

Modern *Homo sapiens*

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- Last time we looked at the Neanderthals, and saw them get replaced by modern *Homo sapiens* from Africa by 30,000 ya
 - so, who *were* those guys?
- When we last looked at Africa, it was populated by late *Homo heidelbergensis*
 - 1200-1300 cc brain; massive, solid browridges; Middle Stone Age mode 3 flake tools
 - from 300,000 to 127,000 ya in Europe, *H. heidelbergensis* developed Neanderthal traits
 - but in Africa at this same time, they did not develop the Neanderthal traits
 - they were not experiencing the strong selection pressures of the cold sub-arctic European climate
 - instead, from about 190,000 to 100,000 ya, the African *H. heidelbergensis* populations started developing traits like modern *Homo sapiens*
 - these are the ones that would later spread out of Africa and replace the Neanderthals, any remaining *H. heidelbergensis* in Asia, and *H. erectus* in Asia
- but at first, the new *H. sapiens* continued to act like their *H. heidelbergensis* ancestors
 - similar mode 3 flake tools, no houses, art, etc.
 - only later, around 50,000 ya, were they clearly, consistently acting and thinking like modern *H. sapiens*
 - and only then did some migrate out of Africa and begin out-competing all other hominins they encountered
- Physical features of *Homo sapiens*
 - smaller face
 - smaller teeth (all of the teeth got smaller: incisors, canines, premolars, molars)
 - projecting chin (“mental eminence”)
 - greatly reduced browridges
 - slightly larger cranial capacity: averages around 1400 cc
 - vs. our immediate predecessor, *H. heidelbergensis*, 1200-1300 cc
 - note that Neanderthals also evolved larger brains, in their separate lineage: parallel evolution
 - higher, more vertical forehead
 - taller, rounder cranium when viewed from the side
 - less like a football, more like a bowling ball
 - rounded back of the cranium (no occipital torus or occipital bun)
 - longer limbs
 - longer hands and fingers
 - more lightly built limbs
 - don’t have the odd incisor wear found on Neanderthals
 - these last two points, especially, suggest increasing reliance on tools for many tasks, rather than teeth and strength

- These features originated in Africa
 - possibly in one region, then spreading out
 - or possibly in various regions, with interbreeding spreading the traits among various populations
 - either way, from 200,000 to 100,000, *H. sapiens* features became more common in Africa
 - eventually shifting all the *H. heidelbergensis* populations of Africa towards *H. sapiens*
 - these early *H. sapiens* continued to make mode 3 flake tools like their *H. heidelbergensis* ancestors had
 - did not make houses, ornaments, art, etc.
 - had one basic, fairly inflexible set of behaviors that changed little from place to place or over time
- Many populations of *H. sapiens* in Africa were apparently somewhat isolated from each other
 - allowing them to evolve differences specific to each region
 - these were not enough to make them separate species, just different populations
 - just as people from Norway look different from people from Italy
- Some time between 100,000 to 50,000 ya, some African *H. sapiens* began to behave more like modern humans
 - making shelters, more sophisticated tools, decorative items, etc. (more on this later)
- Two theories about this behavioral change
 - Human revolution theory
 - little change up to around 50,000 ya
 - then a sudden change in cognitive abilities
 - probably in one small, isolated population
 - maybe due to one or a few genetic mutations
 - maybe due to unusual, strong selection pressures... or?
 - this change was in brain function only; it did not leave any detectable traces in the bones
 - it resulted in a sudden elaboration of tools, art, shelters, trade, etc.
 - Gradualism view
 - *H. sapiens* in Africa gradually evolved this modern behavior from 100,000 to 50,000 ya
 - all across Africa, in different ways in different regions
 - with interbreeding spreading the alleles that favored more complex thinking and behavior
 - which is correct?
 - the debate is ongoing
 - the evidence is not conclusive
 - and it is too scattered and complex to cover in a reasonable way in this class
 - I suspect that the gradualism position is winning
- Either way, by about 50,000 ya
 - there were *H. sapiens* in Africa that thought and behaved basically like modern human foragers do
 - these could be called “cognitively modern” *Homo sapiens*

- since they had been evolving in partially isolated parts of Africa, they were already somewhat different from place to place
- people from one of these populations, presumably in the northwestern part of Africa, moved into the Middle East
 - some of their descendents moved into Europe
 - others moved into Asia, including the extreme, Arctic north (and remember, this was still during the last glacial period of the Pleistocene!)
 - others to southern Asia
 - and from there, to Australia by 40,000 ya
 - getting to Australia required crossing 100 km of open ocean
 - same for some of the other islands where they have been found
 - meaning that they did this multiple times, each time with enough people to found surviving populations
 - this presumably means that they had seaworthy boats at 40,000 ya!
- from about 40,000 to 30,000 ya, cognitively modern *H. sapiens* coexisted with Neanderthals in the Middle East and Europe
 - they remained physically distinct
 - so they evidently did not interbreed much, which genetic studies have also indicated
 - they also remained culturally distinct
 - the Neanderthals that used bone awls and personal ornaments like *H. sapiens* do at Arcy-sur-Cure around 33,000 ya is a rare exception
 - by 30,000 ya, the Neanderthals were gone
- in Asia, by 30,000 ya, cognitively modern *H. sapiens* had replaced any remaining Asian *H. heidelbergensis*, and *H. erectus*
- Cognitively modern *Homo sapiens*
 - No clear physical differences from earlier *H. sapiens*, at least that we can see in their bones
 - But a huge difference in thinking and behavior
 - much more sophisticated, complex technology
 - handled a wider range of environments
 - traveled long distances or traded for raw materials
 - explosion of symbolic behavior...
- Technology of cognitively modern *Homo sapiens*
 - in Europe, called Upper Paleolithic
 - in Africa, called Late Stone Age, or LSA
 - both date to about 45,000 – 10,000 ya
 - Mode 4 stone tools
 - based on blades, rather than flakes
 - blades are long, narrow flakes, rather than wider ones
 - blades can be made by a more efficient technique
 - flakes are often made by
 - preparing a core
 - striking off the desired flake

- then reshaping the core again for the next desired flake
 - this reshaping requires removing flakes that become waste
- a blade core is first worked to a cylindrical or truncated cone shape
- when a blade is struck off from the core, it leaves the core prepared for removing the next one with little or no additional reshaping
 - done properly, there is very little wasted material
- the blades are then retouched into the desired final shape
- this produces much more cutting edge per pound of stone
- Much wider variety of materials used
 - bone, antler, ivory, etc.
 - tools made by *H. heidelbergensis*, Neanderthals, and early (not cognitively modern) *H. sapiens* usually involved only stone and wood, and probably sinew or other fibers
- Much wider variety of distinct tool types
 - lots of very specific, standardized stone tool types
 - obviously made to a specific, preconceived plan
 - obviously intended for particular purposes
 - bone or antler spear points, often barbed
 - atl-atls (spear throwers)
 - spears with detachable foreshafts
 - awls and needles for working hides
 - and many other types
- made tools from specific materials suited to particular uses
 - they obtained specific stone types and specific shells from hundreds of kilometers away
 - vastly farther than Neanderthals or *H. heidelbergensis* had gone for materials
 - implies understanding of materials and long-term planning to get them
 - either by making very long distance procurement journeys and bringing stuff back
 - or by trading with neighbors
 - either way, implies complex social arrangements
- developed numerous distinctly different regional styles of tools, or “cultures”
 - people in different regions and periods had their own tool styles, suggesting modern human ethnic groups or cultures
 - unlike the Acheulean tradition
 - in which *H. ergaster* and early *H. heidelbergensis*
 - made the same, repetitive handaxes
 - in whatever environment they found themselves in
 - for 1.3 million years, with little change
 - unlike the Neanderthal’s Mousterian tool style
 - pretty much the same across the entire European range of the species
 - and pretty much unchanging for 100,000 years
 - Upper Paleolithic tool cultures were different in different places in Europe, not to mention different parts of Africa, Asia, and Australia
 - and most Upper Paleolithic tool cultures lasted just thousands of years
 - still very conservative, but changed far more rapidly than anything before

- they handled a much wider range of environments
 - from extreme Arctic conditions as in north Asia, where it gets to –50 degrees in the winter now, and would have been much colder yet during the Pleistocene
 - extremely dry desert
 - coastal marine environments requiring boats and fishing technology
- definitely big game hunters
 - mostly large, herd animals
 - caribou, bison, woolly rhinoceros, mammoth, horse, etc.
 - also some fish and birds
 - in some regions, *H. sapiens* groups specialized on just one or two species
 - red deer in Spain
 - mammoths in central Asia
 - were these early ethnic groups or cultures?
- definitely built shelters
 - Russia and Czech Republic: pit houses with mammoth bone roofs
- definitely sewed clothing
 - implied by surviving in extremely cold climates
 - lots of bone awls and needles
 - a few burials with lots of beads that appear to have been sewn onto clothing
- explosion of symbolic behavior
 - cave art
 - paintings on cave walls
 - carvings or engravings on cave walls
 - decorations on artifacts
 - tools with handles carved into sculptural animals
 - tools and other objects with designs scratched or engraved on them
 - figurines
 - animals
 - human (usually female) heads: many faceless and abstract, but some portraits?
 - human figurines, usually but not always female
 - personal ornaments
 - necklaces, pendants, etc.
 - beaded hats and clothing
 - clearly ritual burials with offerings
 - bodies painted with red ochre
 - bodies buried wearing beaded hats, clothes, ornaments, etc.
 - such burials imply complex ideas about death and/or the afterlife
 - one adolescent male buried with hundreds of beads, covered with red ochre, with four “batons” made from antlers, three held in his right hand
 - these “batons” do not appear to be tools
 - they were probably for some non-utilitarian purpose, maybe ritual objects such as a shaman might use

- if so, implies complex ideas about the supernatural apart from just treatment of the dead
- Upper Paleolithic, cognitively modern *H. sapiens* were apparently very successful
 - apparently much higher population than Neanderthals
 - many more sites, yet in a much shorter span of time
 - longer life expectancy
 - some Upper Paleolithic *H. sapiens* reached 60 years old
 - 2/3 died over 30
 - while Neanderthals rarely lived past 45
 - and only 1/3 died over 30
 - Boyd and Silk suggest that having these additional older, more experienced people around would have been important for cultural development
 - would have fostered accumulation of knowledge and skills
 - would have promoted transmission of knowledge and skills to the next generation
 - suffered fewer injuries
 - suffered less disease
- How do we know that *H. sapiens* encountered and replaced other hominins?
 - there are other possibilities
 - local populations outside of Africa could have evolved modern *H. sapiens* traits
 - pre-*sapiens* populations could have been interbreeding, exchanging alleles, and evolving more or less together
 - or local populations could have interbred with immigrant *H. sapiens*
 - but none of these fit with the evidence as well as replacement by *H. sapiens*
 - the archaeological dates for Upper Paleolithic burials and tool styles fit a replacement model
 - too many details and too complex arguments to deal with here
 - while suggestive, the archaeological evidence cannot tell us positively about interbreeding versus replacement
 - several different lines of genetic evidence fit with a replacement model
 - these arguments are also quite technical, and the textbook bites off too much in trying to explain them here
 - you only need to know the general conclusions at the level presented here for this course
- Genetic evidence 1: Humans are all genetically very similar
 - much more so than chimpanzees
 - this suggests that we all descended fairly recently from a small number of individuals
 - here is an analogy to explain this reasoning
 - imagine that only the Japanese colonize Mars, and send only Japanese settlers
 - a thousand years later, everyone on Mars will be fairly similar
 - they will all look Japanese
 - because they all descended from a relatively small population, with relatively similar alleles
 - it is possible to mathematically estimate how small the original population was, and how long ago
 - different researchers disagree on the timing and size of the population
 - ranging from just a few thousand to several hundred thousand individuals

- but they all do indicate that a relatively small population gave rise to all the modern people in and out of Africa
- Genetic evidence 2: African populations and individuals are more genetically variable than are individuals and populations from all the rest of the world
 - again, this fits with the model of just some Africans being the founders of all the populations outside of Africa
 - since then, all populations have been evolving differences
 - but some of the African ones were already different from the ones that left
 - so they have had longer to accumulate differences than have the populations outside of Africa, which all started out roughly the same
- Genetic evidence 3: mitochondrial DNA shows that all non-African populations are relatively closely related, while some African ones are more different
 - mitochondrial DNA (mtDNA) is a special form of DNA found in all cells
 - it bypasses most of the processes of chromosomes and heredity that we discussed earlier in class
 - it is only inherited from the mother
 - it can be used to assess genetic similarity of individuals
 - the more similar their mtDNA, the more recently they had a common ancestor
 - it is even possible to calculate roughly how long ago that split must have happened
 - Conclusions from various different methods of studying mtDNA:
 - European and Asian populations split from each other and from one African population fairly recently
 - while some African populations have been separated for much longer
 - this fits with the model of one group of Africans leaving and becoming the ancestors of all the *H. sapiens* in the rest of the world
 - that is, replacing all the earlier hominins out there, rather than interbreeding with them
- Genetic evidence 4: Y chromosome DNA also shows that all non-African populations are relatively closely related, while some African ones are more different
 - Y chromosomes are the male sex chromosomes, inherited only from the father
 - they can be studied in ways similar to those used with mtDNA
 - for technical reasons, this work is currently less advanced
 - Conclusions
 - so far, it agrees pretty well with the mtDNA results
 - European and Asian populations split from each other and from one African population fairly recently
 - while some African populations have been separated for much longer
 - supporting the replacement model
- Conclusions
 - despite all the differences on details presented in the textbook, overall, almost everyone now agrees that
 - physically and cognitively modern humans arose in Africa
 - then spread out and replaced all other hominins around the globe