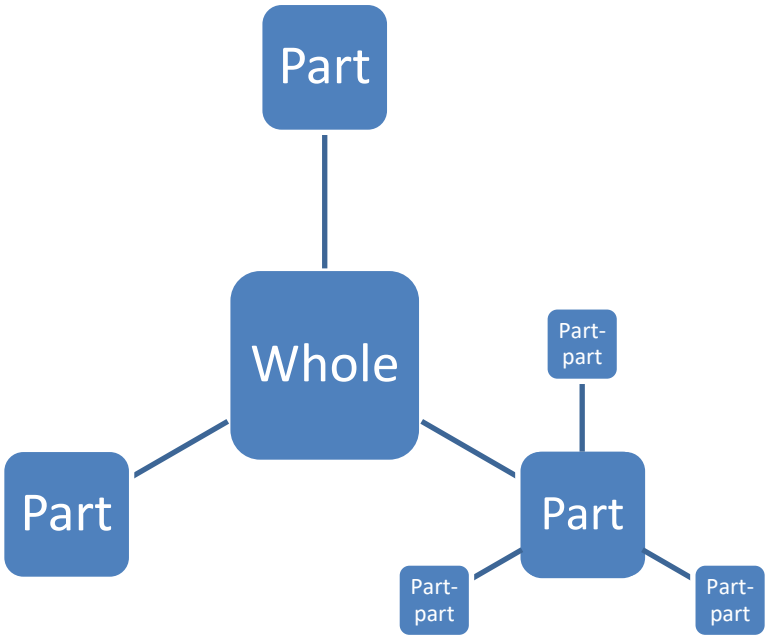
Language and thought form a symbiotic cycle. Thoughts provide us with some of the basic subject matter of language. Without language, though, it would be almost impossible to nail down a thought that is very detailed or abstract. *Linguistic relativism* is the idea that

language influences our very perceptions of reality. There is evidence that cultures visualize space, time, gender, or colors in various ways, influenced by the words used to measure or categorize. [79]

Children are very good at learning spoken language – so good, in fact, that some scientists believe that all babies are born with an instinctive "universal grammar". [80] Others believe that language is just one special cultural skill enabled by our general capacities for memory and association. [81] The brain develops very quickly in early childhood. Language might be "hard-wired" in infancy, not by instinct, but by exposure to language while new connections are forming in the brain.

Another debate concerns the mind's own representation of ideas. One conjecture is that the subconscious mind processes ideas in an unknown logical language of its own, the *language of thought*. [82] Alternatively, thought might originate in non-linguistic form, like a map [83] or a network of interconnected switches [84] , that somehow produces language-like properties. In fact, such experimental systems are called *neural networks*.

***Recursion*** is a thought process that is almost uniquely human. It involves applying an idea repeatedly or to itself, like the idea of a "part":



Recursion may be one of the key prerequisites to thinking linguistically. [85] For example, our well-developed theory of mind allows us to have a "thought within a thought". A "story within a story" allows us to integrate past, present, and future – one of the most important functions of thought and language. [86]

### 4. The Sociology of Language

Language is the vessel of culture. It greatly expands the range of ideas that people can share, whether for making tools, gossiping, or organizing a hunt. Language is especially powerful for preserving skills through the generations, allowing cultural wealth to accumulate. That seems to be what happened among the earliest Eurasians, providing us with the evidence that they had mastered language.

Language was one of the first great institutions to reinforce the ironic us-versus-them effect. While a common language acts as a bridge to bring small communities together, it is a barrier against integration with other people. The hunter-gatherer world must have been fragmented into many thousands of language zones. In New Guinea, one of the last refuges of foraging economies, the average language spans only 15 villages! [87] Language barriers are effectively insurmountable for marriage, so the history of languages must have closely tracked the genealogy of the populations who spoke them. [88]

Spoken languages are very fluid. They change with every generation and easily splinter into dialects. We know from the history of Europe that a root language like Latin can diverge into dozens of mutually incomprehensible languages within a millennium. Partly for this reason, spoken language has serious limitations for preserving factual information. Poetry and song help people memorize their history and folklore, yet, as languages themselves are ephemeral, these verses are not eternal. There are a few extreme traces of collective memory allegedly going back 10,000 years, like American recollections of woolly mammoths. [89] By and large, though, historians believe that collective memories only survive a few centuries. [90] The modern human experience was relived and forgotten 100 times over before writing captured a snapshot of it less than 10,000 years ago.

## *C. Modern Behavior*

### 1. Modernity and Language

How do we define the human spirit? Everyone agrees that advanced human behavior sets us apart from all other species. The interesting question is where we draw the line between our animalistic and human nature. Only if we define that threshold can we begin to answer questions about how our ancestors crossed it. I will define human "modernity" as the behavior that requires language or the mental processes associated with language. Leading anthropologists have enumerated such mental processes as abstract thought, symbolism, planning, and innovation. [91]

Chapter 6 introduced two exceptionally early breakthroughs that form a category of their own. Stone knapping and the control of fire must be considered "borderline modern" behavior. These skills did not necessarily require full-blown language (a handful of scientists argue that they did) yet they are clearly beyond the capacity of other species. Both skills involve planning. The first humans to accomplish them were clearly innovative, but then stone age technology hardly changed for a million years. Neither fire nor tools indicate abstract or symbolic cognition. These noteworthy examples suggest that the transition to linguistic thought and modernism might have been very gradual.

### 2. Modernity Trait Lists

The definitions of modernity above are philosophically interesting but too abstract to guide archaeologists in the field. Since we can't administer intelligence tests to Stone Agers, we must look for concrete evidence that they used language, symbolism, abstract thought, planning, and innovation. Scientists have published numerous "trait lists" of the evidence at hand. Hardly any two lists are identical, and these lists shift with new discoveries. One of the most significant and commonly-cited examples is ritualistic burial of the dead, which I will discuss further in the following topic. Other key signs of modernity are presented here.

### *a. Clothing and ornamentation*

Ornamentation, like paint and jewelry, constitutes some of the earliest known behavior that archaeologists construe as modern. The idea is that a person wears jewelry to symbolize a sense of self, projecting a particular image to others. Jewelry, face paint, head dresses, and the like are also important elements of a uniform dress code that symbolizes group identity. Very often, ornamentation is valued for its sheer aesthetic value. ***Red ochre*** is a very common pigment found in archaeological sites going back almost 300,000 years. [92] Beads drilled with holes, presumably for stringing on necklaces or bracelets, date to at least 100,000 years in Israel [93] and are found throughout Africa in sites 70 – 80 TYO.

Clothes are another obvious indicator of modern behavior. Not only is clothing used for personal expression and identity, but it is an innovative use of resources as protection against the elements. Unfortunately, clothes decompose quickly, so it is difficult to date their origin directly. A particularly clever study has analyzed lice DNA. The lice that occupy our clothes are a different species than head lice. These species appear to diverge from a common ancestor in Africa around 70,000 years ago, and it is reasonable to speculate that clothing, or at least tailored clothing, became common in that time and place. [94]

Clothes are a prime example of *cultural adaptation.* When any other species encounters a new environment, whether through migration or geologic change, its only option is slow biological adaptation by evolution. Humans can afford to be much more impatient. We can put on clothes, erect shelters, or even alter the environment. Cultural adaptation has reduced evolutionary pressure on our physique, one reason that our species is evolving very slowly now.

### *b. Mastering land and sea*

Early *Homo sapiens* had a good sense of places and times beyond the here and now. Only at the modern human horizon do we begin to find resources located far away from their places of origin. [95] People must have had a mental layout of the land. They knew of specific locales that were rich in plants, animals, and minerals, and they understood seasonal variations. They probably traded resources with neighboring bands of people.

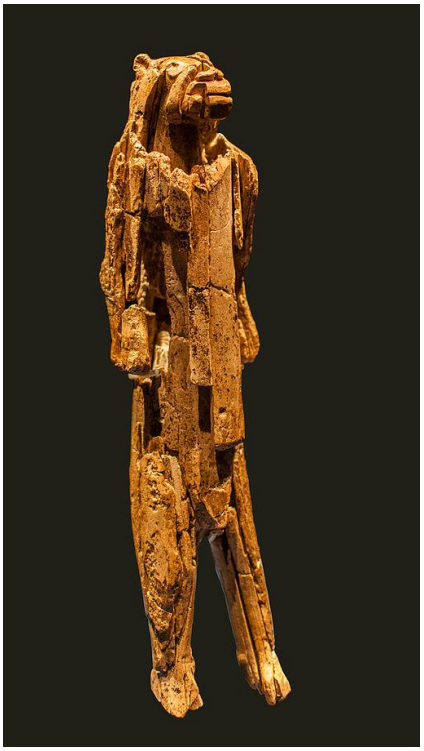
The first wave of modern Asians was probably the earliest seafaring people. The journeys to Australia and Japan [96] give us the oldest indirect evidence of boats or rafts. Even during the lowest sea levels, Australia was never joined to Asia. The only way to get there was by boat, which is why earlier species such as *Homo erectus* had never made it to Australia. Early settlers of Oceania somehow found a way to catch tuna and other deep-sea fish 40,000 years ago, well before the invention of fish hooks! [97] Fish and birds have become much more prevalent in the diet of modern humans.

### *c. Tool technology breakthroughs*

Western Eurasians, in a culture that archaeologists call ***Aurignacian***, utilized a new "prepared core" technique of making stone tools. One of the Aurignacian traits that has especially impressed archaeologists was the degree of specialization and diversity in their toolkit. They seemed to have "a tool for every job", including blades, numerous shapes of scrapers, and awls for punching holes in leather. The blade, defined as a sharpened stone more than twice as long as it is wide, was one of the most important new tools of this period. Craftsmanship became standardized and reached impressive heights. Blade technology offered a much more efficient use of stone material than hand axes. [98]

The *burin* was a stone chisel used to carve softer materials such as wood, bone, ivory, and antlers. This gave modern humans a whole new toolkit made of organic materials. In other words, the burin was a tool to make tools – there's that recursive thought again! In fact, some of these stone-carved antler tools were used to flake or sharpen new stone blades. Needles made of bone demonstrated that people were sewing and probably had quite sophisticated clothing by 40 TYA. Organic materials were also useful for *compound tools*, such as a spear with a stone tip hafted to a wooden shaft. Compound tools were often strengthened with adhesives.

### *d. Art*



Middle Stone Age Africans decorated items with patterns such as dots and cross-hatches. This proto-artistic phase progressed to the famous cave paintings and "Venus" figurines of the Upper Paleolithic. Figurative art more than 30,000 years old is found throughout the Old World. It usually depicts people or animals. Representational paintings and sculptures are undeniable signs of abstract thought, for they are tangible symbols of other things. One of the oldest known sculptures is this downright fanciful lion-man. [99] Musical instruments are also found among Upper Paleolithic artifacts.

## 3. Where and When?

When we define modernity by a trait-list of several archaeological examples, tracing its origins gets complicated. Although Upper Paleolithic Europe was originally defined as the cradle of behavioral modernity, we now know that most modern traits made their earliest appearances in Middle Stone Age Africa. [100] Some of the oldest art in the world, including arguably the first known painting of a human being, is found in Australia. Even Neanderthals exhibited some behaviors that would be characterized as modern.

However, the strands of modernity did not coalesce in a single culture until the Aurignacians in Europe about 45 TYA. Scientists today are fiercely debating the reasons for this cultural surge: ecological need [101] , cultural accumulation [102] , a sudden shift in human mentality [103] , or even a historic bias toward European archaeology. [104] Nevertheless, all humans were living "modern" hunter-gatherer lifestyles by 30 TYA.

## *D. Religion*

### 1. Why we are Religious

The modern human mind is hardwired with at least two critical faculties: abstract thought and the theory of mind. We live in a social world inhabited by conscious, willful minds like our own. We recognize our peers acting in self-interested ways. We understand how to negotiate, scheme, plead, and partner with each other.

With abstract thought, modern humans can conceive of the essence or "spirit" of people and things. If I ask you to think of "your mother", for instance, there is her spirit in your mind. With these spirits as mental imprints, we can imagine and wonder about things unknown and unseen. We can project those spirits into other places and times. It's easy to imagine your mother even after she's dead.

When it all comes together, this mentality creates a very powerful illusion: spirituality. [105] We believe that the spirits in our mind really exist in the outside world. We attribute to them every characteristic of our own minds, seeing them as conscious, emotional, and cunningly self-interested. In fact, when we see something that we don't understand, we tend to "explain" it with the magic willpower of unseen spirits. Whether it's birth, death, war, or the weather, we shrug and say, "That happened because there's a spirit who wanted it that way." We make every attempt to negotiate, plead, and partner with the spirits in charge.

If spirituality is just an illusion, how can it have persisted so long? Beliefs can be passed down and are subject to change, so they undergo their own form of evolution. Evolution is a survival filter, not a truth filter. If religious beliefs offer advantages to the reproduction of themselves or their practitioners, they will live on whether they are true or false. There are reasons to believe that religion adds to a community's fitness. Every culture known to history has religious roots. [106] If there ever were atheistic societies (before the Enlightenment) apparently they either dissolved or eventually adopted a religion. A reasonable explanation is that, before governments existed, it was religion that bounded a community together in defense against others. [107]

Besides that, the veil of perception is very hard to pierce. Our mind is the only window we have to the universe. If that mind has a spiritual tint, then we see spirits in the world.

Spiritual beliefs are culturally reinforced from birth, so every person takes them for granted. It has taken a very unusual scientific revolution in the last millennium to understand nature in terms of inert forces rather than magic willpower.

Religious experiences, as opposed to a religious outlook, are rare, perhaps once-in-a-lifetime, but they can have profound impact on a person's life. People describe these experiences with the same few recurring themes. They generally involve a euphoric flash of "enlightenment" about spiritual unity that feels very meaningful although it cannot be clearly expressed in words. [108] Recent studies have associated some feelings of hyper-religiosity [109] , a sensed presence [110] , or a state of union with God [111] with specific neural patterns. This field of study is in its infancy, but it provides further evidence that, despite the compelling illusion, religious experiences come from within.

## 2. Spiritual Beliefs and Practices

Anthropologists have long suspected that the earliest religions resembled those of today's hunter-gatherer societies. [112] These cultures are described as ***animistic***, meaning that they see nature as animated by spirits. For all their local variations, animistic religions around the world have a common core. The overarching theme is communication with spirits in order to exert some control over the world. [113] The community honors the good spirits and petitions them for food, health, fertility, and guidance. The souls of deceased ancestors are usually revered among the most important spirits. Meanwhile, people must bargain with, defend or fight against harmful spirits that cause illness or misfortune.

Traditional religion is a social activity. Spiritual invocations are often ritualized with public ceremonies that involve special clothing, masks, dance, music, and fire. Ritual is very important for building a sense of community. It reinforces the idea that the community protects its individuals; personal needs are subjugated to the greater good. Again, this social cohesion was probably a pivotal reason that religion has flourished.

As animists must communicate with spirits, they place great import on the boundaries and gateways between the natural and supernatural worlds. Dreams are perceived as visions of the otherworld or messages from spirits. [114] ***Shamans*** are special individuals who function as go-

betweens. A shaman is usually initiated with an illness, psychosis, or trauma. [115] He or she often goes into a trance to cross over to the spirit realm.

The earliest evidence of religious thought is ritualized burial. Of course, there are practical reasons for burial, like concealing smells and keeping scavengers away. Even some early humans buried their dead. *Homo sapiens* burials exhibited something new: a deliberately ritualistic aspect. Common Paleolithic examples included staining the dead with red ochre pigment, laying bodies to rest in standardized positions, or burying them with ceremonial grave goods, clothing, or jewelry. These rituals suggest that people were providing for the soul of the deceased as it passed into an afterlife. Some signs of ritualized burial appear by 100 TYA, [116] though it was much more common in the Upper Paleolithic.

When a modern-day shaman has a vision or dream, he describes it to his villagers. Some are painted on rocks or caves, and these depictions can bear a striking resemblance to the oldest paintings in the world. [117] Likewise, some of the earliest sculptures look like they could represent visions, spirits, or gods. These are only speculations about why prehistoric people invented art – but we can't help speculating.

### 3. Drugs

Drugs are a natural byproduct of the co-evolution of plants and animals. Our ancestors have probably been consuming drugs, wittingly or unwittingly, since well before they were human. Many species of mammals and even some birds incorporate drug-producing plants into their diet. [118]

A drug can have medicinal properties such as killing bacteria or numbing pain. Other drugs are mind-altering substances, which work by manipulating neurotransmitters. For example, when a drug simulates or stimulates dopamine, it makes the brain feel "rewarded" for no reason other than taking the drug. Hallucinogens are a special class of mind-altering drugs that alter perceptions and the senses.

All these categories of drugs – medicinal, mood-altering, and hallucinogenic – are used extensively in foraging societies. [119] Shamans commonly take hallucinogens to embark on their spiritual journeys. In addition to hallucinations and visions, sacred drugs can also produce feelings of ecstasy, enlightenment, and unity with nature. In short, they trigger religious

experiences in the brain. Shamans are also "medicine men", the world's first doctors. They treat their neighbors with a combination of ritual, prayer, and natural medicine.

Though drugs occur naturally, it is usually not possible to use them by simply chewing on leaves. Drugs require considerable preparation such as boiling, scraping, and mashing. Some must be prepared for eating, others for smoking or more unusual forms of ingestion. The desired intoxicant is often interlaced with toxins and must be carefully isolated. This kind of experimentation and preparation clearly requires a modern human mind – and our species has clearly been working hard at it for a long time. Medicine aside, every culture uses drugs, and several psychologists consider intoxication an irrepressible human drive. [120]

# V. SUMMARY

Between the ages of Aristotle and Darwin, Europeans envisioned the universe as a "Great Chain of Being" from Earth all the way up to God. Every form of matter and life was ranked on this chain. Humanity was a unique link, the highest creature with flesh and simultaneously the lowest being with a spirit. The Great Chain is a fitting metaphor for this juncture of prehistory when humans became spiritual and separated themselves from the animal kingdom.

We call ourselves *Homo sapiens,* and one of our favorite perennial questions has been, "Where did we come from?" Just a few centuries ago, there was no evidence to refute the nearly-universal belief that God or gods recently created the first few humans out of magic willpower. Science now tells us a frankly much more interesting story. There is no such thing as the first modern human. Our species emerged gradually from early humans called *Homo heidelbergensis.* As the braincase continued to grow and human bodies became more gracile, our ancestors gradually approached the anatomically modern form that we assume today. We owe our genetic diversity to about 90,000 individuals scattered throughout Middle Stone Age Africa. Their descendants dispersed throughout the Old World 50,000 – 70,000 years ago and have come to occupy all frontiers of the globe since then.

Anatomically modern humans were tenacious survivors. They expanded their habitat at the expense of their predecessors, early humans such as *Homo erectus* and the Neanderthals. The two-million-year-old *Homo* genus, which once teemed with as many as ten species, was whittled down to just one hyper-successful branch by 30,000 years ago. We can take some

consolation knowing that the other species did not entirely vanish but were partly assimilated. Modern humans mated with Neanderthals and Denisovans, and most of us still carry a trace of their genes.

The success of *Homo sapiens* owes much to sophisticated behavior. Although the humans of 50,000 years ago lived a much more primitive lifestyle than ours, all evidence indicates that their brains and minds were just like ours. They lived simpler lives because they were just starting the tradition of cultural accumulation that has reached such miraculous levels by today. They created art and ritualistically buried their dead. They invented cultural adaptations like spear tips, boats, and clothing that allowed them to survive in all environments. We suspect that the blossoming of advanced behavior paralleled the development of spoken language.

When the human mind was ignited with language, it also became a spiritual mind. Humans have such a well-developed imagination that we speculate about invisible causes. We are so adept at seeing our minds reflected in others that we suppose the universe to be imbued with willpower. Pre-scientific people had no viable alternatives to spiritual beliefs; in fact, dreams and drugs served as reasonable evidence for the otherworld. Religion then assumed a vital social role for every small community, long before the organized world religions that we know today.

Animated by the spirit of language and projecting his spirit into the universe, man created gods in his own image. The inner world of the human psyche became perceived as an external reality. Fascinatingly, over the next 100,000 years this supernatural world was to play as large a role as the real one in shaping human affairs.

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