Introduction to Anthropology: Holistic and Applied Research on Being Human

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CONTENTS

MODULE 7: GENUS HOMO AND FIRST CULTURES

The First Cultures

How long ago did the first humans walk the earth? When did they acquire speech and language? Who are our earliest ancestors? What is the sequence of hominin evolution that led to humans? Determining the origins of modern humans is one of the primary goals of paleoanthropology, however, it's challenging to answer this question for several reasons.

Today, *Homo sapiens* are the only living species within the genus, but in the past, numerous species existed that we only know about through fossils, footprints, and archaeological remains. At times, there were more than one species of hominid simultaneously. In the Early Hominin module, we described skeletal modifications that demonstrate bipedalism and discussed several early hominin species. All *Homo* species, however, are bipedalists, so we must use different skeletal traits to distinguish them. For example, the skull is one of the most unique parts of the skeleton, and researchers document traits associated with each hominin species, whether it is the shape of the eyebrow ridge, the crenulation patterns of the teeth, or the size of the brain case.

In addition to studying the shape of the skull, other researchers study aspects of human lifestyles, such as diet. For example, Dr. Pobiner with the Smithsonian Institute studies the remnants of past meals to identify traits that

are uniquely human. She studies how bones are broken, what types of puncture marks are present, and their location on bones to figure out who ate certain animals.

Video 7.1. Check out the video about Dietary Detective presenting Briana Pobiner discussing what you can learn from fossilized remains.

The earliest species of the genus Homo can be traced back nearly 2.4 million years, overlapping with Australopithecus and Paranthropus species (see Figure 7.1). Like Australopithecus and Paranthropus, the genus Homo is characterized by upright, bipedal primates. However, Homo species are distinguished by their relatively large brain cases (or large cranial capacities) compared to their overall body size (see Figure 7.2) and, most importantly, their association with recognizable material culture.

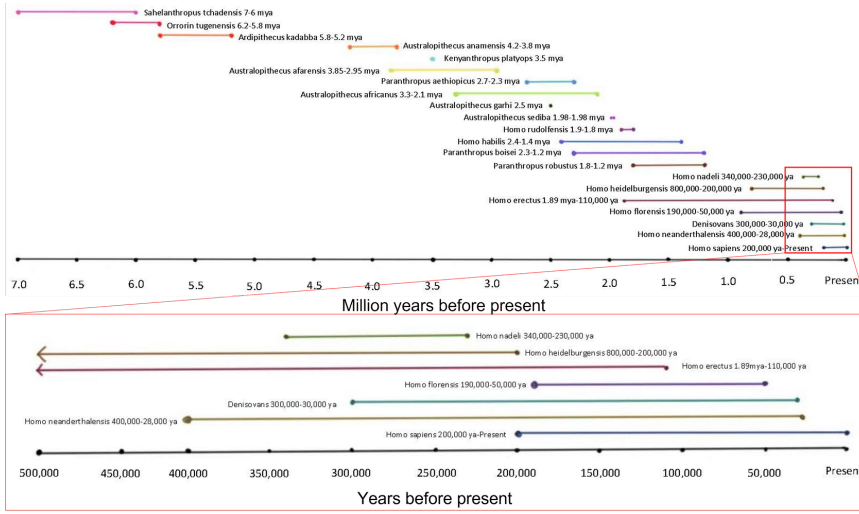

Figure 7.1. Simplified timeline of hominins.

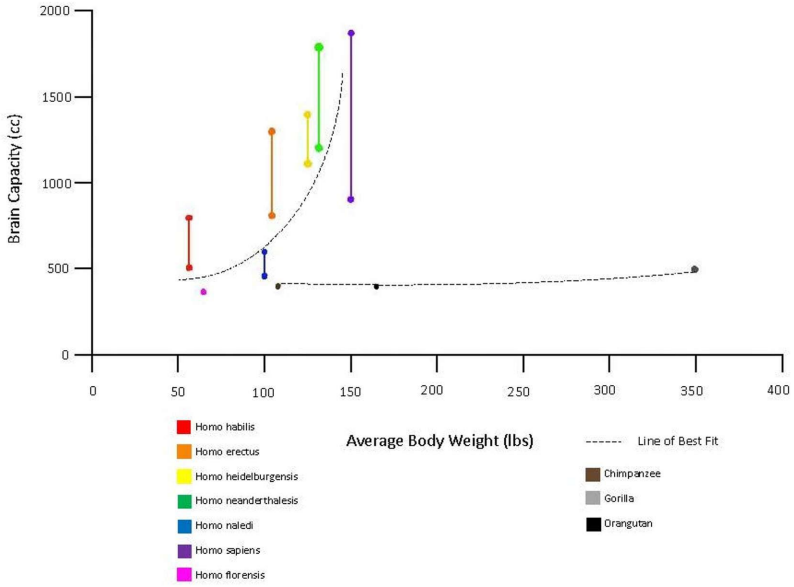

Figure 7.2. Relative brain volume and body weight among several hominids and primates.

Culture is a defining feature of *Homo* species. Earlier hominids, such as *Australopithecus*, had rudimentary forms of culture (see Module 6: Early Hominin Evolution), including making stone tools, which likely required refinement over several generations. With the advent of *Homo* species, the role of culture in adaptation increased, and culture exerted a proportionally greater force on the course of hominin evolution.

The Fossil Record is Tricky to Interpret

Since the turn of the century, researchers have been discovering fossils and identifying new species when they have unusual appearances or seemingly new traits. However, as more information is uncovered from the fossil record and through molecular biology, our understanding of early species has developed. As a result, species are continually split apart or lumped together. For example, formerly *Homo erectus* and *Homo ergaster* were seen as different species, but today, many researchers believe they represent

variation within a single species, which is now collectively called *Homo erectus*.

Identification efforts are hampered by several factors (see Module 6: Early Hominin Evolution). First, there are relatively few fossilized remains available for study. Rarely do researchers find a complete fossilized skeleton of an individual. Instead, it is more common to find broken, fragmented pieces of bone that only make up a portion of a skeleton. Some parts of the skeleton may be completely absent at an excavation site. Some pieces may be so broken that it is difficult to analyze. Therefore, it is often featured in the news if an intact skull or a mostly complete fossil skeleton is discovered.

Most species are represented by incomplete specimens. In fact, some species may only be known by a handful of bones, and different bones may be known for different species. For example, some species are known primarily from cranial remains, while other species are only known through post-cranial remains, such as *Orrrorin tugenensis*. How can we confirm they are different species based solely on bone characteristics in the absence of molecular biology or dating techniques?

Second, there is a lot of variation within a population. When researchers analyze fossils, there is the challenge of determining whether two fossils look different because of normal variation or because they are different species. For example, look around your classroom or the grocery store. People look different, but we are all part of the human race. There are differences in our features that can be accounted for by our ancestry, family lines, and geographic differences. All of these elements result in a range of physiological and cultural distinctions. For example, the Tarahumara (Rarámuri) are renown runners while the *ama* of Japan are renown divers. This type of individual variation is evident in nearly all species that exist today and even those that are long extinct. The same can be said for any existing species as not all German Shepherd dogs look the same nor do all orange tabby cats.

It is likely that different species in the past had a lot of variation within their populations. This variation could be because of age (comparing young and full-grown examples) or sex (comparing male and female examples in groups with significant sexual dimorphism). Additionally, human groups living in some regions today display considerable skeletal differences from

populations of *Homo sapiens* that lived in the same area thousands of years earlier. Populations change over time, and people move about the landscape. Researchers have even documented changes in the modern humans' average stature over time. Therefore, it's difficult to define clear boundaries for humans, let alone any of our ancestors.

Third, even scientists are occasionally stymied by bias. Many of us have preconceived notions regarding how skeletal adaptations should appear in the fossil record. For example, think about how Neanderthals are traditionally portrayed in popular media. Until recently, Neanderthals in television shows, movies, and commercials were depicted as incompetent relatives of modern humans (but see "*Homo neanderthalensis*," below). Consider, too, the tenets of the Great Chain of Being (see Module 2: A Brief History of Anthropology). The Chain emphasizes progressive evolution, and this belief system provided the foundation for modern science. Sometimes, people must consciously remind themselves that evolution is not a unilineal, progressive matter.

Early taxonomic classifications of species often focused on the development of modern humans from primitive origins. People believed that one could easily trace evolved characteristics through the fossil record (see early hominin module, anagenesis, and cladogenesis). However, people now recognize that most species have a suite of more "primitive" and "evolved" ("ancestral" and "derived") characteristics, even modern humans (see Module 4: Evolution and Genetics). As discussed in the previous modules, species are not evolving in a predictable, unilinear fashion. So, it is possible that, like *Ardipithecus* and *Australopithecus* (see Module 6: Early Hominin Evolution), species within the *Homo* genus may have "evolved" and "primitive" characteristics. Each species and even individuals within a species have a mix of traits that include old adaptations persisting through time and new changes that distinguish species. Therefore, identifying fossil species is not always clear cut.

Additionally, a number of new species (e.g., Luzon Man, Dragon Man) have been discovered in recent years that cause us to reconsider how we understand human evolution. These discoveries increasingly emphasize the problem of distinguishing separate species from the perspective of

reproductive isolation and biological species (see hominin evolution module). In fact, just as we now know that Neanderthals interbred with modern humans and Denisovans, the same may be said of other recent discoveries because these early human species were never truly, reproductively isolated from one another. While anagenesis has been ruled out to describe human evolution, cladogenesis may be equally ineffective. It is likely that future research will focus more on hybridization of early human species rather than trying to finalize a phylogeny or distinguish distinct species.

Finally, taphonomic processes impact the shape and condition of fossilized remains. Taphonomy is the study of biological and geological processes that impact remains after death. Time and natural processes can warp or disfigure fossilized remains. After all, fossils are not bones; they are created when bones or other organic remains are covered in sediments and, over thousands of years, the minerals in the soil leech into the bones and replace organic material.

Furthermore, fossilization is a rare process, and few species are identified by complete skeletons. This begs researchers to consider how many species are not represented at all in the fossil record. How many species may have existed that left no evidence for archaeologists to find? The fossil record is like a thousand-page book that has been shredded into a million pieces and scattered to the wind. Paleoanthropologists find a few of those shredded pieces and try to decipher how long the book is and what the story is about. It is difficult to know if you have a representative sample of the entire book or know what parts might be missing. The task is understandably difficult but not impossible.

Video 7.2. Check out the video where Khan Academy describes the process of fossilization.

Based on these considerations, some researchers argue that new species are assigned somewhat carelessly and do not adequately consider skeletal completeness, bone traits, and natural changes. Therefore, the organization of the human family tree is necessarily fluid, and species are grouped and

ungrouped continually over the years. The classification of species has grown organically instead of being scrutinized in a systematic manner. Some researchers argue that paleoanthropologists should inventory and re-analyze all known fossils and critically review their characteristics to redefine the family tree of early humans.

Description of Homo Species

In this module, we discuss some of the most well-represented and more mysterious species within the genus by highlighting what we know (and don't know) about their age, skeletal anatomy, cultural practices, environmental preferences, and distribution around the world (see Table 7.1). Finally, we will discuss different theories regarding the population expansion of genus Homo and explore recent research into this phenomenon.

Homo habilis

Skeletal Anatomy. *Homo habilis* is similar in size to *Australopithecus*, averaging between 3'4" and 4'5" in stature. However, *H. habilis* has a larger brain case and smaller face and teeth (see Figure 7.3). Images of *H. habilis* fossils can be viewed at eFossils (n.d.), but what is most significant is that *H. habilis* represents a shift in evolution. Among previous hominins, we observed the body changing but the head remaining largely the same, but with *H. habilis*, the body is like earlier species, but the head is more modern.

Figure 7.3. Depiction of *Homo habilis* fossil and reconstructed appearance. Images adapted from Wikimedia Commons.

Culture. *Homo habilis* was situated in the *Homo* genus because of its association with **Oldowan tools** (see Figure 7.4). However, *Australopithecus* also existed when these tools started being made. Oldowan tools were made from stones transported from miles away, suggesting that *H. habilis* was planning ahead; something we don't have clear evidence of in earlier species. *H. habilis* also appears to have lived in groups, which suggests some ability to communicate.

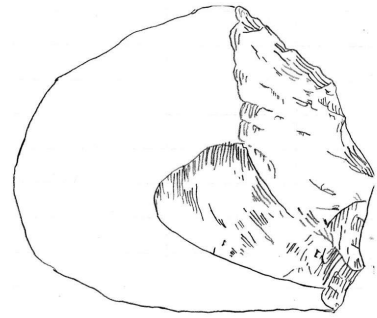

Figure 7.4. Oldowan chopper tool. Images from Wikimedia Commons. Note the rough form of the chopper.

Time and Geographic Range. This species existed between approximately 2.4 and 1.4 million years ago and is found predominantly in eastern and southern Africa.

Confusion. *Homo habilis*, as the earliest documented species in the genus, is one of the most problematic species to define. As more fossil evidence is unearthed, some researchers argue that *H. habilis* is more ape-like than initially thought, especially in terms of body size and proportion. Some paleoanthropologists insist that *H. habilis* is more like the *Australopithecus* species than *Homo* and better suited in a different genus. Additionally, researchers are not sure whether *Homo sapiens* descended from *H. habilis* and whether *H. habilis* and *H. rudolfensis* are variations of the same or different species.

Homo erectus

Skeletal Anatomy. *Homo erectus* looked a lot like modern humans. They were shorter (4'9"-6'1") but had arms and legs in approximately the same proportions as modern humans, making them better adapted for walking than climbing trees. Their skulls had fewer archaic traits but were not quite modern, with a larger brow ridge and smaller brain case than modern humans. **Turkana Boy** is one of the most complete fossil specimens, representing a subadult pre-teen (~8

years old) with a stature of 63 inches (see Figure 7.3). The remains were discovered in 1984, west of Lake Turkana in Kenya, and are approximately 1.5 million years old.

Figure 7.5. Depiction of *Homo erectus* fossil and reconstructed appearance. Images from Wikimedia Commons and Flickr/NCSSM

Culture. *H. erectus* demonstrated group hunting, long-term planning, care for children, improved tool making, and control of fire, which suggests that they relied more heavily on culture for survival than previous hominids. With heads larger than their predecessors and narrower hips (related to improved bipedalism), *H. erectus* children likely had longer childhoods than previous hominids. While they may have grown at a rate closer to modern apes, *H. erectus* likely required extensive care from a parent or community, which gave them time to learn from their elders. *H. erectus* developed a type of hand-axe known as **Acheulian tools** (see Figure 7.4). These leaf-shaped hand-axes combined several different cutting edges into a single tool that were used for a variety of tasks like making other tools and butchering animals. At sites such as Torralba and Ambrona in Spain, there is evidence of *H. erectus* working together to butcher large numbers of animals. These sites and others have evidence of firepits, which makes *H. erectus* the first hominid to control fire. All these cultural adaptations likely combined and allowed *H. erectus* to spread quickly and be the first hominid to leave Africa.

Figure 7.6. Acheulian hand-axe. Image from Wikimedia Commons. Note the "tear-drop" shape of the hand-axe versus the rough form of the Oldowan chopper.

Time and Geographic Range. *H. erectus* lived in Africa and Asia from approximately 1.9 million to 100,000 years ago. They preferred open grasslands and, although the species' broad geographic range included very different climates, its overall morphology was relatively consistent over the range of such environmental variation. This means that survival was not entirely tied to adaptive derived traits resulting from natural selection, which suggests that cultural evolution associated with 'inventions' now played an important role (e.g., clothing and fire in colder climates).

Confusion It is still unknown, exactly, what factors led *H. erectus* to spread so quickly and so far. The ability to walk long distances and increased reliance on animals for food were likely contributing factors, but there may have been others. We also don't know how quickly young *H. erectus* grew or if their parents formed long-term pair bonds to care for them. There also remains questions about whether all the currently identified *H. erectus* specimens are from a single species, or if the *H. erectus* species should be divided into several species.

Homo heidelbergensis

Skeletal Anatomy. Homo heidelbergensis were the first early human species adapted to cold environments with a stocky stature that conserved

heat. The average female stood 5'2" and weighed 112 lbs., while the average male was 5'9" and 136 lbs. H. heidelbergensis had a nearly flat face with almost no chin, and a larger brain case than previous early humans, but still retained pronounced brow ridges (Figure 7.5). It is likely that H. heidelbergensis is a direct ancestor of modern humans. Further, DNA evidence suggests that Homo neanderthalensis and modern humans both evolved from H. heidelbergensis, with H. neanderthalensis evolving in Europe and modern humans evolving in Africa.

Figure 7.7. Depiction of *Homo heidelburgensis* fossil and reconstructed appearance. Images from Wikimedia Commons and Flickr/Wise.

Culture. *H. heidelbergensis* continued *H. erectus'* control of fire and added construction of structures and widespread hunting to their repertoire. The first evidence of structures come from sites such as Terra Amata in France, where archaeologists found evidence of groups of *H. heidelbergensis* returning again and again to build large shelters, some as long as 50 feet. The multiple materials used in these shelters suggest a creative and adaptable mind, and the size of them suggests substantial groups of individuals that likely had an established social structure. While it is likely that *H. erectus* and other early humans made tools out of wood, there is evidence of how sophisticated those tools became by this time from a site near Schöningen, Germany. There, archaeologists discovered nine, 300,000-year-old spears that were hardened

with fire and carved heavier on their leading end to improve striking power.

These spears and other tools, as well as better communication and coordination, allowed *H. heidelbergensis* to be effective hunters. While it is possible that earlier humans also hunted, much of their protein likely came from scavenging already dead animals, but *H. heidelbergensis* actively worked together to take down large animals for food. Additionally, researchers documented a drop in temperature around 870,000 years ago that led large herbivores to migrate into southern Europe through the Po Valley. Evidence suggests that *H. heidelbergensis* recognized the fluctuating environmental conditions, including the growth, movement, and decline of glaciers. The hominins followed the herbivores and were able to carve out environmental niches for themselves, demonstrating a high degree of flexibility and adaptability.

Time and Geographic Range. Hunting, building shelters, controlling fire, and their short and broad physiques allowed *H. heidelbergensis* to live in colder environments from at least 700,000 to 200,000 years ago. However, some paleontologists push the evolution of *H. heidelbergensis* back to 1.3 million years ago. *H. heidelbergensis* lived in East and South Africa, East Asia, and Europe.

Confusion. *H. heidelbergensis* is another good example of the debate between scientists who believe there was a single species with some regional variation (lumpers) versus those who assign different species names to all variations (splitters). In the "splitter" model, there are several other species making up what is referred to as *H. heidelbergensis* in this text. How that argument is determined will influence the range and dates of *H. heidelbergensis*. Further, there is still much to learn about how this species used culture to adapt to its colder environment.

Homo neanderthalensis

Skeletal Anatomy. Neanderthals appear very similar to *Homo sapiens* at first glance, but researchers note differences in specific skeletal traits to differentiate these species. For example, Neanderthals had larger noses that presumably helped warm the cold, dry air of northern regions. Compared

to *Homo sapien*s, their bodies were slightly more robust and compact, with a lower surface area to volume ratio, to help conserve heat. On average, males were 5'5" and 143 lbs., and females were 5'1" and 119 lbs. (see Figure 7.5). Proportional to their heavier bodies, *H. neanderthalensis* often had larger brains than modern humans. Nearly all Neanderthals have a ridge on the occlusal surface of their lower molar teeth (middle trigonid crest), but this trait is present in only 11% of modern humans.

Descending from a single ancestor, *H. neanderthalensis* and *H. sapiens* could and did interbreed. This interbreeding took place about 55,000 years ago after modern humans migrated out of Africa. As a result, approximately 2% of the genome of modern Eurasian populations is of Neanderthal origins.

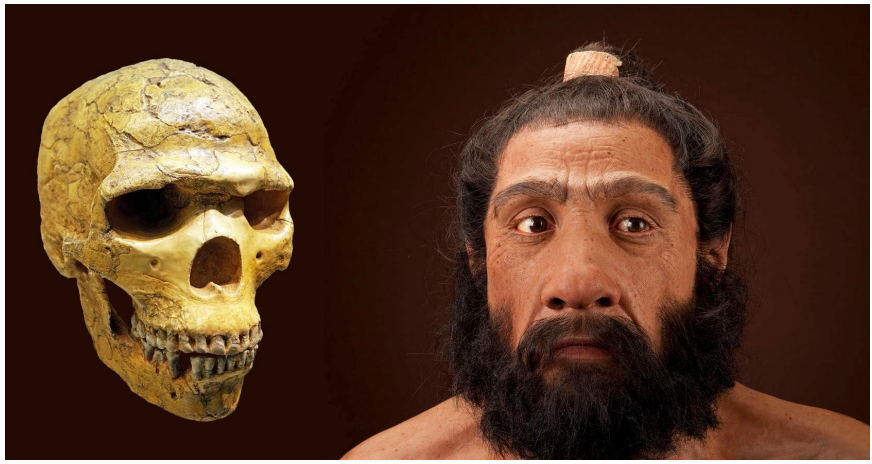

Figure 7.9. Depiction of *Homo neanderthalensis* fossil and reconstructed appearance. Images from Wikimedia Commons.

Culture. Neanderthal culture has long been subject to debate. In 1866, Ernst Haeckel, a German biologist, proposed to name a newly discovered fossil species *Homo stupidus*. This name was in response to Darwin's research on evolution and reflected the tone and perspective of researchers during the 19th century. Even though the scientific name did not stick, the idea of primitiveness and ignorance persisted.

Some researchers suggest that Neanderthals did not have a consistent ability to produce fire during colder periods. An analysis of Neanderthal sites across southwest France suggests that fire was common or intensively used during warmer periods, but less so during cold periods. Researchers believe this reflects how fire can be found in the natural environment more frequently during warm weather. Additionally, in eastern Europe, scientists have observed that wood is rarely found in sediment cores, which suggests that trees and forests were rare during cold periods. Analysis of charcoal from hearths also reveal that bone, not wood, were commonly used to fuel fires. This has been referred to as the **productivity paradox**. Although the harsh steppes of eastern Europe result in mixed conditions, Neanderthals seemed to have fared poorly in cold and treeless areas, while modern humans survived and thrived. In lieu of consistent fire availability, researchers wonder how Neanderthals survived during the Ice Age: how did they stay warm? What foods did they eat? How did they adapt?

They adapted by constructing houses, controlling fire, living in the mouths of caves, and assembling clothes. Similar to *H. heidelburgensis*, Neanderthals built structures, but they also assembled loose fitting clothes to ward off the cold; a first for hominids. They also hunted using spears and fished — another trait not previously seen. Much of Neanderthals' ability to make houses, clothes, and a variety of tools was based on **Mousterian** stone tools (see Figure 7.6). Unlike previous stone tools, Mousterian tools were based on the flakes removed from the stone rather than the stone core. This means that a variety and number of different tools could be produced from a single stone, and the overall amount of working edge per stone was significantly increased.

H. neanderthalensis occasionally buried their dead and cared for the infirm. At Shanidar Cave in Iraq, archaeologists found the remains of a Neanderthal who suffered a blow to the head at a young age. The blow damaged his left eye socket and effected his brain to the extent that he couldn't use his right arm, which eventually caused it to wither. Despite this injury, the Neanderthal lived to be 35-45 years old, eventually developing bony growths in his ears that made him nearly deaf. The fact that an individual lived so long with such profound injuries suggests that Neanderthal groups cared for their members. Many of the *H. neanderthalensis* skeletons found in Shanidar Cave were

intentionally buried, which makes them the first human species to bury their dead. Combined with evidence for making symbolic or decorative items, burial of the dead suggests that Neanderthals had a richer imagination than previous species.

Time and Geographic Range. Neanderthals evolved approximately 400,000 years ago and lived primarily in Europe and portions of southwestern and central Asia. Their appearance on the landscape corresponds to a series of warm interglacial periods that date between 620,000 and 300,000 years ago. Compared to glacial periods, these interglacial periods would have been warmer and supported well-developed forests and diverse plant and animal communities. However, after about 115,000 years ago, the warmer conditions were replaced by cold conditions known as the Early Glacial. This cold period may have allowed modern humans to move into areas that Neanderthals had abandoned, preventing Neanderthals from moving back as the climate warmed and precipitating the extinction of Neanderthals circa 40,000 years ago. As we will see below, modern humans were even more adaptable than Neanderthals.

Confusion. How much climate change, or competition, or interbreeding effected the extinction of *H. neanderthalensis* is still debated among scientists. It has also been suggested that due to large amounts of *H. sapiens* present at the time, that Neanderthals never in fact went 'extinct'. Rather, they were 'absorbed' into those *H. sapiens* that had left Africa. Their 'diluted' genes simply continue to live in us. It is unclear how much the Neanderthal DNA effected modern humans regarding how much of what we see and feel today is a result of Neanderthal genetics? Relatedly, archaeologists are still trying to determine how widespread symbolic behavior was among Neanderthals. Was it something they all did or was it limited to certain groups?

Denisovans

Skeletal Anatomy. The Denisovans are a relatively recent discovery, and an excellent example of the power of DNA research. Only seven specimens have so far been found: three teeth, a finger bone, a partial leg bone, a partial jaw, and a piece of a skull. The DNA extracted from these bones, however,

has allowed a partial reconstruction of what the Denisovans looked like, and how they interacted with both *H. sapiens* and *H. neanderthalensis*. There is still some debate about how the Denisovans fit into the Homo family tree, so their scientific name is currently debated as *H. denisova*, *H. altaiensis*, or *H. sapiens denisova*.

Based on their genetics, Denisovans likely resembled Neanderthals with a large nose and broad chest. Denisovan genetics also suggest that they had dark skin, brown hair, and brown eyes. The physical evidence, however, indicates that Denisovans had larger teeth, with molars closer to Australopithecines than humans. Both Neanderthals and Denisovans likely descended from *H. heidelbergensis*.

Culture. Very little is known about Denisovan culture because there are few identified sites and the association between artifacts from these sites and the Denisovan inhabitants (as opposed to other *Homo* groups that also inhabited the sites) is unclear. In fact, Denisova Cave, where the majority of Denisovan remains have been found, was also occupied by Neanderthals.

Time and Geographic Range. Much of what is currently known about Denisovan distribution is based on genetic modeling and will likely be refined as more specimens are found and provide more direct evidence and genetic data. Denisovans lived from approximately 300,000 (and possibly earlier) to 30,000 years ago (although some populations may have survived until circa 14,000 years ago). Denisovans lived throughout East Asia as far south as New Guinea and as far north as Siberia. They inhabited a wide variety of environments from islands to jungles, to consistently cold high-altitude regions.

Given the geographic range of Denisovans, their similar genetics to Neanderthals, and the archaeological sites with evidence of both species, it is likely that Denisovans interacted with and had culture similar to Neanderthals. Denisovans were also similar enough to both Neanderthals and Homo sapiens that they interbred with both groups. One bone fragment from Denisova Cave represents a female individual with a Neanderthal mother and a Denisovan father, while other genetic evidence demonstrates that Denisovans interbred with H. sapiens as well as other yet-to-be-

identified hominin species.

Recent Denisovan fossil discoveries also indicate that this species adapted to cold, high-altitude places. The fossil of a jaw was discovered in the Tibetan Plateau in the 1980s, but it was only recently identified through protein testing. Additionally, the presence of Denisovan genetics among individuals from New Guinea and Oceania suggests that they were able to build watercraft because these regions were separated from mainland Asia even at the lowest sea levels.

Confusion. New information about Denisovans will come out in the coming years. So, much is still to be learned about these *Homo* regarding how they adapted to such a wide range of habitats, and why they eventually went extinct.

Homo naledi

Skeletal Anatomy. *Homo naledi* are one of the most recent and spectacular discoveries in physical anthropology with the remains of 18 individuals found in the Rising Star Cave in 2013. They represent a mosaic of both *Homo* and *Australopithecus* traits. Their pelvis and shoulders are like *Australopithecus*, while their hands, feet, and brain size are more like *Homo*. However, the cranial morphology of *H. naledi* is most similar to *H. erectus* (see Figure 7.7). The hands of *H. naledi* are suited for climbing trees, while their feet were adapted for walking, which suggests the ability to live in a variety of habitats. *H. naledi* stood approximately 4'9" tall and weighed between 88-123 pounds.

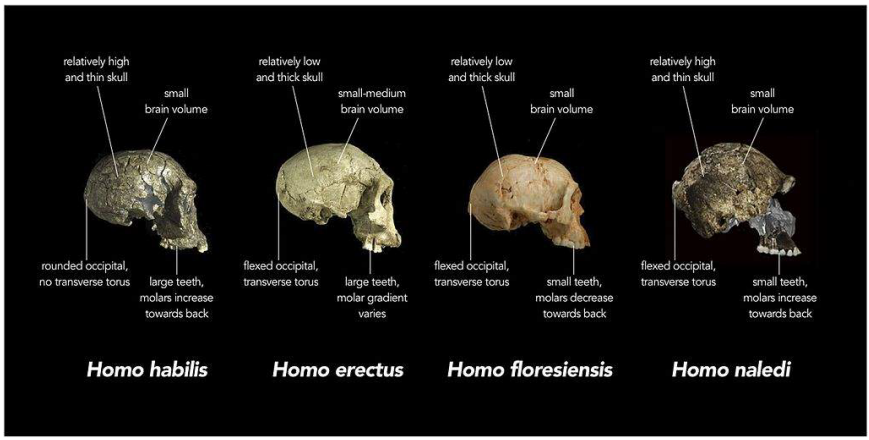

Figure 7.11. Comparison of skull features of *Homo naledi* and other early human species. Image form Wikimedia Commons.

Culture. Relatively little is known about the culture of *H. naledi* because they have only been found in two deposits at one site. No tools were found at the Rising Star Cave site, and it is unclear if *H. naledi* placed their dead in the cave, or if they were deposited there by another species – perhaps a predator.

Time and Geographic Range. *H. naledi* lived 335,000 to 236,000 years ago in southern Africa. This is a time when other *Homo* species would have lived in the same area. It may be that the *H. naledi* inhabited an environmental niche that limited competition with other *Homo*. The teeth of *H. naledi* are unique among *Homo* species, and it appears adapted for a mix of environments.

Confusion. While we have a significant number of *H. naledi* individuals to study, the fact that they were recently discovered and from a single site leaves many questions to be answered: did *H. naledi* use tools? What environments did *H. naledi* inhabit, and what sorts of foods did they eat? How did *H. naledi* relate to contemporaneous *Homo* species, and how do they relate to *H. sapiens*?

Homo floresiensis

Skeletal Anatomy. *H. floresiensis* is the smallest of the known *Homo* species, standing only 3'6" tall and weighing approximately 66 lbs. They are sometimes called the Hobbit species because of their diminutive size and relatively large feet. They also had small heads and brains, receding foreheads, and large teeth. It is possible that *H. floresiensis* evolved its small size due to island dwarfism, which happens when a species lives on an island with limited resources and predators as a smaller size is a better adaptation.

Culture. Despite their small brains, *H. floresiensis* are associated with stone tools and possibly use of fire. They hunted small elephants (also a result of island dwarfism) and large rodents.

Time and Geographic Range. *H. floresiensis* have only been found on the island of Flores in Indonesia. They lived there from at least 100,000 years ago, and possibly as long ago as 190,000 years, until 50,000 years ago.

Confusion. As with other recently discovered species, such as *H. naledi* and the Denisovans, there is a lot still to learn about *H. floresiensis*. It is still unclear which species were the immediate ancestor of *H. floresiensis* (see Figure 7.8) and if *H. floresiensis* became smaller due to island dwarfism or was small prior to arriving on Flores. Did *H. floresiensis* have art or other forms of cultural expression? Why did *H. floresiensis* go extinct?

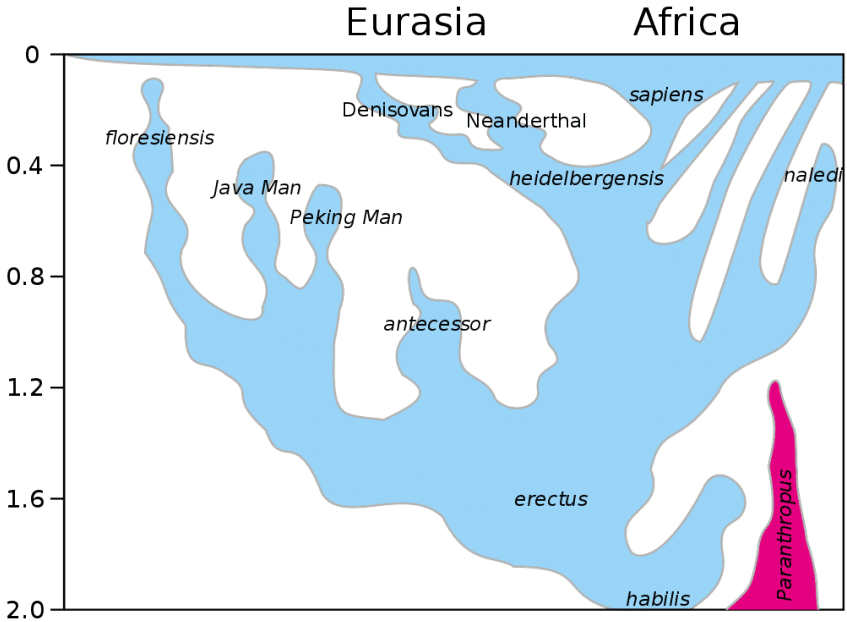

Figure 7.12. Possible relationships between *Homo* species during the last 2 million years. Image from Wikimedia Commons.

Homo sapiens

Skeletal Anatomy. Modern humans have a prominent chin that protrudes forward; however, this trait is absent from all other species within the *Homo* genus. They also have a high forehead and large braincase. Many of the other traits of humans, such as full bipedalism adapted for long-distance walking and precision grip with opposable thumbs, are present in earlier species. Modern *H. sapiens* evolved in Africa, likely from *H. heidelbergensis*, and subsequently spread across the globe.

Culture. Many researchers emphasize cultural adaptations as a major advantage that facilitate the survival of *Homo sapiens* over other hominins. Though modern humans used **Neronian** technologies, similar but smaller than Mousterian tools, they also developed innovative technologies such as bows and arrows. Modern humans have what is called "cognitive fluidity." That is the ability to take in large amounts of information from different sources, synthesize it, and create an original

solution. This includes the ability to think creatively and abstractly, which likely led to the rapid and wide spread of humans across the globe. It also led to artistic, social, and technological advances that underscore our modern lives (see Module 5: Primates and Module 8: Upper Paleolithic and Ice Age). For example, analysis of faunal remains and isotopic data reveal that modern humans subsisted on a more diverse diet than Neanderthals. *H. sapiens* also had the ability to make fitted clothes, which allowed them to live in colder environments. Further, they also had the ability to make boats, which requires the combination of several different materials in novel ways and allowed them to access (and return from) previously inaccessible lands. While the mental abilities of *H. sapiens* do not appear in the fossil record, they can be seen in the archaeological record and the fact that *H. sapiens* appear to have out-competed other contemporaneous *Homo* species.

Time and Geographic Range. However, *H. sapiens* should not revel in their "last species standing" title, because we have not been around that long. Modern humans became widespread around 100,000 years ago, and likely evolved 200,000 years ago in Africa, although some researchers think the first humans appear around 300,000 years ago. That is to say that modern humans have been around for no more than 0.3 million years, as compared to *H. habilis* which survived for 1 million years, and *H. erectus* that lived for 1.8 million years. Even Neanderthals existed for 0.37 million years. Thus, all the previous, "unsuccessful" species of Homo inhabited the earth for a longer amount of time than modern humans have. Climatically, the last interglacial period is documented between 185,000 and 115,000 years ago, and conditions were warmer and wetter during that time period than present day conditions. Temperatures may have been about 10°C warmer, with diverse plant and animal communities, but conditions became slightly cooler until 70,000 years ago, which is recognized as an early glacial period. However, 70,000-10,000 years ago, is considered a periglacial period with sustained, colder climates with a few short cycles of slightly warmer temperatures. Conditions become starker and more barren and may correlate, in part, to the decline of Neanderthals.

Confusion. The attributes that make *H. sapiens* uniquely human is the subject of Anthropology, and the rest of this course.

Climate, Environment, Migration, and Adaptation

Beginning with *H. erectus* members of the *Homo* lines spread out of Africa, populating Asia and Europe, and eventually Australia. With the advent of *H. sapiens*, this spread reached the Americas (and in more recent times, Antarctica), making humans the most widely dispersed species on the planet.

In the course of these migrations, *Homo* had to adapt to fluctuations and changes in local and global environments. *H. erectus* primarily spread east, staying in similar latitudes and climates, but subsequent species spread to the north and south, inhabiting a wide range of environments. Culture was a necessary adaptation to successful migration because it allowed groups to adapt quicker than evolution. It's more expedient and comfortable to put on a cloak and build a fire than it is to wait around for the genetic mutation that allows a distant descendant to grow more body hair. Thus, modern humans and their contemporaries could adapt as the environment around them shifted, and they moved into novel environments. While some of these migrations may have been a form of exploration, most were likely in pursuit of animals and other resources. Animals and plants are not as adaptable as humans so, as the climate changed (and it changed often from 2 million years ago onward), they shifted their ranges to stay alive. Similarly, animals may have changed their behaviors to avoid humans, and in response, humans would have (again) adjusted. Gradually, they moved across continents. These early humans were mobile people, moving throughout the year, so a shift of a mile one direction every year or so wouldn't have concerned them. However, compounded over about 80,000 years, these subtle migrations covered the globe.

Video 7.3. Check out the video where the American Museum of Natural History presents 7 million years of human evolution.

Summary

Beginning approximately 2 million years ago, the *Homo* genus evolved from what was, in many ways, a clever Australopithecine using simple tools and living only in Africa, to modern humans with highly evolved cultures and global distribution.

The relatively rapid spread of *Homo* species and the explosion of art, technology, and social organization (particularly after 100,000 years ago), was the result of expanding brain sizes and capabilities. In turn, this led to a variety of complex cultures. At many times, there were several species of Homo living at the same time and, occasionally, in the same regions. Some of these species interbred, and there is more to be learned about how the histories of the Homo species interacted with one another because of gaps in the fossil and archaeological records. However, new discoveries in the field and in the lab of fossils and DNA is constantly expanding our understanding of our immediate ancestors.

	Age	**Height**	**Cranial Capacity (cubic cm)**	**Skeletal Anatomy**	**Famous Fossils**	**Cultural Milestones**	**Other Associated Species**
Homo habilis	2.4–1.4 mya	3'4"–4'5"	509–752	Larger brain size but smaller teeth and mouth compared to Australopithecus	Olduvai Gorge, Tanzania	First stone tools (Oldowan); Africa only	*Australopithecus garhi; Homo rudolfensis*
Homo erectus	1.9 mya – 100,000 ya	5'–6'	750–1250	Strong neck muscles, short foreheads,	Zhoukoudian Collection, China;	Sophisticated stone tools	*Homo ergaster*

				prominent brow ridges; long brain case; shoveled incisor teeth	Turkana Boy, Kenya; Dmanisi Collection, Georgia; Java Man, Indonesia	(Acheulian); first controlled fire; biocultural evolution; migrated across Africa, Europe, and Asia	
Homo heidelburgensis	800,000–200,000 ya	5'2"–5'9"	1100–1390	Compact body; large brow ridges; short foreheads; long brain case	Kabwe 1, Zambia	Controlled fire; found across Africa, Europe, and Asia	Late *Homo erectus; Homo antecessor*
Homo neanderthalensis	400,000–28,000 ya	5'1"–5'5"	1200–1750	Large boned and heavily muscled. Large brain.	Shanidar Cave, Iraq; La Chapelle-aux-Saints, France; La Ferrassie Cave, France	Interbed with *Homo sapiens;* sophisticated stone tools (Mousterian); Europe and Southwest Asia	*Homo sapiens*; Denisovans
Denisovans	300,000–30,00	Unknown	unknown	Large boned and heavily	Denisova Cave, Russia;	Interbred with *Homo*	*Homo sapiens*; *Homo*

	0 ya			muscled.	Baishiya, China	*sapiens* and Neanderthals; lived in a wide variety of environments	*neanderthalensis*
Homo naledi	340,000–230,000, ya	4'9"	450–600	Mixture of Australopithecine and Home traits	Rising Star Cave, South Africa	unknown	unknown
Homo sapiens	200,000 ya–present	5'2–5'7"	900–1880[b]	Large brain and protruding chin.	Jebel Irhoud, Morocco; Skhūl V, Israel; Cro-Magnon 1, France	Sophisticated stone tools (Neronian), fitted clothing, widespread art	*Homo heidelburgensis*
Homo floresiensis	190,000–50,000 ya	3'6"[a]	380[a]	Dwarf *Homo erectus*	"Hobbits" of Flores, Indonesia	Tool use and hunting	*Homo erectus*

Review Questions

- **T/F.** With the advent of the Homo species, culture exerted proportionally less force on the course of human evolution compared to earlier species.
- **T/F.** Evidence of hybridization of early human species complicates phylogeny reconstruction.
- **T/F.** Homo erectus is associated with Oldowan stone tools.
- **T/F.** Homo erectus is the first species to migrate out of Africa.
- **T/F.** Homo heidelbergensis have stocky statures adapted for heat conservation in cold environments.

Discussion Questions

- What traits define modern *Homo sapiens sapiens* (us), and when did those traits develop?
- What role did cultural adaptation (as opposed to natural adaptation) play in the survival of species during the last two million years?
- In our current understanding of *Homo* evolution over the last 32 million years, what roles did anagenesis and cladogenesis play?
- Why is it important for anthropologists to keep searching for individual skeletons that represent the missing "links" in hominin evolution?

Activities

1. Acheulean hand-axe production (Soap Knapping)

Acheulean hand-axes are the oldest formally shaped stone tools in the world, dating between 1.76 million and 200,000 years ago. Hundreds of thousands of these tools have been found across the Old World. The standard shape of these tools across time and space has prompted researchers to consider how such standardization was achieved. It is unknown whether hominins had the ability to talk more than 200,000 years ago, and there is no archaeological evidence of speech. The following activity was adapted from Morgan et al. 2015 and considers tool making as a proxy indicator for language origins.

This activity takes artistic license but helps students think creatively about research while learning about stone tools at the same time. Soap is used in place of stone. Popsicle sticks are used for flaking. Essentially, the popsicle sticks are used to "push" flakes off the soap core. Students don't need any background in knapping. Newspaper is recommended to cover desks to catch the soap debitage. Tougher brands of bar soap like Dial work better than softer bar soaps like Dove. If providing soap for many students, a single bar of soap can be cut into four pieces (bisecting along the tall axis and then cutting each thin piece in half. Alternatively, students can bring an unused bar of soap to class.

- This activity is divided into two parts. First, students are presented with images and/or replications of Acheulian hand-axes. If available, graduate-student volunteers can be distributed around the room to demonstrate soap-knapping. Students are asked to make an Acheulian hand-axe out of soap using the guides, but neither students nor volunteers can talk, make sounds, or gesture. Give students 10-15 minutes to knap their soap tool.
- After 10-15 minutes, stop everyone and ask them to share their work. How many students noticed the bifacial edges of the hand-axe? How many noticed the chipped edges or zig-zag sides? Has anyone achieved a relatively thin tool? How many achieved a roughly teardrop shape? Ask them what contributed to their

difficulties in knapping.

- For the second part, ask students to refine their hand-axe. For this part, they are allowed to talk, ask questions, and gesture as needed. Show students the bifacial edge and demonstrate how it is achieved by flipping the tool over and over, working methodically. You can also show students a short video on flint-knapping, such as: toilet porcelain spearhead - YouTube
- After 10 minutes, ask everyone to stop and share their work. Did students have more success when they could ask questions and talk? How did this activity help students understand the creative ways that paleoanthropologists study human culture in the past?

Key Terms

Acheulian hand-axe: The leaf-shaped tool developed by *H. erectus* that combined several different cutting edges into a single tool and was used for a variety of tasks from making other tools to butchering animals.

Anagenesis: Species directly evolving into later ones, without branching.

Ancestral traits: Original or primitive traits retained and inherited from a distant ancestor.

Cladogenesis: The formation of new species through branching from a common ancestral species.

Culture: The collection of learned behaviors, ideas, languages, and traditions that characterize a social group.

Denisovans: Like both *H. sapiens* and *H. neanderthalensis,* there is still some debate about how the Denisovans fit into the *Homo* family tree, so their scientific name is currently debated as *H. denisova*, *H. altaiensis*, or *H. sapiens denisova.* Most likely descended from *H. heidelburgensis,* they lived from approximately 300,000 years ago to 30,000 years ago throughout East Asia as far south as New Guinea and as far north as Siberia.

Derived traits: Evolved or mutated traits present in the most recent ancestor.

Fossilization: A process where the calcium and phosphorus content of organic remains are gradually replaced by iron silica, resulting in 'stone-like' remains.

Homo erectus: Extinct species of the human genus, lived in Africa and Asia from approximately 1.9 million to 100,000 years ago. Characterized by Acheulian tools and being the first hominids to control fire and leave Africa, as well as a large brow ridge and long brain case.

Homo floresiensis: Extinct species of the human genus that have only been found on the island of Flores in Indonesia, living there from possibly as long ago as 190,000 years to 50,000 years ago. Characterized by "Hobbit-like" features.

Homo habilis: Extinct species of the human genus, found predominantly in eastern and southern Africa**,** living between **a**pproximately 2.4 and 1.4 million years ago. Characterized by Oldowan tools, a larger brain size, but smaller teeth and mouth compared to *Australopithecus.*

Homo heidelbergensis: Extinct species of the human genus, lived in East and South Africa, East Asia, and Europe from at least 700,000 to 200,000 years ago, but some paleontologists push the evolution of *H. heidelbergensis* back to 1.3 million years ago. Characterized by their continued control of fire, compact bodies, large brow ridges, short foreheads, and long brain cases.

Homo naledi: Extinct species of the human genus**,** lived in southern Africa 335,000 to 236,000 years ago. Characterized by a mixture of *Homo* and *Australopithecus* traits.

Homo neanderthalensis: Extinct species of the human genus**,** lived primarily in Europe and portions of southwestern and central Asia, lived approximately between 400,000 years ago to 28,000 years ago. Characterized by the use of Mousterian tools, and large bones and brains.

Homo sapiens: Modern humans become widespread around 100,000 years ago, and likely evolved 200,000 years ago in Africa. Characterized by large brains and protruding chins.

Hybridization: Interbreeding between two different species to reproduce a novel species.

Mousterian tools: Stone tools used by Neanderthal's that were based on the flakes removed from the stone rather than the stone core itself. A large number of different tools could be produced from a single stone and the overall amount of working edge per stone was significantly increased.

Neronian tools: Stone tools used by modern humans that were similar but smaller than Mousterian technologies.

Oldowan tools: Tools made from stones transported from miles away, suggesting that *H. habilis* was planning ahead, something we don't have clear evidence of in earlier species. *Homo habilis is* associated with Oldowan tools. However, *Australopithecus* also existed when these tools started being made.

Productivity paradox: The question of how mammals and megafauna survive on the expected low vegetation produced in colder, harsher environments.

Sexual dimorphism: Distinct difference in size or appearance between the sexes of an animal.

Taphonomy: The study of biological and geological processes that impact bone and other remains after death.

Turkana Boy: One of the most complete fossil specimens of *Homo erectus* discovered, representing a subadult pre-teen (~8 years old) with a stature of 63 inches. The remains were discovered in 1984 west of Lake Turkana, in Kenya and are approximately 1.5 million years old.

Suggested Readings

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Videos

Khan Academy. 2012. How are dinosaur fossils discovered and collected? Electronic document, https://www.youtube.com/watch?v=rYjs8Wtfnzo, accessed 25 May 2020.

[https://www.youtube.com/watch?time_continue=78&v=VYSw0EWwNhw

Dietary Detective: Smithsonian Scientist, Briana Pobiner; 9 March 2011]

American Museum of natural History 2018 Seven Million Years of Human Evolution

PBS NOVA Becoming Human, Episodes 1–3
Dailymotion links:
1 https://www.dailymotion.com/video/x3km6fx
2 https://www.dailymotion.com/video/x3l998n
3 https://www.dailymotion.com/video/x3oatqe